TYPE B3 SUBMITTAL

MS AIR NATIONAL GUARD

CONSTRUCT NEW FIRE CRASH RESCUE STATIONS

PN: LRXQ109002

SPECIFICATIONS

AUGUST 2022

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Technical Specifications
for
Construct New Fire Crash Rescue Stations
LRXQ109002
B3 Submittal

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SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Progress meetings.

D. Construction progress schedule.

E. Contractor's daily reports.

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

G. Other required submittals.

H. Number of copies of submittals.

I. Requests for Interpretation (RFI) procedures.

J. Submittal procedures.

1.02 RELATED DOCUMENTS AND REQUIREMENTS

A. Section 00 72 00 - General Conditions: Dates for applications for payment.

B. Section 00 72 00 - General Conditions: Duties of the Construction Manager.

C. Section 00 73 00 - Supplementary Conditions: Duties of the Construction Manager.

D. Section 01 60 00 - Product Requirements: General product requirements.

E. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

F. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - 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 Information (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.

1.04 PROJECT COORDINATION

A. Project Coordinator: The General Contractor will designate one individual as Project Coordinator or Superintendent, as referred to in the General Conditions. **Prior to beginning work his name and qualifications will be submitted, in**

writing, to the Architect for approval. Upon approval of the Architect and the Owner, he will remain until the project is completed and cannot be removed during construction without the written consent of the Owner and the Architect. If a new Superintendent is required the Contractor shall submit the new proposed replacement name and qualifications for approval. **Individuals without satisfactory experience and qualification may not be approved.**

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

C. During construction, coordinate use of site and facilities through the Project Coordinator.

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

E. Comply with instructions for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 10 00 - Summary.

F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

G. DUTIES OF PROJECT COORDINATOR
   1. General
      a. Coordinate and direct the work of all subcontractors and material suppliers.
      b. Complete a pre review or pre construction meeting if required by the Specifications of all work prior to the start of any activity or trade. Identify and communicate coordination issues to all appropriate parties to assure a smooth informed assembly of work.
      c. Coordinate all mock ups required by the Contract Documents.
      d. Supervision: Supervise the activities of every phase of work taking place on the project including all subcontracts.
      e. Complete and or confirm all layouts of dimensions for all trades and all subcontractors.
      f. Mechanical/Electrical: Take special care to coordinate and supervise the work of the plumbing, heating and cooling and electrical subcontractors.
      g. Communication: Establish lines of authority and communication at the job site.
      h. The project coordinator must be present on the job all of the time or whenever the General Contractor or Subcontractors are completing work.
      i. Assist in obtaining building and special permits required for construction.
   2. Interpretations of Contract Documents:
      a. Consultation: Consult with Architects and Engineers to obtain interpretations.
      b. Assistance: Assist in resolution of any questions.
      c. Transmission: Transmit written interpretations to concerned parties.
   3. Project Communication
      a. All project communications shall be through the Project Managers. All Contractor and Subcontractor questions shall be directed to Duvall Decker Architects by the General Contractor Project Coordinator. All Communications from the Owner will be delivered to the Contractor by the Architect. No other instructions are contractually valid. No other person or entity is authorized to provide information on the Project.

b. All submittals, digital or physical, shall be delivered and picked up from to the project office (Duvall Decker Architects, P.A., 2915 North State Street, Jackson, Mississippi 39216).
c. The following are the only forms of written communication valid for the project. All correspondence will be sent via e-mail (print paper copies for your records). Contractual correspondence (Change Orders, Pay Applications Notice Letters etc) must also be sent as hard copy.
    1) **Requests for Information (RFI)**: Generated by the Contractor for specific questions on the project. Submit all RFIs to Duvall Decker Architects, P.A., Project Manager. All RFI's must be in writing and must be answered in writing. Number RFIs sequentially and keep a status log and copies of all RFIs in the project trailer.
    2) **Bulletins**: Additional project information will be supplied by the Architect or Owner (through the Architect) in Bulletins. (If a change in scope or time is required, a change order may be requested or proposed by the Contractor). Bulletins will be numbered sequentially. Keep a status log and copies of all Bulletins in the project trailer.
    3) **Field Reports**: Field Reports documenting the progress and issues of construction will be distributed to the Contractor and all project team members by the Architect after field visits and will include digital photographs to illustrate the progress of construction. Field Reports will be numbered sequentially. Keep a status log and copies of all Field Reports in the project trailer.
    4) **Written Letters**: Letters may be generated by any party and copied to all project Team members. Letters may be required for contractual direction or notices. These must always be verified in a hard copy delivered via US mail or US certified mail.

4. Digital Communication: The Contractor shall establish a computer with an internet connection at the project job trailer with an email address, digital camera and printer for more effective communication. All correspondence will be sent via e-mail (print paper copies for your records). Contractual correspondence (Change Orders, Pay Applications notice Letters, etc.) must also be sent as hard copy.
5. Cessation of Work: Stop all work not in accordance with the requirements of the Contract Documents.
6. Division One: Coordinate and assist in the preparation of all requirements of Division 1 and specifically as follows:
    a. Cutting and Patching: Supervise and control all cutting and patching for other trades' work.
    b. Project Meetings: Schedule and preside at all project meetings. Take and distribute meeting minutes.
    c. Construction Schedule: Prepare and submit all construction schedules. Supervise work to monitor compliance with schedules.
    d. Shop Drawings, Product Data and Samples: Administer the processing of all submittals required by the Project Manual.
    e. Schedule of Values: Assist in preparation and be knowledgeable of each entry in the schedule of values.
    f. Testing: Coordinate all required testing.
    g. Temporary Facilities and Controls: Allocate, maintain and monitor all temporary facilities.
    h. Substitutions and Product Options: Administer the processing of all substitutions.

i. Project Closeout: Conduct final inspections and assist in collection and preparation of Close Out Documents.
j. Cleaning: Direct and execute a continuing cleaning program throughout construction, requiring each trade to dispose of their debris.
k. Project Record Documents: Maintain up-to-date project record documents.
l. Enforce all safety requirements.
m. Complete Daily Reports as required in the Contract Documents.

7. Changes: Recommend and assist in the preparation of request to the Architect for any changes in the Contract.
8. Application for Payment: Assist in the preparation and be knowledgeable of each entry in the Application and Certificate for Payment.
9. Contractor's Monthly Reports and Monthly Owner Architect Contractor Meeting: Superintendent's Daily Project Reports shall be submitted with each Application for Payment. The Contractor shall lead a Monthly OAC meeting to completely review the status of the project. A Monthly Project Report shall be submitted at each Monthly OAC Meeting and shall in include all Project Logs: Submittals, Bulletins, RFI's, CO's and Updated Project Schedule. The Contractor shall keep and distribute meeting minutes of the OAC meetings within 5 days of the meeting.

H. Subcontractor's Duties
1. The subcontractor is responsible to coordinate and supervise his employees in the work accomplished under his part of the contract and as it interfaces with other work. Follow the direction of the Project Superintendent and General Contractor.
2. Schedules: Conduct work to assure compliance with construction schedules.
3. Suppliers: Transmit all instructions to his material suppliers.
4. Cooperation: Cooperate with the project coordinator and other subcontractors.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Attendance Required:
1. Owner.
2. Architect.
3. Contractor.
4. All Major Subcontractors.

C. Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Distribution of list of subcontractors, list of products, schedule of values, and progress schedule.
5. Submission of Submittal log.
6. Designation of personnel representing the parties to Contract, Owner and Architect.
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 two copies to Architect, Owner, participants, and those affected by decisions made.

3.02 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. Contractor's superintendent.
   5. Major subcontractors as required.

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 off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Maintenance of quality and work standards.
   11. Effect of proposed changes on progress schedule and coordination.
   12. Other business relating to 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.

3.03 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 5 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.

3.04 DAILY CONSTRUCTION REPORTS

A. Responsibility
   1. The Contractor (Superintendent) shall keep a Daily Construction Report documenting the conditions which exist and the construction related activities which occur at the Project Site, for every Calendar Day, from the date of the Notice To Proceed through the Date of Final Acceptance. Include only factual

information. Do not include personal remarks or opinions regarding operations and/or personnel.

2. For any day which is not a scheduled work day (Holiday, Saturday, Sunday) and during which no work was performed, the Contractor shall indicate on the report only the weather and site conditions which were known to exist on that day.

B. Report Format
   1. 8-1/2" x 11" pre-printed standardized form for reporting the required data. Contractor's standard Construction Report, Daily Log, or similar form, may be used when approved by Architect. Entries shall be printed or in a legible handwriting.
   2. The Daily Construction Report shall record the following information concerning events at Project site and project progress:
      a. Contractor Identity: Name, Address, Phone, Fax, e-mail.
      b. Project Identity: Name, Location, Architect's Project Number
      c. Project Weather Conditions: Clear, partly cloudy, overcast, misting, light rain, heavy rain, hot, cold, warm, temperature range, wind, conditions. Include statement indicating impact of Weather Conditions on work scheduled for that day.
      d. Site Conditions: Clear, muddy, dusty. Include statement indicating impact of Site Conditions on the work scheduled for that day.
      e. Work in Progress (including work begun and completed) with names of entities performing work and number of employees present for each.
      f. Visitors to Site.
      g. Problems encountered and disposition of each.
      h. Summary of Architect's instructions.
      i. Name and signature of Contractor's authorized representative who prepared the report.
      j. List of subcontractors at Project site.
      k. Major equipment at Project site.
      l. Material deliveries.
      m. Safety, environmental, or industrial relations incidents.
      n. Meetings and significant decisions.
      o. Unusual events (submit a separate special report).
      p. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
      q. Testing and/or inspections performed.
      r. Signature of Contractor's authorized representative.

C. REPORT DISPOSITION
   1. Contractor shall keep the "original" of each daily report on file at the Project Site at all times and one copy at Contractor's Office. Monthly and Project Record submittals shall be in accordance with Heading D hereinafter.

D. SUBMITTALS
   1. Monthly Submittals
      a. Contractor shall submit two (2) sets of copies of the Daily Project Reports with each monthly Application for Payment. One copy will be retained for the Architect and one copy will be forwarded to the Owner's Representative.

b. The days for which reports are submitted shall coincide with the days for which each Application for Payment is made and may not necessarily be 1st through 31st; could be, for example, 25th to 25th.

2. Project Record Submimttals: Contractor shall provide Two (2) bound sets, of the Daily Reports in accordance with Section 01700 – Project Closeout Documents.
3. Closeout Document Submittal Format
   a. Binders: Commercial quality, 8 - 1 / 2" x 11", 3 - Three ring black binder.
   b. Identification (Title Page): The first page following the clear cover shall include the following typed information:
      1) Project Identity.
      2) Contractor Identity
      3) Timer Period of Reports
      4) Dates ranges if in separate binders

3.05 REQUESTS FOR INFORMATION (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.
   3. 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 - 01 60 00 - 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, with an explanatory notation.
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, with an explanatory notation.
   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. Identify and include 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.

3.06 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Submit at the same time as the preliminary schedule specified in Section - 01 32 16 - Construction Progress Schedule.
   2. Coordinate with Contractor's construction schedule and schedule of values.
   3. Format schedule to allow tracking of status of submittals throughout duration of construction.
   4. 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.
   5. 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.

3.07 SUBMITTALS FOR REVIEW

A. For basic requirements refer to AIA Document A201, General Conditions of the Contract for Construction, Paragraph 3.12, "Shope Drawings, Product Data, and Samples."

B. 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.

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

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

E. The Contractor shall submit all Shop Drawings and Samples requiring color or finish selections within thirty days of the Notice to Proceed. The Architect will hold these submittals in order to review all color and finish items together. Once all color and finish items are recieved, the Architect will review these submissions and provide selections to the Owner for review within fifteen working days. Color and Finish selections will only be made upon Owner approval. The Contractor shall notify the Architect if any of these items will adversely affect the schedule and the Architect will expedite the review of those items.

F. The Contractor shall submit a schedule for the submission of all shop drawing, sample, and product information for the Architect's approval within 7 days of the Notice to Proceed. The schedule shall include a planned delivery date from subcontractor, general contractor review period, planned delivery date to Architect, Architect's review period and latest date needed for construction or material purchase.

G. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.08 SUBMITTALS FOR INFORMATION

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

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

3.09 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 01 78 00 - 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.

3.10 OTHER REQUIRED SUBMITTALS

A. Subcontractor List
   1. Within seven (7) days after award of the contract, the Contractor shall submit to the Architect in writing, a list of all subcontractors and portions of work to be performed by each.
   2. Subcontractors named shall be approved or disapproved in accordance with requirements of AIA Document A201, General Conditions of the Contract for Construction, Paragraph 5.2, "Award of Sub-contracts and Other Contracts for Portions of the Work."

B. SUPERINTENDENTS QUALIFICATIONS
   1. With or prior to the submission of the executed contract, the Contractor shall submit to the Architect in writing, the name and qualifications of the proposed Superintendent. The submission shall include name, contact information, resume, list of similar projects stating responsibility and at least 5 references with contact information. If after due investigation, the Architect and or Owner has reasonable objection to the proposed superintendent the Contractor

shall propose another to whom the Architect and or Owner has no reasonable objection.

C. SCHEDULE OF VALUES
   1. The required schedule of values shall be submitted to the Architect in duplicate for approval before the first request for payment is made under the Contract. See Section 01370 for requirements.

D. CONSTRUCTION SCHEDULE
   1. For basic requirements, refer to AIA Document A201, General Conditions of the Contract for Construction, Paragraph 3.10, "Contractor's Construction Schedule."
   2. The required work progress schedule shall be submitted to the Architect in duplicate and approved before the first request for payment is made under the Contract.
   3. The schedule prepared by the Contractor shall fit within the number of calendar days for completion of the project as indicated in the Contract. It is hereby understood and mutually agreed that the Notice to Proceed issued by the Architect will be the start of the total time allowed for construction of the Project. On acceptance of the building by the Owner and issuance of the Certificate of Substantial Completion by the Architect, the time of completion of this Contract shall terminate.
   4. Once approved the Schedule base line shall not change. The contractor shall show progress in relation to the base line.
   5. The Contractor shall furnish copies of this schedule to all concerned contractors and subcontractors and they may use this schedule in scheduling and completing each phase of construction.
   6. The Contractor and all subcontractors are advised to strictly adhere to this schedule.

E. GUARANTEES, WARRANTIES AND CERTIFICATES
   1. For basic requirements refer to AIA Document A201, General Conditions of the Contract for Construction, Paragraph 3.5, "Warranty," Section 01700, Project Closeout, and various sections of these Specifications for specific sampling, testing, analyzing and reporting required.
   2. Submit all guarantees, warranties and certificates to the Architect for transmittal to the Owner.

F. TEST REPORTS AND DATA
   1. All test reports and data as required by the various sections of these Specifications and in accordance with Section 01400 shall be submitted to the Architect within three (3) days of the tests performed.

G. OPERATING AND MAINTENANCE INSTRUCTIONS
   1. Where indicated in the various sections of the Specifications, furnish operating and maintenance instructions. Forward the instructions to the Architect for review. Information to be submitted in triplicate should include the following:
      a. Complete manufacturer's operating instructions and recommended cleaning and maintenance.
      b. List of spare parts and materials for each piece of equipment recommended by manufacturer.
      c. Name and address of authorized service organization and parts depot.
      d. Where indicated in the various sections of the Specifications, provide the services of a factory trained operator to instruct the Owner's authorized representative in the operation, control and maintenance of the equipment.

H. RECORD DRAWINGS
1. Upon completion of the project, the Contractor shall submit to the Architect two (2) sets of drawings marked to record all changes made during construction.
2. All changes made during the actual construction of the project shall be indicated on the drawings in yellow pencil and the location of all piping, drainage, cleanouts, apparatus and equipment shall be indicated.

3.11 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; 2 of which will be retained by Architect.
1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.12 SUBMITTAL PROCEDURES

A. General Requirements:
1. Use a separate transmittal for each item.
2. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
4. 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.
5. 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. Deliver submittals to Architect at business address.
6. 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.
7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
8. Provide space for Contractor and Architect review stamps.
9. When revised for resubmission, identify all changes made since previous submission.
10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.

11. 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.
12. Submittals not requested will not be recognized or processed.

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

C. Shop Drawing Procedures:
1. The Contractor shall submit for the approval of the Architect, accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work. No work shall be fabricated or installed by the Contractor until such approval has been given.
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 and will be returned to the Contractor for resubmission.
4. All shop drawings, submittals and product information shall be complete. If resubmission is required the complete submittal must be re-submitted. If isolated components or the submittal require re-submission, they must be marked as resubmitted within a complete resubmission of all materials.
5. Drawings and schedules shall be submitted accompanied by letter of transmittal which shall give a list of the numbers and dates of the Drawings submitted. Drawings shall be complete in every respect and bound in sets. Unless items are otherwise listed it will be understood that all shop drawings for inter-related items will be submitted at the same time.
6. The Shop Drawings shall be marked with the name of the project, numbered consecutively , and bear the stamp of approval of the Contractor as evidence that the drawings have been checked by the Contractor. Any drawings submitted without the stamp of approval will not be considered and will be returned to the Contractor for Resubmission.
7. The Contractor shall submit all Drawings and Schedules sufficiently in advance to allow ample time for checking, correcting, re-submitting, and re-checking.
8. Shop Drawings shall be processed from subcontractor through the Contractor. No shop drawings shall be submitted to the Architect by a subcontractor or material supplier.
9. The Shop Drawings shall be marked with the name of the project, numbered consecutively, and bear the stamp of approval of the Contractor as evidence that the drawings have been checked by the Contractor. Any drawings submitted without the stamp of approval will not be considered and will be returned to the Contractor for Resubmission.
10. The Contractor shall make every effort to provide shop drawings for construction and equipment conforming to the Contract Documents. The Contractor shall check shop drawings submitted by the subcontractor and material suppliers in order to determine their completeness and accuracy for construction purposes, prior to submission of such drawings to the Architect. Where changes from the Contract Documents are proposed, the Contractor shall indicate the difference in his submittal. The Contractor's check shall also determine whether or not the equipment will be compatible with his sequence of operation or the Owner's, if specified. If the equipment is not compatible with the intended or specified sequence, he shall notify the Architect.

11. The Architect will review shop drawings submissions within a reasonable amount of time (except as noted above). The Architect will include all comments or corrections desired on the first transmittal. Thus, when drawings which need corrections are resubmitted, the Architect will be able to confine his attention to those items commented on in the previous submission. **Shop drawings, which are incomplete or indicate no attempt at conformance with the Contract Documents, shall not be submitted to the Architect for review. If incomplete shop drawings are submitted to the Architect, they will be returned to the Contractor without review.**
12. The approval of shop and setting drawings will be general and, except as otherwise provided in this section, shall not be construed as permitting any departure from the Contract requirements as relieving the Contractor of the responsibility for any errors in details, diversions, or otherwise that may exist; or as approving departures from additional details or instructions previously furnished by the Architect.

D. Samples Procedures:
1. The Contractor shall furnish for the approval of the Architect any samples, required by the Specifications or that may be requested by the Architect, of any materials or equipment he proposes to use and shall prepay all shipping charges on the samples.
2. No materials or equipment of which samples are required to be submitted for approval shall be used on the work until such approval has been given by the Architect, save only at the Contractor's risk and expense.
3. Each sample shall have a label indicating the material represented, it's place of origin and the name of the producer, the Contractor, and the project for which the material is intended. Samples of finished materials submitted shall be so marked as to indicate whether the materials represented are required by the drawings or specifications.
4. A letter in duplicate submitting each shipment of samples shall be mailed under separated cover by the Contractor and contain a list of samples, the name of the project for which the materials are intended, and the trade names and manufacturers of the material.
5. The approval of any sample shall be only for the characteristics of for the uses named in such approval and no other. No approval of a sample shall be taken in itself to change or modify any contract requirement. When a material has been approved, no additional sample of that material will be considered and no change in brand or make will be permitted.

E. Transmit each submittal with a copy of approved submittal form.

F. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

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

H. 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.

I. Deliver submittals to Architect at business address.

J. Schedule submittals to expedite the Project, and coordinate submission of related items.

K. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

L. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

M. Provide space for Contractor and Architect review stamps.

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

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

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

3.13 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. "Approved", or language with same legal meaning.
      b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
         1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
      c. "Approved as Noted, Resubmit 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

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SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, with network analysis diagrams and reports.

1.02 RELATED SECTIONS

A. Section 01 10 00 - Summary: Work sequence.

B. Section 01 20 00 - Price and Payment Procedures: Application for Payment and Schedule of Values.

C. General Conditions of the Contract for Construction.

1.03 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

1.04 SUBMITTALS

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

B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

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

D. Submit updated schedule with each Application for Payment.

E. Submit in PDF format.

F. Submit under transmittal letter form specified in Section 01 30 00 - Administrative Requirements.

1.05 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a preliminary network diagram.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

D. Provide legend for symbols and abbreviations used.

E. Coordinate with 01 20 00 - Pricing and Payment Procedures: Schedule of Values.

3.03 NETWORK ANALYSIS

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.
   3. Listing of activities on the critical path.

3.04 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with the Owner and Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

3.07 RECOVERY SCHEDULE

A. When the project is behind schedule, the Contractor shall submit a recovery schedule detailing how lost time is to be reclaimed,...etc.

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SECTION 01 35 53
SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Security measures including formal security program, entry control, personnel identification, guard service, and miscellaneous restrictions.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: use of premises and occupancy.

1.03 SECURITY PROGRAM

A. Protect Work, existing premises and Owner's operations from theft, vandalism, and unauthorized entry.

B. Initiate program in coordination with Owner's existing security system at project mobilization.

C. Maintain program throughout construction period until Owner occupancy.

1.04 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site and existing facilities.

B. Allow entrance only to authorized persons with proper identification.

1.05 PERSONNEL IDENTIFICATION

A. Provide identification badge to each person authorized to enter premises.

B. Badge To Include: Personal photograph, name, assigned number, expiration date and employer.

C. Maintain a list of accredited persons, submit copy to Owner on request.

D. Require return of badges at expiration of their employment on the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 40 00
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. Control of installation.
F. Mock-ups.
G. Tolerances.
H. Manufacturers' field services.
I. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 00 31 00 - Available Project Information: Soil investigation data.
B. Document 00 72 00 - General Conditions: Inspections and approvals required by public authorities.
C. Section 01 30 00 - Administrative Requirements: Submittal procedures.
D. Section 01 42 19 - Reference Standards.
E. Section 01 60 00 - 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 2014).
B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.
C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.
D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.
F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.
G. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. 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.
C. 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.

D. 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.

E. 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.

F. 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.

G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.05 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.

1.06 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 C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
   2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
   3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
   4. Laboratory: Authorized to operate in Mississippi.
   5. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
   6. 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. 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.

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

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

D. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Make corrections as necessary until Architect's approval is issued.

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

F. 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.

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

B. 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.

C. 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.

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

E. 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 of equipment and certification as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
   1. Observer subject to approval of Architect.

C. 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.

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SECTION 01 42 19
REFERENCE STANDARDS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Document 00 72 00 - General Conditions: Reference standards.

1.02 QUALITY ASSURANCE

A. For products or 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 the reference standard of date of issue specified in this section, except where a specific date is established by applicable code.

C. Obtain copies of standards when required by Contract Documents.

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

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

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

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

2.01 AA -- ALUMINUM ASSOCIATION, INC.

A. AA DAF-45 - Designation System for Aluminum Finishes; 2003.

B. AA SAAA-46 - Standards for Anodized Architectural Aluminum; 1978.

C. AA BDAS-516161 - Behavior and Design of Aluminum Structures; 1992.

2.02 AAMA -- AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

A. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

E. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

2.03 ACI -- AMERICAN CONCRETE INSTITUTE INTERNATIONAL

2.04 AGA -- AMERICAN GALVANIZERS ASSOCIATION, INC.

A. AGA-89 - Hot Dip Galvanizing for Corrosion Protection of Steel Products; 1989.

2.05 AISC -- AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

B. AISC 360 - Specification for Structural Steel Buildings; 2010.

2.06 ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE

2.07 APA -- APA - THE ENGINEERED WOOD ASSOCIATION

2.08 ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2015.

C. ASHRAE (REFR) - ASHRAE Handbook - Refrigeration; 2014.

D. ASHRAE (HVACS) - ASHRAE Handbook - HVAC Systems and Equipment; 2012.

E. ASHRAE Guideline 0-2005 - The Commissioning Process; 2005.

2.09 ASTM A SERIES -- ASTM INTERNATIONAL

A. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2014.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

F. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2016.

G. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014 (Editorial 2017).

I. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2016.

J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2018.

K. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

L. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

M. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

N. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).

O. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

2.10 ASTM B SERIES -- ASTM INTERNATIONAL

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

D. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2012.

2.11 ASTM C SERIES -- ASTM INTERNATIONAL

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2018.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

E. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

F. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2006 (Reapproved 2011).

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

H. ASTM C793 - Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants; 2005 (Reapproved 2010).

I. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2015.

J. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

K. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members; 2018.

L. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a (Reapproved 2015).

M. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).

N. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

O. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.

P. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2000 (Reapproved 2011).

Q. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.

R. ASTM C1135 - Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants; 2000 (Reapproved 2011).

S. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2014.

T. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets; 2008 (Reapproved 2012).

U. ASTM C1249 - Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications; 2006 (Reapproved 2010).

V. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2018a.

W. ASTM C1401 - Standard Guide for Structural Sealant Glazing; 2014.

2.12 ASTM D SERIES -- ASTM INTERNATIONAL

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).

B. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2010).

C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2013.

D. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.

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

F. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems; 2014.

2.13 ASTM F SERIES -- ASTM INTERNATIONAL

A. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2015.

B. ASTM F1700 - Standard Specification for Solid Vinyl Tile; 2013a.

C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

2.14 AWI -- ARCHITECTURAL WOODWORK INSTITUTE

A. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

2.15 ICC -- INTERNATIONAL CODE COUNCIL, INC.

2.16 IES/IESNA -- ILLUMINATING ENGINEERING SOCIETY

2.17 NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

2.18 NRCA -- NATIONAL ROOFING CONTRACTORS ASSOCIATION

A. NRCA MS103 - Handbook of Accepted Roofing Knowledge (HARK); Fourth Edition.

B. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

C. NRCA MS104 - The NRCA Roofing Manual: Steep-slope Roof Systems; 2013.

2.19 SDI -- STEEL DECK INSTITUTE

2.20 SDI -- STEEL DOOR INSTITUTE

2.21 SMACNA -- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.

A. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

2.22 TCNA -- TILE COUNCIL OF NORTH AMERICA, INC.

2.23 UL -- UNDERWRITERS LABORATORIES INC.

A. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

B. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

PART 3 UNITED STATES GOVERNMENT AND RELATED AGENCIES DOCUMENTS

3.01 CFR -- CODE OF FEDERAL REGULATIONS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. 36 CFR 1192 - Americans with Disabilities Act Accessibility Guidelines for Transportation Vehicles; Final Guidelines; Architectural and Transportation Barriers Compliance Board; current edition.

END OF SECTION

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SECTION 01 45 33
CODE-REQUIRED SPECIAL INSPECTIONS

PART 1 GENERAL

1-01 DESCRIPTION

A. The Contractor shall employ one or more special inspectors to provide inspections during construction and shall employ testing laboratory to perform all tests. All payments to special inspectors and testing labs shall be by Contractor. The special inspector shall be approved by the Owner, Architect, and Engineer.

B. Special inspection and testing shall meet the requirements of the International Building Code Section 1704. Requirements and forms for structural inspections and testing are included.

1. Statement of Structural Special Inspections.
2. Special Inspection Final Report.
3. Qualifications of Inspections and Testing Technicians.
4. Special Inspection Daily Report.
5. Special Inspection Weekly Report.
6. Special Inspection Discrepancy Notice.
7. Structural Special Inspection Schedule.
8. Wind Force Resisting Structure.
9. Seismic Force Resisting Structure.

C. Special inspections shall be approved by the Architect and Engineer. All reports shall be sent to the Contractor, Architect, Engineer, and Owner.

D. Duties and Responsibilities

1. Signify presence at jobsite. Special inspectors should notify Contractor personnel of their presence and responsibilities at the jobsite. If required by the building official, they shall sign in on the appropriate form posted with the building permit.

2. Observe assigned work. The special inspector shall observe assigned work for conformance with the building department approved (stamped) design drawings and specifications and applicable workmanship provisions of the International Building Code. Architect/Engineer-reviewed shop drawings may be used only as an aid to inspection.

   For continuous special inspection, the special inspector shall be on site at all times observing the work requiring special inspection. Periodic inspections, if any, must have prior approval based on a separate written plan reviewed and approved by the Architect and Engineer and the registered design professional in responsible charge. Periodic inspection is intended to mean that the inspector at periodic times inspects all work performed but is not required to “witness” the work being performed.

3. Report nonconforming items. The special inspector shall bring nonconforming items to the immediate attention of the Contractor, Architect, Engineer, and Owner and note all such

items in the daily report. If any item is not resolved in a timely manner or is about to be incorporated in the work, the special inspector shall immediately notify the registered design professional in responsible charge and post a discrepancy notice.

4. Provide timely reports. The special inspector should complete written inspection reports for each inspection visit and provide the reports on a timely basis. The special inspector or inspection agency shall furnish these reports directly to the Contractor, Architect, Engineer, Owner, and others as designated (See IBC Section 1704.1.2). These reports should be organized on a daily format and may be submitted weekly at the option of the building official. These reports should include:

    a. Description of daily inspections and tests made with applicable locations;
    b. Listing of all nonconforming items;
    c. Report on how nonconforming items were resolved or unresolved as applicable; and
    d. Itemized changes authorized by the architect, engineer, and building official if not included in nonconforming items.

5. Submit final report. The special inspector or inspection agency shall submit a final signed report to the Contractor, Architect, Engineer, and Owner stating that all items requiring special inspection and testing were fulfilled and reported and, to the best of his/her knowledge, in conformance with the approved design drawings, specifications, approved change orders and the applicable workmanship provisions of the International Building Code. Items not in conformance, unresolved items or any discrepancies in inspection coverage (i.e., missed inspections, periodic inspections when continuous were required, etc.) shall be specifically itemized in this report.

E. Contractor Responsibilities

1. Notify the special inspector. The Contractor is responsible for notifying the special inspector or agency regarding individual inspections for items listed on the attached schedule and as noted on the building department approved plans. Adequate notice shall be provided so the special inspector has time to become familiar with the project.

2. Provide access to approved plans. The contractor is responsible for providing the special inspector access to approved plans.

3. Retain special inspection records. The Contractor is also responsible for retaining at the jobsite all special inspection records completed by the special inspector upon request.

STRUCTURAL SPECIAL INSPECTION SCHEDULE
VERIFICATION AND INSPECTION OF FABRICATORS

Verification and Inspection Task		Applicable To Project?	Frequency		Referenced Standard	Code Reference	Agent
			Continuous	Periodic			
1. Applicable Element (Fabricator Certification Requirements)		Yes		X		1704.2 1704.3 1704.6	
A. Structural Steel (AISC Certified For Conventional Steel Building) B. Steel Joists/ Joist Girders (SJI Member) C. Steel Roof Deck (SDI Member) D. Precast Concrete Wall Panels (PCI Group C Manufacturer with C3 Certification) E. Load Bearing Concrete Masonry (NCMA Member)							
2. When Special Inspections Are Required By The Building Official:		Yes		X			
A. Fabrication And Implementation Procedure: The Special Inspector Shall Verify That The Fabricator Maintains Detailed Fabrication And Quality Control Procedures That Provide A Basis For Inspection, Control Of The Workmanship, And The Fabricator's Ability To Conform To Approved Construction Documents And Referenced Standards. The Special Inspector Shall Review The Procedures For Completeness And Adequacy Relative To The Code Requirements For The Fabricator's Scope Of Work.							
3. When Special Inspections Are Not Required By The Building Official:		Yes		X			
A. Upon Completion Of Fabrication, The Approved Fabricator Shall Submit A Certificate Of The Complicance To The Building Official Stating That The Work Was Performed In Accordance With The Approved Construction Documents.							

STRUCTURAL SPECIAL INSPECTION SCHEDULE
VERIFICATION AND INSPECTION OF SOILS

Verification and Inspection Task		Applicable To Project?	Frequency		Referenced Standard	Code Reference	
			Continuous	Periodic			
Verify materials below footings are adequate to achieve the design bearing capacity.		Yes		X	Geotech. Report	1704.7	
Verify excavations are extended to proper depth and have reached proper materials.		Yes		X		1704.7	
Perform classification and testing of controlled fill materials.		Yes		X		1704.7	
Verify use of proper materials, densities and lift thickness during placement and compaction of controlled fill.		Yes	X			1704.7	
Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly.		Yes		X		1704.7	

STRUCTURAL SPECIAL INSPECTION SCHEDULE
VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION

Verification and Inspection Task		Applicable To Project?	Frequency Cont.	Frequency Periodic	Referenced Standard	Code Reference	
Inspection of reinforcing steel, including prestressing tendons, and placement.		Yes		X	ACI 318:3.5, 7.1-7.7	1913.4	
Inspection of reinforcing steel welding in accordance with Table 1704.3, Item 5b.		Yes			AWS D1.4 ACI 318: 3.5.2		
Inspect bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased.		Yes	X			1911.5	
Verifying use of required design mix.		Yes		X	ACI 318:Ch.4, 5.2-5.4	1904.2.2, 1913.2, 1913.3	
At the time fresh concrete is sampled to fabricate specimens for strength tests perform slump and air content tests, and determine the temperature of the concrete.		Yes	X		ASTM C 172, ASTM C 31, ACI 318: 5.6, 5.8	1913.10	
Inspection of concrete and shotcrete placement for proper application techniques.		Yes	X		ACI 318: 5.9, 5.10	1913.6, 1913.7, 1913.8	
Inspection for maintenance of specified curing temperature and techniques.		Yes		X	ACI 318: 5.11-5.13	1913.9	
Inspection of prestressed concrete: a. Application of prestressing forces. b. Grouting of bonded prestressing tendons in the seismic-force-resisting system.		No	X X		ACI 318: 18.20, ACI 318: 18.18.4		
Erection of precast concrete members.		No		X	ACI 318: Ch. 16		
Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs.		No		X	ACI 318: 6.2		
Inspect formwork for shape, location and dimensions of the concrete member being formed		No		X	ACI 318: 6.1.1		

STRUCTURAL SPECIAL INSPECTION SCHEDULE
VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION-TABLE 1

Verification and Inspection Task		Applicable To Project?	Frequency		Referenced Standard	Code Reference	
			Cont.	Periodic			
1. Material verification of high-strength bolts, nuts and washers:							
a. Identification markings to conform to ASTM standards specified in the approved construction documents.		Yes		X	Applicable ASTM material specifications; AISC 360, Section A3.3		
b. Manufacturer's certificate of compliance required.		Yes		X			
2. Inspection of high-strength bolting:							
a. Bearing-type connections.		Yes		X	AISC 360, Section M2.5	1704.3.3	
b. Slip-critical connections.		Yes	X	X			
3. Material verification of structural steel:							
a. Identification markings to conform to ASTM standards specified in the approved construction documents.		Yes			ASTM A 6 or ASTM A 568	1708.4	
b. Manufacturer's certified mill test reports.		Yes			ASTM A.6 or ASTM A 568		
4. Material verification of weld filler materials:							
a. Identification markings to conform to AWS specification in the approved construction documents.		Yes			AISC 360, Section A3.5		
b. Manufacturer's certificate of compliance required.		Yes					

STRUCTURAL SPECIAL INSPECTION SCHEDULE
VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION-TABLE 2

Verification and Inspection Task		Applicable To Project?	Frequency		Referenced Standard	Code Reference	
			Cont.	Periodic			
5. Inspection of welding:							
a. Structural steel:							
1) Complete and partial penetration groove welds.		Yes	X				
2) Multipass fillet welds.		Yes	X		AWS D1.1	1704.3.1	
3) Single-pass fillet welds > 5/16"		Yes	X				
4) Single-pass fillet welds ≤ 5/16"		Yes		X			
5) Floor and roof deck welds.		Yes		X	AWS D1.3		
b. Reinforcing steel:							
1) Verification of weldability of reinforcing steel other than ASTM A 706.		No		X			
2) Reinforcing steel-resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special reinforced concrete shear walls and shear reinforcement.		No	X		AWS D1.4, ACI 318: 3.5.2		
3) Shear reinforcement.		No	X				
4) Other reinforcing steel.		No		X			
6. Inspection of steel frame joint details for compliance with approved construction documents:				X			
a. Details such as bracing and stiffening.		Yes				1704.3.2	
b. Member locations.		Yes					
c. Application of joint details at each connection.		Yes					

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drinking Water
B. Temporary telecommunications services.
C. Temporary sanitary facilities.
D. Temporary Controls: Barriers, enclosures, and fencing.
E. Vehicular access and parking.
F. Waste removal facilities and services.
G. Project identification sign.
H. Field offices.
I. Storage Sheds and Containers
J. Furnishing and Maintenance of Equipment
K. Removal of Utilities, Facilities, and Controls

1.02 RELATED REQUIREMENTS

A. Section 01 35 53 - Security Procedures
B. Section 01 51 00 - Temporary Utilities.

1.03 TEMPORARY UTILITIES - SEE SECTION 01 51 00

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

1.04 DRINKING WATER

A. The General Contractor shall furnish and provide drinking water facilities for all workmen on the job. This shall include icing when required, paper cups, etc., all maintained in a sanitary condition.

1.05 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
B. Telecommunications services shall include:
   1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
   2. Internet Connections: Minimum of one; DSL modem or faster.
   3. Email: Account/address reserved for project use.
   4. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.

1.06 TEMPORARY SANITARY FACILITIES

A. On all projects, the General Contractor shall provide and maintain required facilities and enclosures. Toilets are to be installed in strict accordance with the regulations of the State Board of Health. The toilets are to be located on the site as directed by the Architect or his authorized representative. Provide at time of project mobilization.
B. Maintain daily in clean and sanitary condition.

1.07 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

E. Provide all necessary warning and danger lights from twilight to sunrise.

F. All such barriers shall be in strict accordance with all legal requirements and laws.

1.08 FENCING

A. Install temporary 6'-0" high galv. metal construction fencing & gates where shown. Fencing shall consist of 2-1/2" dia. Corner posts and 2" dia. Intermediate posts spaced at 10'-0" o.c. max. Posts shall extend into ground 3'-0" min. Typ. Provide 2" dia. Horiz. Post @ top of fence typ. Provide 1-1/4" dia. Horiz. Bracing posts @ mid-height each. Side of corner posts typ. Fencing to consist of galv. Wire fabric with continuous weather-resistant visual screen fabric. Employ 1/4"x3/4" galv. Stretcher bars and tension bands @ wire fabric ends typ. Intermediate attachments to be wire tied. Equip with vehicular and pedestrian gates with locks.

1.09 SECURITY - SEE SECTION 01 35 53

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.10 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.11 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

E. No burning of trash or debris shall be done on Owner's property. All such materials shall be removed from the site and disposed of in accordance with local laws and ordinances.

1.12 FIELD OFFICES

A. Each Contractor shall be responsible for supplying, maintaining, and removing his own Field Office when directed: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table in locations on the site as directed by the Architect, or his authorized representative and best suited for their respective uses, as follows.

B. The Field Office is for the use of the Contractor, Architect's representative, and Owner's representative.

C. Provide space for Project meetings, with table and chairs_____. Provide office with a desk with drawers for filing correspondence for each user, and a blueprint rack, all with suitable hardware; a door and window; and a minimum of 100 square feet.

D. Provide a telephone, fax machine, answering machine, a digital camera and a computer with a scanner and printer and an internet connection and email address. The Contractor and computer system shall be capable of taking digital photographs or scanning drawings, downloading them to the computer and emailing them to the Architect.

E. Maintain office in a sanitary and usable condition.

F. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.13 STORAGE SHEDS AND CONTAINERS

A. The Contractor and subcontractor shall be responsible for supplying storage sheds and or containers with the appropriate environment for the materials stored.

1.14 FURNISHING AND MAINTENANCE OF EQUIPMENT

A. Contractor shall furnish and maintain all equipment such as temporary stairs, ladders, ramps, scaffolds, hoists, runways, derricks, chutes, elevators, etc. as required for proper execution of the work of all trades. All such apparatus, equipment and construction shall meet all the requirements of the Labor Law and other state or local laws applicable thereto.

1.15 DEMOLITION

A. The Contractor shall demolish all existing work required to complete the new work specified herein and as indicated on the drawings. Contractor shall assume ownership of said demolished materials and remove from site, except items chosen by the Owner to remain in his possession.

1.16 FIRE PROTECTION DURING CONSTRUCTION

A. The Contractor shall provide and maintain in working order U. L. fire extinguishers having a 2A-20BC or equivalent rating in all temporary offices, storage sheds, and one such extinguisher per 3,000 square feet of building floor area under construction during the period of construction. Dry chemical type extinguishers shall not be used. Exit ways leading to building exits shall be maintained and kept free of all debris, materials, and equipment.

B. Special precautions shall be taken to minimize the fire hazards when it becomes necessary to use stoves, salamanders, tar pots, or other temporary heating devices. Such devices shall conform to the requirements of the National Fire Code of the National Fire Protection Association and shall be used only when job is attended. Such devices shall be located so that there is a clearance of not less

than six feet above or less than two and one half feet on all sides between devices and unprotected combustible materials nor shall they be placed within ten feet (10') of tarpaulin or canvas covers. Legs of temporary heating devices shall be properly insulated when it is necessary to place such equipment on combustible platforms.

C. Combustible materials shall not be stored near structural steel members until fireproofing has been installed. Forms of combustible material shall be stripped from reinforced concrete construction as soon as setting of the concrete will permit and shall be promptly removed from the building. The use of wood scaffolding shall be kept to a minimum and entirely eliminated when possible in order to eliminate fire hazards from this source. No part of the building where forms are in place shall be used for the storage of flammable materials of any kind.

D. Special precautions shall be taken to reduce fire hazards where electrical or gas welding or cutting work is done and suitable fire extinguishing equipment shall be maintained near such operations.

E. Paints, varnishes, volatile oils, etc., shall be stored in a room having good ventilation and containing no other material, or in U. L. listed metal lockers or metal boxes with self-closing covers. These cabinets shall be limited to a 60 gallon storage capacity with not more than three storage cabinets per area. Provide a 2A:20B:C rated fire extinguisher for protection in each of these areas. Gasoline and other volatile and flammable liquids shall be stored in a metal barrel well away from structures or other combustible materials.

1.17 MAINTENANCE AND REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Maintain all temporary facilities and controls as long as needed for the safe and proper completion of the Work.

B. Remove all such temporary facilities and controls as rapidly as progress of the Work will permit, or as directed by the Architect.

C. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.

D. Clean and repair damage caused by installation or use of temporary work.

E. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 51 00
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

A. Section 01 50 00 - Temporary Facilities and Controls:
   1. Temporary telecommunications services for administrative purposes.
   2. Temporary sanitary facilities required by law.

1.03 TEMPORARY ELECTRICITY

A. Cost: By Contractor.

B. Provide power service required from utility source.

C. Power Service Characteristics: _____ volt, _____ ampere, three phase, four wire.

D. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.

E. Provide main service disconnect and over-current protection at convenient location and meter.

F. Permanent convenience receptacles may be utilized during construction.

G. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.04 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft (to achieve a minimum lighting level of _____ watt/sq m).

B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

C. Maintain lighting and provide routine repairs.

1.05 TEMPORARY HEATING

A. Cost of Energy: By Contractor.

B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.

C. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.

1.06 TEMPORARY COOLING

A. Cost of Energy: By Contractor.

B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.

C. Maintain maximum ambient temperature of 80 degrees F (26 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.

1.07 TEMPORARY VENTILATION

A. Existing ventilation equipment may not be used.

1.08 TEMPORARY WATER SERVICE

A. Cost of Water Used: By Contractor.

B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

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SECTION 01 57 03
STORMWATER POLLUTION PREVENTION PLAN

Plan Development. For this contract, the following Storm Water Pollution Prevention Plan (SWPPP) elements will be provided by the Government. Plan Sheet indicating locations of Best Management Practices (BMP'S) controls and the Plan Sheet titled "Erosion Control Details" contained in the Contract Documents. Contractor shall adopt these elements in their SWPPP of record and shall comply with all requirements. The SWPPP for this project shall be in accordance with sound engineering practices. This plan shall identify potential sources of pollution that may affect the quality of storm water discharges associated with construction activity. Furthermore, this plan shall describe and ensure that implemented control measures are maintained in order to minimize pollutants in storm water discharges and assure compliance with the terms and conditions of this permit.

The Contractor is responsible for the preparation of the SWPPP. The SWPPP shall be developed, executed, and maintained in accordance with sound engineering practices, local stormwater ordinances, and the State of Mississippi's Storm Water Small Construction General Permit (Mississippi Department of Environmental Quality, Office of Pollution Control).

The Contractor shall make a copy of the SWPPP available to the Government or Office of Pollution Control inspectors for review at the time of any on-site inspection.

Upon beginning any construction activities, the Contractor shall implement appropriate measures of control to assure that the SWPPP is in compliance with the terms of the plan.

The Contractor shall make revisions to the SWPPP throughout the duration of the project to address any changes in design, construction, operation, or maintenance, which may potentially affect the discharge of pollutants to State waters.

Erosion and Sediment Controls. The Contractor shall implement the following controls with best management practices in accordance with the permit requirements to minimize erosion and control the loss of sediment from the construction area: The following descriptions of measures to be utilized will address these minimum components:

Silt fence shall be utilized in variable areas over the complete length of this project to prevent sedimentation from leaving the construction limits due to increased water shed in certain areas and from damaging areas away from the site. These controls shall be installed after the clearing and prior to the grubbing of the site.

Erosion checks shall be placed in the downside of streambeds crossed by the pipeline to reduce the amount of sedimentation loss. This type of filter barrier shall be provided through the duration of the project as indicated on the plans, unless otherwise specified by the Government.

Temporary and permanent seeding shall be utilized throughout the course of the project in areas where these measures are deemed necessary, unless otherwise specified by the Government.

Housekeeping Practices. Designated areas for equipment maintenance and repair shall be provided. Furthermore, areas for concrete chute wash off, waste receptacles with regular collection of waste, and protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials shall be provided throughout the duration of the project. Adequately maintained sanitary facilities shall also be provided.

Implementation of Controls. Erosion controls shall be in place before land disturbance begins in order to prevent erosion and adverse impacts to off-site areas and receiving streams.

Maintenance and Weekly Inspections. All erosion controls shall be inspected at least once every seven calendar days, within twenty-four hours of the end of a half-inch storm event, or as often as necessary to ensure that appropriate erosion and sediment controls have been properly constructed and maintained and to determine if additional or alternative control measures are required. All inspections conducted must be documented and certified. Documentation must include the day and time the inspection was performed, who performed the inspection, any deficiencies noted, and corrective action needed. Documentation of all inspections must be kept with the SWPPP. Inspection must continue until such time that planned construction activities have been completed, land disturbing activities have ceased, and disturbed areas have been stabilized with no significant erosion occurring. Upon successful completion of all permanent erosion and sediment controls, inspection and reporting requirements are no longer required. Copies of the inspection report forms shall be provide to the Contracting Officer. The Contracting Officer shall retain all records, reports, and information resulting from activities required by this permit for a period of at least three years from the date construction was completed.

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SECTION 01 57 13
TEMPORARY EROSION CHECKS

PART 1 - GENERAL

1-01 DESCRIPTION

A. This work consists of furnishing, constructing and maintaining wattles for the retention of soil along the toe of fill slopes, around inlets, swale areas, small ditches, sediment basins and other areas as directed by the Contracting Officer in accordance with the requirements shown on the plans and these specifications. Also, the work includes removing and disposing of the erosion checks and silt accumulations as directed by the Contracting Officer.

PART 2 - MATERIALS

2-01 VEGETATIVE MATERIALS FOR MULCH

A. Wattles used around inlets shall have a minimum diameter of twelve inches (12”) and a length adequate to meet field conditions. Wattles used at other locations shall have a minimum diameter of twenty inches (20”) and a length adequate to meet field conditions. The stakes used in securing the wattles in place shall be placed approximately three feet (3’) apart throughout the length of the wattle. Stakes shall be wooden and of adequate size to stabilize the wattles to the satisfaction of the Contracting Officer.

PART 3 - EXECUTION

3-01 GENERAL

A. The erosion checks shall be constructed at the locations and according to the requirements shown on the plans or as directed by the Contracting Officer. Erosion checks required along the toe of fill slopes shall be constructed prior to grading operations at the site. For other locations, the erosion checks shall be constructed when directed by the Contracting Officer.

3-02 MAINTENANCE AND REMOVAL

A. The Contractor shall maintain the erosion checks and remove and dispose of silt accumulations as directed by the Contracting Officer.

B. When the erosion checks are no longer needed, they shall be removed and the Contractor shall dispose of the silt accumulations and treat the disturbed areas in accordance with the contract requirements.

END OF SECTION
01 57 13

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SECTION 01 57 23
SILT FENCE

PART 1 - GENERAL

1-01 DESCRIPTION

A. This work consists of furnishing, construction and maintaining a water permeable filter type fence for the purpose of removing suspended soil particles from the water passing through it in accordance with the requirements shown on the plans and these specifications.

PART 2 - MATERIALS

2-01 GEOTEXTILE FABRIC

A. Unless specified otherwise, the fabric may be woven or nonwoven. The fabric shall consist only of long chain polymeric yarns of filaments such as polypropylene, poly-ethylene, polyester, polyamide or polyvinylidene-chloride and shall be formed into a stable network such that the yarns or filaments retain their relative position. The fabric shall be mildew resistant and inert to biological degradation and naturally encountered chemicals, alkalies and acids. Fabric which is not protected from sunlight after installation shall contain stabilizers and/or inhibitors to make it resistant to deterioration from direct sunlight, ultraviolet rays and heat.

B. The edges of the fabric shall be selvaged or finished in such a manner to prevent the outer yarn or filaments from raveling. The fabric shall be free of defects or flaws which affect the required physical properties.

C. Fabric shall be manufactured in widths of not less than three feet. Sheets of fabric may be sewn or bonded together at the factory or other approved locations but deviation from the physical requirements will not be permitted.

D. Tests for manufacturer's certification shall be conducted with fabric as shipped by the manufacturer and acceptance testing will be conducted with fabric from the project.

E. The fabric shall conform to the physical requirements of Type I or II as shown in Table 1. Unless a specific type is specified in the plans or contract documents, the Contractor may select Type I or II.

2-02 WOVEN WIRE BACKING

A. Except as provided herein, the silt fence shall be reinforced with a woven wire backing. The wire backing shall be at least 32 inches high and have no less than six horizontal wires. Vertical wires shall be spaced no more than 12 inches apart. The top and bottom wire shall be 10 gage or larger. All other wire shall be no smaller than 12-1/2 gage.

2-03 POSTS

A. Wood or steel posts may be used. Wood posts shall have a minimum diameter of three inches and length of five feet and shall be straight enough to provide a fence without noticeable misalignment. Steel tee posts shall be five long, approximately 1-3/8 inches wide, 1-3/8 inches deep and 1/8 inch thick with a nominal weight of 1.33 pounds per foot prior to fabrication. The posts shall have projections, notches or holes for fastening the wire backing or fabric to the posts.

2-04 STAPLES

A. Staples shall be made of nine gage wire with a minimum length of one inch after bending.

2-05 IDENTIFICATION

A. Each roll of fabric or container shall be visibly labeled with the name of the manufacturer, type of fabric or trade name, lot number and quantity of material.

2-06 MANFACTURER'S CERTIFICATION

A. The Contractor shall furnish to the Contracting Officer three copies of the manufacturer's certified test reports and certification that each lot complies with the requirements of the contract. All fabric, steel pins, washers, fence posts, woven wire and wire staples are subject to approval by the Contracting Officer upon delivery to the work site and prior to incorporating in the work.

PART 3 - EXECUTION

3-01 PLACEMENT OF THE FENCE

A. The silt fences shall be constructed at the locations shown on the plans or as directed by the Contracting Officer.

B. All posts shall be installed so that no more than three feet of the post shall protrude above the ground. Extra post for bracing shall be installed as directed by the Contracting Officer. The woven wire shall be securely fastened to the wood posts with staples. When metal posts are used, the wire shall be fastened to the post with wire or other approved means. The bottom edge of the fabric shall be buried 6" below ground surface to prevent undermining. When splicing of the fabric is necessary, two posts shall be installed approximately 18" apart and each piece of fabric shall be fastened to both posts.

The fabric will be rejected if it has defects, rips, holes, flaws, deterioration, of damage incurred during manufacture, transportation, storage or installation

C. Type II fabric may be installed without the woven wire fence backing provided all of the following conditions are met:

1. Post spacing is reduced to six feet or less.

2. The fabric has been approved by the Contracting Officer and the manufacturer recommends its use without the woven wire backing.

3. Fence posts shall be inclined toward the runoff source at an angle of not more than 20° from vertical.

4. Fabric shall be attached to the posts in such a manner that purpose intended is satisfied and maintained.

3-02 MAINTENANCE AND REMOVAL

A. The Contractor shall maintain the silt fence and the fabric shall be removed and replaced when deteriorated to such an extent that it reduces the effectiveness of the silt fence.

B. Unless otherwise directed, all temporary silt fences shall be removed. Upon removal, the Contractor shall remove and dispose of any excess silt accumulations, dress the area to give a pleasing appearance and vegetate all bare areas in accordance with the contract requirements. The temporary materials will remain the property of the Contractor and may be used at other locations provided the materials are acceptable to the Contracting Officer.

TABLE I
GEOTEXTILE FABRICS -- MINIMUM AVERAGE ROLL VALUE

Type Designation								
Physical	I	II	III	IV	V	VI	VII	Test Method
Tensile Strength, lbs. Weaker principle direction	50	90	90	90	200	280	450	ASTM D 4632 (CRE) (See note 1)
Elongation at required strength, percent.	-	50 (max)	20	50	-	-	-	ASTM D 4632 (CRE) (See note 1)
Bursting Strength, psi	100	180	140	-	300	450	700	ASTM D 3786, Diaphragm Bursting Tester.
Puncture Strength, psi	-	-	35	-	80	110	180	ASTM D 3787, Tension Testing Machine with Ring Clamp; Steel Ball replaced with a 5/16 inch hemispherical tip.
Trapezoidal Tear, lbs	-	-	35	-	65	100	150	ASTM D 4533 (CRE) (See note 1)
Retained Strength when wet, percent	100	100	100	-	100	100	100	ASTM D 4632 (CRE) AND ASTM 3786 AND 3787, as above. (See note 1)
Thickness, mils.	-	-	-	40	-	-	-	ASTM D 1777
Weight, oz./sq. yd.	-	-	-	4-9	-	-	-	ASTM D 3766, Option A or B
Asphalt Retention, oz./ sq. ft.	-	-	-	3.0	-	-	-	Miss. Test Method MT 64
Maximum Change in Area, percent.	-	-	-	15	-	-	-	Miss. Test Method MT 64
Permeability, cm./sec.) See note 2)	-	-	.01	-	.01	.01	.01	AASHTO M 288 (Appendix)
Flow Rate, gal./min/sq. ft. (See note 2)	-	-	30	-	30	30	30	AASHTO M 288 (Appendix)
Equivalent Opening Size (EOS) (See notes 2 & 3) Woven Fabric NonWoven Fabric	20-100 20+	20-100 20+	40-100 40+	- -	70-100 70+	70-100 70+	70-100 70+	Miss. Test Method MT 60
Tensile Strength after Ultraviolet exposure, lbs.	40	80	-	-	-	-	-	ASTM D 4632 (CRE) after 500 hours exposure on xenon arc weatherometer as detailed in ASTM G 26 (See note 1)

Note 1: A test result shall be the average of the test values of five specimens.
Note 2: Unless designated otherwise in the plans of contract documents.
Note 3: The EOS test for nonwoven fabric may be waived by the Contracting Officer.
Note 4: All of the above strength tests except "retained strength" are to be conducted in a dry condition.

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SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 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.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

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

2.02 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.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

3.02 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

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

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.

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

C. Store with seals and labels intact and legible.

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

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

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

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

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

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

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

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

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SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Cleaning and protection.

E. Starting of systems and equipment.

F. Demonstration and instruction of Owner personnel.

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

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

B. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.

C. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.

D. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

E. Individual Product Specification Sections:
   1. Advance notification to other sections of openings required in work of those sections.
   2. Limitations on cutting structural members.

1.03 SUBMITTALS

A. See Section 01 30 00 - 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. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.
   6. Include in request:
      a. Identification of Project.
      b. Location and description of affected work.
      c. Necessity for cutting or alteration.
      d. Description of proposed work and products to be used.
      e. Alternatives to cutting and patching.
      f. Effect on work of Owner or separate Contractor.

g. Written permission of affected separate Contractor.
h. Date and time work will be executed.

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

1.04 PROJECT CONDITIONS

A. Use of explosives is not permitted.

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

C. 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.

D. 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.

E. 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.

1.05 COORDINATION

A. 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.

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

C. 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.

D. 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.

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

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

G. 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 -- NOT USED

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 four 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. 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; and _____.
   2. Grid or axis for structures.

3. Building foundation, column locations, ground floor elevations, and _____.

E. Periodically verify layouts by same means.

F. 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 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

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

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

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

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

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

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

3.07 SYSTEM STARTUP

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

B. Notify Architect and Owner seven days prior to start-up of each item.

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

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

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

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

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

3.08 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

3.09 ADJUSTING

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

B. Testing, adjusting, and balancing HVAC systems: See Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

3.10 FINAL CLEANING

A. See Section 01 74 00 - Cleaning.

B. Execute final cleaning prior to final project assessment.

C. Use cleaning materials that are nonhazardous.

D. 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.

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

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

G. Clean filters of operating equipment.

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

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

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

3.11 CLOSEOUT PROCEDURES

A. Scope: The work required under this section consists of the sequence of required inspections and closeout documents for substantial completion, and the requirements for final inspection and submission documents for final payment.

B. Contractor's Punch List
   1. Contractor shall 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.
   2. The Contractor's Correction Punch List shall itemize all non-conforming and incomplete items, to include all General, Mechanical, and Electrical Items. Furnish Architects with Four (4) copies of Contractor's Punch List including all General, Mechanical and Electrical items.
   3. Furnish all subcontractors a typewritten list of non-conforming and incomplete items and the time in which items are to be corrected and completed.
   4. Contractor shall verify completion of all items on the Contractors Correction Punch List, including mechanical and electrical items. **Upon completion and verification**, Contractor shall notify the Architect in writing that all of the

Contractors Punch List items are complete and the Project is ready for inspection and the Architects Punch List.

C. Architect's Punchlist and Inspection
   1. Upon written notice from Contractor to Architect of completion of all Contractors' Punch List items, the Architect shall visit the site to verify that the Project is ready for the Architect's Inspection.
      a. If it is determined at that time that the Project is ready for inspection, the Architect and Engineers will develop a Punch List, listing all incomplete or non-conforming items. Upon completion of the Architect's Punch List, Architect will transmit four (4) copies to the Contractor.
      b. If it is determined that the Project is not ready for a Punch List, the Architect will notify the Contractor to review the Project and Contract Documents and continue to correct and/or complete all non-conforming and incomplete work. This sequence will continue until the Project is ready for the Architects inspection. In accord with Owner/Architect Agreement, the Architect will invoice the Owner for Additional Services for each re-inspection and that amount will be passed on to the Contractor as liquidated damages as determined by the Owner.

D. Owner's Punch List and Inspection
   1. Upon written notice from Contractor to Architect of completion of all Architects' Punch List items, the Architect shall visit the site to verify that the Project is ready for Owner's Inspection.
      a. If it is determined at that time that the Project is ready for inspection, the Architect and Owner will develop a Final Punch List, listing all incomplete or non-conforming items. Upon completion of the Owners Punch List, Architect will transmit it to the Contractor.
      b. If it is determined that the Project is not ready for an Owner's Punch List, the Architect will notify the Contractor to review the Project and Contract Documents and continue to correct and/or complete all non-conforming and incomplete work. This sequence will continue until the Project is ready for the Owner's inspection. In accord with Owner/Architect Agreement, the Architect will invoice the Owner for Additional Services for each re-inspection and that amount will be passed on to the Contractor as liquidated damages as determined by the Owner.

3.12 SUBSTANTIAL COMPLETION

A. Upon written notice from the Contractor to the Architect of the completion of all the Owners Punch List items, and when all other requirements are satisfied, the Architect and Owner shall determine if the project is Substantially Complete.

B. If the Project is Substantially Complete at the time of the Owners Punch List and the Submission of the Closeout Documents has been approved, the Architect will prepare a Certificate of Substantial Completion Document with an attached list of incomplete or non-forming items and establish the number of calendar days that all Work is to be completed.

C. If it is determined by the Owner that the Project is not substantially complete, the Architect shall notify Contractor, and Contractor shall continue until the project is complete and continue correcting incomplete and nonconforming punch list items. The Contractor shall notify the Architect for re-inspection when the building is Substantially Complete and schedule a re-inspection. This sequence will continue until the Project can be turned over to the Owner for its intended use as defined above and as determined by Owner and Architect. The Owner will be invoiced by

the Architect for Additional Service for each re-inspection and passed on to the Contractor as liquidated damages as determined by the Owner.

D. Substantial Completion is defined in accordance the General Conditions 9.8.1, As the following: " Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with Contract Documents so the Owner can occupy or utilize the Work for its intended use".

E. Prior to the Contractors request of an Owners inspection, the Closeout Documents shall submitted for review receive approval from the Architect. Note; Substantial completion shall not be established until all Closeout Documents have been submitted, checked and approved by the Architect.

3.13 CLOSEOUT DOCUMENTS

A. In general Documents for Closeout are to be submitted by the Contractor to the Architect for transmittal to the Owner and shall be in triplicate (unless otherwise noted), and shall be but are not limited to, the following:
   1. Documents required by all Local State, Federal Governmental Authorities having jurisdiction.
   2. Copies of all required Test Reports.
   3. Certification that all Work by the General and all Subcontractors has been inspected for compliance with Contract Documents and all General, Mechanical, Electrical Punch List items are complete.
   4. Contractors Daily Reports – Two (2) bound sets of copies.
   5. Contractor's and Subcontractor's one (1) year guarantee against all defects in materials and workmanship.
   6. Copies of all individual guarantees, warranties and certificates required by the Specifications.
   7. Copies of all approved Shop Drawings and Submittals.
   8. As- Builts- **Two (2) sets of Construction Document prints** that are marked with red pencil to show all departures from original Drawings ***AND*** **a digital copy PDF** marked with red to show all departures from original Drawings.
   9. Additional Documents as may be specified within Contract Documents.
   10. Two (2) indexed copies of all shop drawings, parts lists, warranties, equipment brochures, operating instructions, etc., bound and covered in manner acceptable to Architect.
   11. Invoices for all items for which allowances are specified.
   12. Affidavit certifying that no asbestos containing materials have been installed by the Contractor or Subcontractors on this project.
   13. Furnish delivery and acceptance receipt from the Owner for extra, paint, and all other overstock items required by the contract documents.
   14.
   15. Submit Contractor Payment of Debts and Claims. (AIA Form G706). General Contractor, each Subcontractor, and Supplier.
   16. Submit Contractor's Affidavit and Release of Liens. (AIA Form G706A). General Contractor, each Subcontractor, and Supplier.
   17. Submit Consent of Surety for Release of Final Payment to Contractor. (AIA Form G707).

3.14 FINAL PAYMENT

A. Contractor shall submit final application for payment after Substantial Completion has been established. If incomplete or non conforming work remains the Owner may deduct amounts to cover the cost of those items. When all work is complete

and approved the Contractor can submit a final Application for Payment. Owner will make Final Payment upon certification by Architect.

B. Final Acceptance of the Project does not relieve the Contractor of fulfilling the terms and conditions of the Contract Documents.

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SECTION 01 71 13
MOBILIZATION – DEMOBILIZATION

PART 1 - **GENERAL**

1-01 DESCRIPTION

A. Mobilization-Demobilization shall consist of all moving in, including preparatory work and operations and moving out, including all dismantling and clean-up work and operations performed by the Contractor.

B. Mobilization shall include the movement of all labor, equipment, supplies and incidentals to the project site; establishment of facilities necessary for work on the project; and other work and operations which must be performed or costs not directly attributable to other pay items, exclusive of bidding costs, which must be incurred by the Contractor before beginning and during the early stages of production work on the project site.

C. Demobilization shall include the movement of all labor, equipment, supplies and incidentals from the project site; dismantling and removal of temporary facilities; clean-up of the project site and all work areas; and other work and operations which must be performed or costs not directly attributable to other pay items which must be incurred by the Contractor after completion of certain items of work and all other work on the Contract has been completed.

PART 2 - COMPENSATION

2-01 MEASUREMENT

A. The percentage of the lump sum amount for this section will be measured in accordance with the Schedule of Values submitted by the Contractor and approved by the Contracting Officer within the following limitations:

% of Total Contract Earned*	% of Maximum Lump Sum This Item Allowed
10%	40%
25%	60%
80%	90%

B. When all work under this Contract is completed by the Contractor and accepted by the Contracting Officer, one hundred percent (100%) of the Lump Sum Amount will be allowed.

* Total Contract earned will be equal to certified estimates approved by the Contracting Officer exclusive of the Mobilization-Demobilization Lump Sum and Materials Stored Amounts.

2-02 PAYMENT

A. Payment for Mobilization-Demobilization shall be made at the Contract lump sum price and in accordance with 2-01, MEASUREMENT. This price shall be full compensation for furnishing all materials, labor, supervision, equipment and incidentals necessary to satisfactorily complete the work.

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SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions and 00 73 00 - Supplementary Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

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

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

1.03 SUBMITTALS

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

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. 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.
   3. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 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.

F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

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

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

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

D. 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.

E. 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.

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

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

H. Include sequence of operation by controls manufacturer.

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

J. Provide control diagrams by controls manufacturer as installed.

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

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

M. Include test and balancing reports.

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

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

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

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

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Binders: Commercial quality, 8-1/2 by 11 inch (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.

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

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

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

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

J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

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

L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data
      b. Air and water balance reports.
      c. Certificates.
      d. Photocopies of warranties and bonds.

N. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

O. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

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

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

C. Co-execute submittals when required.

D. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

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SECTION 01 81 13

SUSTAINABLE DESIGN REQUIREMENTS

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. Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for Project to obtain LEED "ANG Meritable" certification based on USGBC's LEED 2009.

1. Specific requirements for LEED may also be included in other Sections.
2. Some LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.

a. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on aspects of Project that are not part of the Work of the Contract.

B. LEED Goals:

1. A copy of the LEED Project scoresheet is attached at the end of this Section that indicate the points to be achieved by the Project.

1-03 ADMINISTRATIVE REQUIREMENTS

A. Work of this project includes compiling all documentation required for submission for the LEED certification. Work is not complete until Government has received all documentation required for LEED certification.

1. Provide documentation required by LEED and LEED review.

B. Provide materials and procedures necessary to obtain LEED prerequisites and credits required in this Section. Other Sections may specify requirements that contribute to LEED prerequisites and credits. Refer to other sections for additional materials and procedures necessary to obtain LEED prerequisites and credits.

C. Respond to questions and requests for additional information from Contracting Officer and the USGBC regarding LEED credits until the USGBC has made its determination on the project's LEED certification application.

D. LEED Conference: Schedule and conduct a conference at a time convenient to Government within 21 days prior to commencement of the work.

1. Attendees: Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: LEED goals for the project, Contractor’s action plans, and discussion of targeted LEED Prerequisites and Credits.

3. Minutes: Record and distribute minutes to attendees and other entities with responsibilities for obtaining LEED Credits.

1-04 ACTION SUBMITTALS

A. General: Submit additional LEED submittals required by other Specification Sections.

1. Submit each LEED submittal simultaneously with applicable product submittal. B.

LEED Documentation Submittals:

1. General, Sustainable Materials Attributes Form: Project submittals must be accompanied by a completed Sustainable Materials Attributes Form. Submittal packages must also include highlighted documentation supporting the sustainability claims made on the Sustainable Materials Attributes Form.

a. Provide location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.

2. Building-Level Energy Metering: Product data for meters, sensors, and data collection system used to provide continuous metering of building energy-consumption performance.

3. Construction and Demolition Waste Management: Comply with the industry standards for "Construction Waste Management and Disposal."

4. Building Product Disclosure and Optimization: Environmental Product Declarations complying with LEED requirements.

5. Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 1, Raw Material Source and Extraction Reporting.

a. Corporate sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.

6. Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices.

    a. Extended Producer Responsibility: Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.

    b. Bio-Based Materials: Product data and certification for bio-based materials, indicating that they comply with requirements. Include statement of costs.

    c. Certified Wood: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.

    d. Materials Reuse: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs.

    e. Recycled Content: Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.

7. MRc4, Building Product Disclosure and Optimization, Material Ingredients: Option 1, Material Ingredient Reporting.

    a. Material ingredient reports for products that comply with LEED requirements for material ingredient reporting, including but not limited to the following: 1) Manufacturer Inventory.

        2) Health Product Declaration.

        3) Cradle to Cradle certifications.

        4) Declare product labels.

        5) ANSI/BIFMA e3 Furniture Sustainability Standard.

8. Building Product Disclosure and Optimization, Material Ingredients: Option 2, Material Ingredient Optimization.

    a. Documentation for products that comply with LEED requirements for material ingredient optimization, including but not limited to the following:

        1) GreenScreen Benchmarks.

        2) Cradle to Cradle certifications. 3) REACH optimizations.

9. Indoor Air Quality: Comply with the industry standards for "Indoor Air Quality Management."

10. Low-Emitting Materials: Product data, indicating VOC content and emissions testing documents showing compliance with requirements for low-emitting materials, for the following materials:

a. Paints and coatings.

b. Adhesives and sealants.

c. Flooring.

d. Products containing composite wood or agrifiber products or wood glues.

e. Ceilings, walls, thermal, and acoustic insulation.

f. Exterior applied materials.

g. Furniture.

1-05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For LEED coordinator.

B. Project Materials Cost Data: Provide statement indicating total cost and shop labor for materials used for Project. Costs exclude site labor, overhead, and profit. Include breakout of costs for the following categories of items:

1. Wood construction materials.
2. Furniture.
3. Passive plumbing materials.
4. Passive mechanical (HVAC) materials.
5. Passive electrical materials.
6. Earthwork and exterior improvements, hard costs.

C. LEED Action Plan: Provide preliminary submittals within 30 days of the Notice to Proceed indicating how the LEED requirements will be met.

D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following.

1. Submit LEED documentation to the Government with each Application for Payment.

1-06 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2-01 MATERIALS, GENERAL

A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated. Contractor to determine a combination of credit options best suited for achieving credits required.

1. Exclusions: Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, is excluded from the credit calculations. Also excluded are products purchased for temporary use on the project, like formwork for concrete.

2-02 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION

A. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Option 1. Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) which meet one of the disclosure criteria:

1. Product-Specific Declaration: Valued as one quarter (1/4) of a product.
2. Industry-Wide (Generic) EPD: Valued as one half (1/2) of a product.
3. Product-Specific Type III EPD: Valued as one whole product.

B. Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 1, Raw Material Source and Extraction Reporting. Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) which meet one of the disclosure criteria:

1. Corporate sustainability reports.

C. Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices. Provide products that meet at least one of the responsible extraction criteria below for at least 25%, by cost, of the total value of permanently installed building products in the project:

1. Extended producer responsibility program.
2. Bio-based materials.
3. Certified Wood: Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products: a. Rough carpentry.
   b. Miscellaneous carpentry.
   c. Heavy timber construction.
   d. Wood decking.
   e. Metal-plate-connected wood trusses.
   f. Structural glued-laminated timber.
   g. Finish carpentry.

h. Architectural woodwork.

i. Wood paneling.

j. Wood veneer wall covering.

k. Wood flooring.

l. Wood lockers.

m. Wood cabinets.

n. Furniture.

4. Materials Reuse: The following materials may be salvaged, refurbished, or reused materials:

a. Mechanical VAV controls

5. Recycled content.

a. Exceptions: Do not include fire protection, operational plumbing, operational mechanical, and operational electrical components, and specialty items, such as elevators and equipment, in the calculation.

D. Building Product Disclosure and Optimization, Material Ingredients: Option 1, Material Ingredient Reporting.

1. Use at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm), which meet one of the following disclosure criteria:

a. Manufacturer Inventory.

b. Health Product Declarations (HPDs).

c. Cradle to Cradle (C2C) certifications.

d. Declare product labels.

e. ANSI/BIFMA e3 Furniture Sustainability Standard.

E. Building Product Disclosure and Optimization, Material Ingredients: Option 2, Material Ingredient Optimization.

1. Use products that document their material ingredient optimization using the paths below for at least 25%, by cost, of the total value of permanently installed products in the project, which meet one of the following disclosure criteria:

a. GreenScreen benchmarks.

b. Cradle to Cradle certifications.

c. REACH optimizations.

2-03 LOW-EMITTING MATERIALS

A. Low-Emitting Materials, General Emissions Requirements: Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.1-2010, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.1 as follows:

1. 0.5mg/m3 or less,
2. between 0.5 and 5.0 mg/m3 or, 3. 0.50 mg/m3 or more.

B. Low-Emitting Materials, Paints and Coatings: For field applications that are outside the weatherproofing system, use paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.

Product Type:	Allowable VOC Content (g/L):
Bond Breaker	350
Clear wood finishes - Varnish	275
Clear wood finishes – Sanding Sealer	275
Clear wood finishes - Lacquer	275
Colorant – Architectural Coatings, excluding IM coatings	50
Colorant – Solvent Based IM	600
Colorant - Waterborne IM	50
Concrete – Curing compounds	100
Concrete – Curing compounds for roadways & bridges	350
Concrete surface retarder	50
Driveway Sealer	50
Dry-fog coatings	50
Faux finishing coatings - Clear topcoat	100

Faux finishing coatings – Decorative Coatings	350
Faux finishing coatings - Glazes	350
Faux finishing coatings - Japan	350
Faux finishing coatings – Trowel applied coatings	50
Fire-proof coatings	150
Flats	50
Floor coatings	50
Form release compounds	100
Graphic arts (sign) coatings	150
Industrial maintenance coatings	100
Industrial maintenance coatings – High temperature IM coatings	420
Industrial maintenance coatings – Non-sacrificial antigraffiti coatings	100
Industrial maintenance coatings – Zinc rich IM primers	100
Magnesite cement coatings	450
Mastic coatings	100
Metallic pigmented coatings	150
Multi-color coatings	250
Non-flat coatings	50
Pre-treatment wash primers	420
Primers, sealers and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	250
Roof coatings	50
Roof coatings, aluminum	100
Roof primers, bituminous	350
Rust preventative coatings	100
Stone consolidant	450

Sacrificial anti-graffiti coatings	50
Shellac- Clear	730
Shellac – Pigmented	550
Specialty primers	100
Stains	100
Stains, interior	250
Swimming pool coatings – repair	340
Swimming pool coatings – other	340
Traffic Coatings	100
Waterproofing sealers	100
Waterproofing concrete/masonry sealers	100
Wood preservatives	350
Low solids coatings	120

C. Low-Emitting Materials, Paints and Coatings: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Low-Emitting Materials, Adhesives and Sealants: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005:

Architectural Applications:	Allowable VOC Content (g/L):
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50

Dry wall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single ply roof membrane adhesives	250
Specialty Applications:	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Computer diskette manufacturing	350
Contact adhesive	80
Special purpose contact adhesive	250
Tire retread	100
Adhesive primer for traffic marking tape	150
Structural wood member adhesive	140
Sheet applied rubber lining operations specialty	850
Top and Trim adhesive	250
Substrate Specific Applications:	
Metal to metal substrate specific adhesives	30
Plastic foam substrate specific adhesives	50
Porous material (except wood) substrate specific adhesives	50
Wood substrate specific adhesives	30
Fiberglass substrate specific adhesives	80
Sealants:	
Architectural sealant	250
Marine deck sealant	760

Nonmember roof sealant	300
Roadway sealant	250
Single-ply roof membrane sealant	450
Other sealant	420
Sealant Primers:	
Architectural non-porous sealant primer	250
Architectural porous sealant primer	775
Modified bituminous sealant primer	500
Marine deck sealant primer	760
Other sealant primer	750
Other	
Other adhesives, adhesive bonding primers, adhesive primers or any other primers	250

1. Exception: The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.

E. Low-Emitting Materials, Adhesives and Sealants: For field applications that are inside the weatherproofing system, 90 percent of adhesives and sealants shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Low-Emitting Materials, Flooring: Flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

G. Low-Emitting Materials, Composite Wood: Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

H. Low-Emitting Materials, Ceilings, Walls, Thermal, and Acoustic Insulation: Ceilings, walls, and thermal insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

I. Low-Emitting Materials, Exterior Applied Materials: At least 90 percent of exterior applied materials, measured by volume, shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

1. The following materials are prohibited and do not count toward total percentage compliance:
   a. Hot-mopped asphalt for roofing.
   b. Coal tar sealants for parking lots and other paved surfaces.

J. Low-Emitting Materials, Furniture: At least 90 percent of furniture, measured by cost, shall be tested in accordance with ANSI/BIFMA Standard Method M7.1-2011; comply with ANSI/BIFMA e32011 Furniture Sustainability Standard, Sections 7.6.1 and 7.6.2, using either the concentration modeling approach or the emissions factor approach; and model the test results using the open plan, private office, or seating scenario in ANSI/BIFMA M7.1, as appropriate. K. Additional Low-Emitting Requirements:

1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.
3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

2-04 INDOOR WATER USE REDUCTION

A. Indoor Water Use Reduction, Appliances: Provide ENERGY STAR or performance equivalent appliances.

Indoor Water Use Reduction, Plumbing Fixtures: Do not exceed water flow requirements indicated in Division 22 - PLUMBING.

PART 3 - EXECUTION

3-01 NONSMOKING BUILDING

A. Environmental Tobacco Smoke Control: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.

3-02 CONSTRUCTION WASTE MANAGEMENT

A. Construction and Demolition Waste Management: Comply with the industry standards for "Construction Waste Management and Disposal."

3-03 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. Construction Indoor Air Quality Management Plan: Comply with the industry standards for "Indoor Air Quality Management."

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SECTION 02 41 13
SELECTIVE SITE DEMOLITION

PART 1 - **GENERAL**

1-01 DESCRIPTION

A. This work shall consist of the demolition, removal, and satisfactory disposal of structures, foundations, pavement, curb, culverts, utilities, and any other items which are designated in the Contract Documents to be removed.

1-02 EXAMINATION OF SITE

A. The Contractor shall visit the site and inform himself fully of the amount of demolition required under the Contract.

B. The Contractor shall fully familiarize himself with the surrounding area and the conditions of access under which the project is to be completed.

PART 2 - MATERIALS

2-01 NONE

PART 3 - EXECUTION

3-01 GENERAL REQUIREMENTS

A. Contractor shall obtain and pay for all required demolition permits and shall conform with all Local, State, and Federal laws and codes.

B. Contractor shall raze or remove and satisfactorily dispose of all items designed to be removed.

C. Contractor shall preserve and protect all structures, sidewalks, driveways, fences, trees, private utilities, and all other items which are to remain.

D. Contractor shall conform to applicable codes, safety of adjacent structures, dust control, run-off control, and off-site disposal locations and notify any affected utility companies before starting work. Contractor shall not burn or bury material on site.

E. Contractor shall not close or obstruct roadways, sidewalks or hydrants, without permits.

F. Contractor shall conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

G. Contractor shall remove foundation walls and footings to a minimum of two (2) feet below finished grade beyond area of new construction and deeper, if necessary, to accommodate new construction areas.

H. Contractor shall backfill, grade, and compact areas affected by demolition. Grassed areas shall be fertilized and seeded as specified elsewhere in the Contract Documents.

I. Any damaged or destroyed sewer, water or other utility services shall be repaired, plugged or capped as required by the Contracting Officer.

End of Section
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SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1-01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1-02 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 03 30 00 - Cast-In-Place Concrete.

1-03 RELATED SECTIONS

A. Section 03 20 00 - Concrete Reinforcing.

B. Section 03 30 00 - Cast-in-Place Concrete.

1-04 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ACI 347 - Recommended Practice For Concrete Formwork.

D. PS 1 - Construction and Industrial Plywood.

1-05 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension.

1-06 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 347.

B. Maintain one copy of document on site.

1-07 QUALIFICATIONS

A. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Mississippi.

1-08 REGULATORY REQUIREMENTS

A. Conform to International Building Code for design, fabrication, erection and removal of formwork.

1-09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

1-10 COORDINATION

A. Coordinate this Section with other Sections of work which require attachment of components to formwork.

B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

PART 2 PRODUCTS

2-01 WOOD FORM MATERIALS

A. Softwood Plywood: PS 1, B Grade, Group 1, Exterior.

B. Softwood Plywood: PS 1, HDO, Group I Exterior.

C. Lumber: No. 2 grade; with grade stamp clearly visible.

2-02 PREFABRICATED FORMS

A. Preformed Steel Forms: Tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces. Special care shall be used at areas of exposed concrete.

2-03 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, adjustable length, free of defects that could leave holes larger than 1/2 inch in concrete surface.

B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

C. Corners: Chamfer type; 3/4 x 3/4 inch.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

2-04 CARDBOARD VOIDS AND RETAINERS

A. Cardboard voids shall be by Savway Carton Forms, Inc. or approved equal. Forms shall be impregnated with parafin and laminated with moisture resistant adhesive. Size as shown on drawings. Forms shall be designed to carry 1,000 pounds per square foot.

B. Plastic retainers shall be by Savway Carton Forms, Inc. or approved equal.

PART 3 EXECUTION

3-01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3-02 EARTH FORMS

A. Earth forms are permitted for spread footings, interior grade beams and the interior face of perimeter grade beams. The exterior face of perimeter grade beams shall be formed.

3-03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Formwork ties for grade beams with exposed exterior shall be uniformly spaced horizontally and vertically.

F. Obtain approval before framing openings in structural members which are not indicated on Drawings.

G. Provide chamfer strips on external corners of beams, columns and walls.

3-04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3-05 INSERTS, EMBEDDED PARTS, AND OPENINGS

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

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3-06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3-07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3-08 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than 6 times for concrete surfaces to be exposed to view.

3-09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

3-10 SCHEDULE

A. Grade B plywood for areas not exposed.

B. HDO plywood for Grade Beams and wall to be exposed.

C. Steel column forms for exposed concrete columns.

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1-01 SECTION INCLUDES

A. Reinforcing steel bars and accessories for cast-in-place concrete.

1-02 RELATED SECTIONS

A. Section 03 10 00 - Concrete Forming and Accessories.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. Section 01 45 33 - Code-Required Special Inspections.

1-03 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ACI SP-66 - American Concrete Institute - Detailing Manual.

D. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

E. ANSI/AWS D1.4 - Structural Welding Code for Reinforcing Steel.

F. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

G. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.

H. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.

I. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.

J. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1-04 SUBMITTALS

A. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1-05 QUALITY ASSURANCE

A. Contractor Quality Assurance:
   1. Perform Work in accordance with CRSI 63, 65 and Manual of Practice, ACI 301, ACI SP-66, and ACI 318.
   2. Maintain one copy of each document on site.
   3. Submit certified copies of mill test report of reinforcement materials analysis.

1-06 STRUCTURAL SPECIAL INSPECTION AND TESTING

A. Contractor shall coordinate and schedule in a timely manner with the testing laboratory to perform the following inspections and tests:
   1. Inspection of reinforcing steel for size, spacing, location and support.
   2. Inspection of proper reinforcing steel concrete coverage.
   3. Submit certified copies of mill test report of reinforcement materials analysis.
   4. Welder's Certificates: If approved by the Engineer of Record, submit Certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1-07 QUALIFICATIONS

A. Welders' Certificates: Submit Certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1-08 COORDINATION

A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2-01 REINFORCEMENT

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

B. Fiber Reinforcement: Similar and equal to Fibermesh InForce as manufactured by Synthetic Industries. Application rate shall be 1.5 pounds per cubic yard. Provide where shown on drawings.

2-02 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

2-03 FABRICATION

A. Fabricate concrete reinforcing in accordance with ACI 318.

B. When approved by Engineer of Record, weld reinforcement in accordance with ANSI/AWS D1.4 and ANSI/AWS D12.1.

C. Locate reinforcing splices not indicated on drawings, at point of minimum stress.

PART 3 EXECUTION

3-01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings. Do not cut bars.

D. Maintain concrete cover around reinforcing as per ACI 318.

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1-01 SECTION INCLUDES

A. Cast-in-place concrete building members, floors, foundation walls, grade beams, footings, and etc.

B. Floors and slabs on grade.

C. Control, expansion and contraction joint devices associated with concrete work, including joint sealants.

D. Site concrete.

1-02 RELATED SECTIONS

A. Section 03 10 00 - Concrete Forming and Accessories.

B. Section 03 20 00 - Concrete Reinforcing.

C. Section 01 45 33 - Code-Required Special Inspections.

1-03 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 302 - Guide for Concrete Floor and Slab Construction.

C. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

D. ACI 305R - Hot Weather Concreting.

E. ACI 306R - Cold Weather Concreting.

F. ACI 308 - Standard Practice for Curing Concrete.

G. ACI 318 - Building Code Requirements for Reinforced Concrete.

H. ANSI/ASTM D1190 - Concrete Joint Sealer, Hot-Poured Elastic Type.

I. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

J. ASTM C33 - Concrete Aggregates.

K. ASTM C94 - Ready-Mixed Concrete.

L. ASTM C150 - Portland Cement.

M. ASTM C260 - Air Entraining Admixtures for Concrete.

N. ASTM C494 - Chemicals Admixtures for Concrete.

O. ASTM C618 - Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.04 SUBMITTALS

A. Product Data: Provide data on joint devices, attachment accessories and admixtures.

B. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.

1-05 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of embedded utilities and components which are concealed from view.

1-06 QUALITY ASSURANCE

A. Contractor Quality Assurance:
   1. Perform Work in accordance with ACI 301.
   2. Maintain one copy of each document on site.
   3. Acquire cement and aggregate from same source for all work.
   4. Conform to ACI 305R when concreting during hot weather.
   5. Conform to ACI 306R when concreting during cold weather.

1-07 STRUCTURAL SPECIAL INSPECTION AND TESTING

A. Contractor shall coordinate and schedule in a timely manner with the testing laboratory to perform the following tests and inspections. Tests shall be performed in accordance with ACI 301.
   1. Verify correct design mix is provided.
   2. Perform a slump test as deemed necessary for each load of concrete. Record if water or admixtures are added to the concrete at the jobsite. Perform additional slump tests after job site adjustments.
   3. Mold four specifications per set for compressive testing; one set for each 100 or less cubic yards of each class concrete placed per day. Test one at 7 days, 2 at 28 days, and hold one as a spare to be broken as directed by the Architect/Engineer if compressive strengths do not appear adequate.
   4. For each set of molded specimens record the following:
      a) Slump
      b) Temperature, ambient and concrete
      c) Air content
      d) Location of placement

e) Verification of correct design mix

5. Inspection of concrete placement for proper application techniques.
6. Inspection for maintenance of specified curing temperature and techniques.

B. The ready-mixed concrete plant shall be certified for conformance with the requirements of the National Ready Mix Concrete Association.

C. Slab on Grade Floor Surface: Test floor flatness and levelness per ASTM E-1155. F_F 25/ F_L 18 minimum overall and F_F 18/ F_L 13 minimum local.

1-08 COORDINATION

A. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

B. Coordinate all embedded items.

PART 2 PRODUCTS

2-01 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I or Type II.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Clean and not detrimental to concrete.

2-02 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical: ASTM C494 Type F - Water Reducing, High Range added at job site after slump tests have been performed.

C. Fly Ash: ASTM C618.

2-03 ACCESSORIES

A. Vapor Retarder: Refer to other sections.

B. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 5,000 psi in 28 days.

2-04 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler: ASTM D1751; Asphalt impregnated fiberboard or felt.

B. Sealant for Pavements, Sidewalks, Curb and Gutter: Silicone joint sealant Dow Corning 888 or approved equal.

2-05 CONCRETE MIX

A. Mix and deliver concrete in accordance with ASTM C94, Alternative No. 2.

B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1 or Method 2. Submit proposed mix design to Architect/Engineer in accordance with ACI 301.

C. Provide concrete to the following criteria:
1. Compressive strength: As noted on drawings or other specification sections.
2. Slump: 3 to 5 inches.
3. Water/Cement Ratio shall be .5 or below for all concrete.

D. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.

E. Do not use calcium chloride.

F. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.

G. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

PART 3 EXECUTION

3-01 EXAMINATION

A. Verify site conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3-02 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

3-03 PLACING CONCRETE

A. Place concrete in accordance with ACI 318 and ACI 301.

B. Notify Architect/Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.

D. Install joint devices in accordance with manufacturer's instructions.

E. Construction joints in floor slabs and floor beams shall be located in the middle third of the span.

F. Construction joints for grade beams shall be located at one third of the span beyond the support.

G. Place concrete continuously between predetermined expansion, control, and construction joints.

H. Do not interrupt successive placement; do not permit cold joints to occur.

I. Slab on Grade Floor Surface: F_F 25/F_L 18 minimum overall and F_F 18/F_L 13 minimum local.

3-04 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Apply bonding agent to substrate in accordance with manufacturer's instructions.

C. Place concrete floor toppings to required lines and levels.

3-05 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed with smooth rubbed finish.

B. Finish concrete floor surfaces in accordance with ACI 301.

C. Wood float surfaces which will receive tile with full bed setting system.

D. Steel trowel surfaces which will receive carpeting, resilient flooring, or seamless flooring.

E. Steel trowel surfaces which are scheduled to be exposed.

F. Pavements and sidewalks - light broom finish.

3-06 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure floor surfaces in accordance with ACI 308.

3-07 PATCHING

A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

C. Patch imperfections as directed in accordance with ACI 301.

3-08 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect/Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

END OF SECTION

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SECTION 03 33 10
CAST-IN-PLACE ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Furnish, place and finish the cast-in-place architectural concrete and related items indicated on the Drawings and as specified herein.
   1. The work of this Section includes formwork, reinforcement and accessories, concrete mix design, concrete materials, placement procedures, and finishes for exposed architectural concrete work.

B. Related work specified elsewhere:
   1. Section 03 10 00 - Concrete Forming and Accessories
   2. Section 03 20 00 - Concrete Reinforcing
   3. Section 03 30 00 - Cast-in-place Concrete

C. This Section shall be supplemented by all other applicable Division 3 Sections that relate to formwork, reinforcement, and cast-in-place concrete for structural and general concrete construction.

1.02 DEFINITION

A. Cast-in-Place Architectural Concrete: Concrete that is exposed to public view on surfaces of the completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.

B. Cast-in-place architectural concrete shall be used in the following locations:
   1. All exposed exterior concrete walls exposed to view.
   2. All exterior exposed concrete site walls.
   3. Exposed concrete grade beams

C. Cast-in-place architectural concrete is not required at the following locations:
   1. Any concrete work not exposed to public view or concealed within finished construction.

1.03 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Formwork Shop Drawings: Show formwork construction plan and elevations including form-facing joints, rustications, construction and contraction joints, form joint-sealant details for both form butt joints and corner joints, form tie location and patterns, inserts and embedment, cutouts, cleanout panels, and other items that visually affect cast-in-place architectural concrete for all walls beams and ceilings. (See Detail 14 on Sheet C5.0 for example of typical layout pattern.)

D. Product Samples/Literature: For each of the following materials:
   1. Form-facing panels.
   2. Form-release agent.
   3. Form ties.
   4. Form liners.
   5. Chamfers and rustications.
   6. Curing compound.

E. Concrete Finish Samples: Architectural concrete samples, cast vertically, and approximately 4" x 18" x 18" to demonstrate the finish to be achieved.

F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
   1. Cementitious materials
   2. Admixtures.
   3. Curing compounds

G. Placement Schedule: Submit concrete placement schedule before start of architectural concrete placement operations. Include location of all joints including construction joints. Coordinate construction joints with Reinforcing Shop drawings see Section 032000.

H. Minutes of pre-installation conference.

1.04 QUALITY CONTROL

A. Concrete Contractor Qualifications: An experienced cast-in-place concrete contractor who has specialized in installing cast-in-place architectural concrete similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Concrete Producer Qualifications: A firm experienced in the production and delivery of ready-mixed concrete complying with ASTM C 94 requirements for production facilities and equipment.
   1. Producer shall be certified according to the National Ready Mixed Concrete Associations' Certification of Ready Mixed Concrete Production Facilities.

C. Testing Agency Qualifications: An independent testing agency, approved by the Architect and, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated.
   1. Personnel conducting field test shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program recognized by ASTM C 1077.

D. Source Limitations: Obtain concrete-making materials and forming and forming materials from the same suppliers to provide cast-in-place architectural concrete of consistent quality in appearance and physical properties.

E. ACI Standards: Comply with ACI 301, "Specification for Structural Concrete"; and ACI 117, "Specifications for Tolerances for Concrete Construction and Materials," unless more stringent provisions are indicated.

F. Mock-ups: Before casting architectural concrete, the Contractor shall build a mock-up to demonstrate aesthetic effects and qualities of materials and execution. The mock up shall be a 6'-0" x 8'-0" x 1'-0" partial wall. Cast mock-up to comply with the following requirements, using materials and methods that will be used in the completed Work:
   1. Build mock-up in the location so as to not interfere with other construction.
   2. Notify Architect seven days in advance of dates and time when mock-ups will be constructed.
   3. Use forms, form and corner joints, form ties, release agent and other products that will be used in the Work.
   4. Demonstrate curing, cleaning and protecting of cast-in-place architectural concrete, finishes as applicable.
   5. In presence of Architect, damage a part of the exposed surface of cast-in-place architectural concrete and damage materials and techniques proposed for repairs to match adjacent undamaged surfaces.
   6. Obtain Architect's approval of mock-ups before casting architectural concrete.

7. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Demolish and remove mock-ups when directed.
9. If mock up is not approved, re-make the mock up in a new location.

G. Pre-Construction Conference: Conduct conferences at Project site to comply with requirements in Division 1 Section "Project Meetings." Review all requirement of the work. Discuss sequence and placement requirements to ensure high quality architectural concrete.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

A. General: Comply with Section 03 10 00 - Concrete Forming and Accessories for formwork except as shown in this Section.

B. Forms for architectural concrete shall be non-absorptive and provide continuous, true and smooth architectural concrete surfaces with uniform color and finish. Form panels shall be equal to products of Sylvan Industries, Inc. 7400 SW Cherry Drive, Portland, Or. 97223 (1-800-842-1990). Form panels shall be HDO plywood, ¾" thick, 7 ply, Structural 1 (all Douglas fir), as follows:
   1. High density overlay (HDO) Plywood 2 side (100/100), 2 step processed (sanded prior to application of paper faces), up to 4'x8' size as indicated on the drawings. HDO plywood forms may be reused, if not damaged.

C. Form joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or S, Grade NS, that adheres to form joint substrates.

D. Form Joint Water Proofing: Foam faced weather stripping with one side adhesive to be used between panels and at corners.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments of those surfaces. Agent shall be of a type that will aid in the reduction of surface blemishes.

F. Form Ties: Factory-fabricated ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish ties with cone spreaders that, when removed, will leave holes 1" in diameter on concrete surface and leave no corrodible metal closer than 11/2" from the plane of architectural concrete surface.

2.02 REINFORCEMENT AND ACCESSORIES

A. General: Comply with Section 03 20 00 - Concrete Reinforcing, for steel reinforcement and other requirements for reinforcement accessories.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Where legs of wire bar supports contact forms, use all-plastic or CRSI Class 1 plastic-protected bar supports.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I of same type, brand, and source for entire Project.

B. Blended Hydraulic Cement: ASTM C 595M, may be used following approval by the Architect.

C. Normal-Weight Aggregate: ASTM C 33. Coarse may be Size 57 or 67. Fine aggregate shall be natural sand, from the same sources for entire Project. Blending sizes shall be added to aid in the production f a well-graded combined

aggregate. When combined, the aggregate grading shall be such that not more than 75% of the combined aggregates retained on the No. 8 sieve are also retained on the 3/8" sieve.

D. Water: Potable, complying with ASTM C 94 except free of wash water from mixer washout operations.

E. Chemical Admixtures: Certified by manufacturer to contain not more than 0.1 percent water soluble chloride ions by mass for cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
   1. Air-Entraining Admixture: ASTM C 260
   2. Water-Reducing Admixture: ASTM C 494, Type A
   3. High-Range or Mid-Range Water-Reducing Admixture: ASTM C 494, Type F.
   4. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.04 CURING MATERIALS

A. Clear, Liquid Membrane-forming Curing Compound: ASTM C 309

B. Moisture-Retaining materials such as polyethylene film must be prevented from being left in contact with the architectural concrete.

2.05 REPAIR MATERIALS

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

B. Concrete Patching Mixture: Prepare different blends of gray and white cements and fine aggregate and finish to similar to the cast-in-place concrete and determine which blend matches the cast-in-place concrete.

2.06 CONCRETE MIXES

A. Prepare mixture proportions to reach type and strength of cast-in-place architectural concrete determined by either laboratory trial mix or field test data bases. Trial proportions can be prepared according to ACI 211.1 to meet the requirements of ACI 301. The blend of the combined aggregates should not show excessive or limited quantities of each size. Particular attention shall be given to the Nos. 4 and 8 sieves. When the combined grading is plotted on the 0.45 Power Chart. The trend shall be similar to the theoretical optimum trend line.

B. Proportion concrete mix as follows:
   1. Compressive Strength (28 Days): 4,500 psi
   2. Maximum Water-cementitious Materials Ratio: 0.45
   3. Maximum Slump: 4-inches plus/minus 1-inch

C. Maximum Slump for Concrete Containing High-Range, Water-Reducing Admixture: 8-inches after admixture is added to concrete with 2-inch slump.

D. Air Content: Add air-entraining admixture to concrete exposed to the weather at manufacturer's prescribed rate to result in architectural concrete at point of placement having an air content of 3 to 5%

2.07 CONCRETE MIXING

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

PART 3 - EXECUTION

3.01 FORMWORK

A. General: Comply with Section 03 10 00 - Concrete Forming and Accessories for formwork, embedded items, and shoring and re-shoring. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces.

B. Limit concrete surface irregularities, designated by ACI 347-04 as gradual, as follows:
   1. Class A, 1/8-inch for vertical surfaces.

C. 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 braded to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

D. Unless otherwise indicated on the Drawings, outside corners and edges of cast-in-place architectural concrete shall have square corners. Gaskets of closed cell compressible neoprene shall be used at form joints to prevent leakage.

E. Add span boards to the inside surface panel joints to keep panels even with each other and to prevent leakage. (See typical form detail requirements on Sheet C5.1.)

F. Install formliners at entry canopy as shown in drawings and in accordance with the manufacturer’s recommendation.

G. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement.

H. Form Openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations form trades providing such items.

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

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

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

3.02 REINFORCEMENT AND INSERTS

A. General: Comply with Section 03210 - Reinforcing Steel, and ACI 301 for fabricating and installing steel reinforcement.

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

3.03 REMOVING AND REUSING FORMS

A. Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed 24 hours after placing concrete, provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
   1. Schedule form removal to maintain surface appearance that matches approved mock-ups.

B. 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

if 28-day design compressive strength. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

C. Clean and repair surfaces of forms to be reused in the Work. Do not use spit, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.

D. 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 architectural concrete surfaces.

3.04 JOINTS

A. Construction Joints: Install construction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete 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.
   2. Use bulkhead forms with keys of plywood, wood, or expanded galvanized steel sheet, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete. Align construction joint within rustications attached to form-facing material.
   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.

B. Contraction Joints: Form wakened-plane contraction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Form Butt Joints: Apply a bead of caulk or foam tape weather-stripping to one edge and force the adjacent pieces of formwork together and back-up to prevent separating on the non architectural face side. Apply the specified rustication over the joint on the architectural face.

D. Corner Joints: When wood chamfers are used, apply a bead of caulk on each of the two square faces to prevent paste leakage. Nail the chamfer strip tightly in the form corner. When square corners are to be produced, apply the adhesive side of the compressible tape to the edge of one form face. Overlap the first face with the adjacent form and clamp the forms tightly together to prevent leakage
   1. All walls to have square edge joints.

3.05 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. Water may be added to mixture during delivery at Project up to the amount shown on the delivery ticket as allowed within the mixture design or as allowed by the Architect.

C. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
   1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
   2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator.
   3. Place vibrators into the concrete such that the radius of their influence overlaps by 1/3.
   4. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to loose plasticity.
   5. At each insertion, manipulate the vibrator in an up-and-down motion to force out the air trapped between the concrete and the form at a rate of 1" per second or to remove all air form the concrete. Follow practices established during the construction of the mock-up.

E. Cold-Weather Placement: Comply with requirements of Section 03310. Protect concrete in the forms from physical damage or reduced strengthen that could be caused by frost, freezing actions, or low temperatures.

F. Hot-Weather Placement: Comply with requirements of Section 03310.

G. Concrete shall be placed in such a manner that it will not be influenced by the steel placement to contribute to segregation.

3.06 FINISHES, GENERAL

A. Architectural Concrete Finish: Match the finish in the approved mock-up and Architect's design reference sample, identified and described as indicated.
   1. The architectural concrete finish shall be smooth free of form surface marks.

B. 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.

3.07 AS-CAST FORMED FINISH

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams and form ties.
   1. Fill (patch) form tie holes to produce a finished recess of 1/2 inch.

3.08 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures according to ACI 301.

3.09 FIELD QUALITY CONTROL

A. General: Comply with Section 03 30 00 - Cast-in-place Concrete, including the specified reference documents, for field quality-control requirements. If aggregate grading varies beyond the agreed upon tolerances for the combined aggregates, adjust proportions to correct for the variations.

3.10 REPAIRS, PROTECTION, AND CLEANING

A. Repair and cure damaged finished surfaces of cast-in-place architectural when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mock-ups.

1. Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to Architect's approval.

B. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.

C. Protect cast-in-place architectural concrete form staining, laitance, and contamination during remainder of construction period.

D. Wash and rinse surfaces according to concrete finish applicator's written recommendations. Protect other Work from Staining or damage due to cleaning operations.
   1. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.

END OF SECTION

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SECTION 03 35 11
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

B. Polished concrete.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

B. Section 03 30 00 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.05 MOCK-UP

A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.

B. Mock-Up Size: 10 feet (3 m) square.

C. Locate where directed.

D. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.07 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet (2.5 m) above the floor surface over each 20 foot (6 m) square area of floor being finished.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

A. Unless otherwise indicated, all concrete floors are to be finished using liquid densifier/hardener.

B. Liquid Densifier/Hardener:
   1. Use at following locations: All areas listed as polished in Finish Schedule.

C. Polished Finish:
   1. Use at following locations: All areas listed as polished in Finish Schedule.

2.02 DENSIFIERS AND HARDENERS

A. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.

2.03 POLISHED CONCRETE SYSTEM

A. Polished Concrete System: Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.
   1. Acceptable Systems:
      a. Ameripolish, Inc; Ameripolish Polished Concrete System: www.ameripolish.com/#sle.
      b. Euclid Chemical Company; DOUBLE DIAMOND POLISHED CONCRETE FLOOR SYSTEMS: www.euclidchemical.com/#sle.
      c. PROSOCO, Inc; Consolideck Polished Concrete System: www.prosoco.com/consolideck/#sle.
      d. W. R. Meadows, Inc; Induroshine and Bellatrix Concrete Enhancer: www.wrmeadows.com/#sle.
      e. Advanced Floor Products, Inc.; Retro-Plate 99: www.retroplatesystem.com.
      f. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate, with installer present, for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work. Do not proceed until unsatisfactory conditions are corrected.

B. Verify that base slab meets finish and surface profile requirements in Division 3 Section "Cast-In-Place Concrete," and Project Conditions above.

C. Prior to application, verify that floor surfaces are free of construction latents.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Start any of the floor finish applications in presence of manufacturer's technical representative.

B. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

E. Concrete must be in place a minimum of 45 days or as directed by the manufacturer before application can begin.

F. Application is to take place at least 10 days prior to installation of furniture or accessory installation, thus providing a complete, uninhibited concrete slab for application.

G. Only a certified applicator shall apply product. Applicable procedures must be followed as recommended by the product manufacturer and as required to match approved test sample.

H. Achieve waterproofing, hardening, dust-proofing, and abrasion resistance of the surface without changing the natural appearance of the concrete, except for the sheen.

3.04 CONCRETE POLISHING

A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
   1. Final Polished Sheen: Satin finish; other sheens are included as comparison to illustrate required sheen; final sheen is before addition of any sealer or coating, regardless of whether that is also specified or not.
   2. Satin Finish: Reflecting images from side lighting.

B. Protect finished surface as required and as recommended by manufacturer of polishing system.

3.05 WORKMANSHIP AND CLEANING

A. The premises shall be kept clean and free of debris at all times.

B. Remove spatter from adjoining surfaces, as necessary.

C. Repair damages to surface caused by cleaning operations.

D. Remove debris from jobsite:
   1. Dispose of materials in separate, closed containers in accordance with local regulations.

END OF SECTION

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SECTION 03 36 00
CONCRETE DRIVES AND APRONS

PART 1 GENERAL

1-01 DESCRIPTION

A. This item covers the installation of drives and aprons constructed of Portland Cement Concrete with steel reinforcement in accordance with the details, dimensions and typical cross section and to the lines and grades as shown on the Contract Documents or established by the Contracting Officer.

B. Refer to Section 03 30 00 herein for details concerning cement, reinforcement and other work.

PART 2 MATERIALS

2-01 GENERAL

A. Insofar as applicable, all material shall meet the requirements specified in Section 03 30 00. Concrete for this construction shall be Class "C" unless otherwise specified. The compressive strength of the cement when tested at 28 days age shall be 3500 pounds per square inch, minimum. The water/cement ration shall in no case exceed the maximum allowed in the design mix.

B. Expansion joint filler shall be premolded bituminous fiber board of the nonextruding resilient type as specified.

PART 3 EXECUTION

3-01 SUBGRADE PREPARATION

A. The existing soil of the subbase shall be scarified to a depth of 12” below top of subgrade elevation and re-compacted.

B. The base shall consisting of 6” of Dense Graded Crushed Limestone (MDOT Gradation No. 610 or 825-B) compacted to a minimum 95% maximum dry per Standard Proctor.

C. Loose rocks or pieces of broken concrete shall be buried to a depth of at least 18 inches below the subgrade elevation and all holes and depressions backfilled and compacted in 6 inch layers to the specified density.

3-02 FORMS

A. Metal forms shall be used in all cases unless otherwise specified except that on curves of short radii the Contracting Officer may permit wooden forms for backing flexible materials. On normal curves the Contractor shall use flexible steel forms to avoid the effect of broken chords.

B. Metal forms shall have a flat surface on top for finishing edges of the slabs. All forms shall be securely staked, braced and held firmly against displacement from the required line and shall be sufficiently tight to prevent leakage of mortar.

C. Metal forms shall be free from rust, grease and old concrete accretions and shall be cleaned after each usage.

3-03 EXPANSION JOINTS & CONSTRUCTION JOINTS

A. Expansion joint fillers for drives and aprons of the specified thickness shall be placed at intervals not to exceed 12 feet each way in slabs but the spacing shall be adjusted to prevent expansion joint occurring in the center of a driveway. Joint filler shall be performed and shall extend full depth without horizontal joints. Any filler protruding after the concrete is finished shall be neatly trimmed off flush with surface.

B. Joints shall be 1/2" thick unless otherwise specified.

C. Concrete joints are not to be greater than 12’x12’.

3-04 PLACING AND FINISHING CONCRETE

A. The concrete shall be placed on a moist subgrade, deposited to the proper depth, tamped and spaded sufficiently to compact the concrete and to bring the mortar to the surface, after which it shall be finished smooth and even by means of a wood float. Before the concrete is given the final finishing, the surface of the pavement shall be checked with a ten (10) foot straightedge and any irregularities of more than one eighth (1/8) inch in ten (10) feet shall be eliminated.

B. Concrete drives and aprons shall be constructed true to line, grade and cross section and in uniform sections at the thicknesses specified and the locations indicated on the drawings. The forms on the face of all slabs shall be removed as soon as the concrete will hold its shape and the surface shall be floated with a wooden float to a smooth and even finish, but no plastering will be permitted.

C. The concrete used in the construction shall be poured with the desired slump and consistency. Any concrete found to have excessive slump and lacking in the desired consistency shall be discarded from use.

D. The edges on the face of the slab shall be rounded with approved finishing tools having the radii shown on the plans. Edges where expansion joint material has been placed shall be finished with an edging tool having a radius of not over one quarter (1/4) inch. Any exposed surface against which some rigid type of construction is to be made shall be left smooth and uniform so as to permit free movement of the drive or apron.

3-06 REINFORCEMENT

A. Dowel bars are to be installed at all concrete pavement control and construction joints. Dowel bars are to be 30" #4 reinforcing bars spaced at 30" on center.

3-07 PROTECTION AND CURING

B. Immediately after finishing the concrete, it shall be protected and cured in accordance with the provisions and requirements of Section 03 30 00, herein.

C. Any section which is damaged, before final acceptance of the work, shall be removed and reconstructed by the Contractor without extra compensation.

3-08 BACKFILLING AND CLEANING UP

A. After the concrete has set sufficiently the spaces on the sides of the drive or apron shall be refilled to the required elevation with suitable material, which shall be tamped in layers of not over six (6) inches until firm and solid.

B. All surplus material shall be disposed of as directed and the entire work left in a neat and presentable condition.

END OF SECTION
03 36 00

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1-01 SECTION INCLUDES

A. Structural steel, embedded items, and miscellaneous steel.

B. Fabrication shop coat painting.

C. Steel erection.

1-02 RELATED SECTIONS

A. Section 05 50 00 - Metal Fabrications.

B. Section 09 90 00 - Painting and Coating.

C. Section 01 45 33 - Code-Required Special Inspections.

1-03 REFERENCES

A. ASTM A36 - Structural Steel.

B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.

C. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.

D. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.

E. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.

F. ASTM A325 - High Strength Bolts for Structural Steel Joints.

G. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

H. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

I. ASTM A992 - Structural Steel, Grade 50.

J. AWS A2.0 - Standard Welding Symbols.

K. AWS D1.1 - Structural Welding Code.

L. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

M. SSPC - Steel Structures Painting Council.

1-04 SUBMITTALS

A. Shop Drawings:
1. Indicate sizes, spacing, and locations of structural members.
2. Connections.
3. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.

B. Mill Test Reports: Submit indicating structural strength.

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

1-05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings. Provide ultrasonic testing reports for all complete penetration shop welds.

B. Maintain one copy of each document on site.

1-06 STRUCTURAL SPECIAL INSPECTIONS AND TESTING

A. Contractor shall coordinate and schedule in a timely manner with the testing laboratory to perform the following tests and inspections:
1. Anchor bolts
   a) Anchor bolt size, configuration, and embedment shall be verified prior to placement of concrete.
2. Inspect identification markings for compliance.
3. Review Manufacturer’s Certificate of Compliance.
4. Review certified mill test reports.
5. Bolted connections
   a) Inspection and testing shall be in accordance with AISC specifications for Structural Joints using ASTM A325 or A490 Bolts.
   b) Provide periodic inspection of all bearing type bolted connections and continuous inspection of slip critical connections. Slip critical connections, if any, will be specifically noted on drawings.
6. Field welded connections
   a) Inspection shall be in accordance with AWS Structural Welding Code.
   b) Visually inspect all field welded connections. Provide continuous inspection for complete and partial penetration groove welds; multi-pass fillet welds; single-pass fillet welds greater than 5/16". Provide periodic inspection for fillet welds equal to or less than 5/16"; and joist, floor and deck welds.
   c) Provide ultrasonic inspection of all complete penetration welds.
   d) Verify welder qualifications.
   e) Review weld filler material markings for compliance.

f) Review Manufacturer's Certificate of Compliance.

7. Inspection of steel frame joint details for compliance with approved construction documents.
   a) Details
   b) Member location
   c) Joint details at each joint

PART 2 PRODUCTS

2-01 MATERIALS

A. Structural Steel Members:
   1. W Shapes: ASTM A992 (Grade 50).
   2. Angles, Channels, Plates: ASTM A36.

B. Structural Tubing: ASTM A500, Grade B.

C. Pipe: ASTM A53, Grade B.

D. Shear Stud Connectors: ASTM A108 forged steel, headed.

E. Bolts, Nuts, and Washers: ASTM A325; galvanized to ASTM A123 for galvanized members.

F. Anchor Bolts: ASTM A307.

G. Welding Materials: AWS D1.1; type required for materials being welded.

H. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 5000 psi at 28 days.

I. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

J. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I Inorganic.

2-02 FABRICATION

A. Provide shop workmanship equal to the best modern practice conforming to listed industry standard and in accordance with the latest requirements of the American Institute of Steel Construction.

2-03 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 2.

B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, and high strength bolted connections.

C. Galvanize to ASTM A123, structural steel members indicated on drawings. Provide minimum 1.25 oz/sq.ft.

PART 3 EXECUTION

3-01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3-02 ERECTION

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

B. Field weld components indicated on Drawings or shop drawings.

C. All exposed welds shall be ground smooth.

D. Do not field cut or alter structural members without approval of Engineer.

E. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3-03 ERECTION TOLERANCES

A. All erection of steel, bracing and etc. should be as required by AISC.

END OF SECTION

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SECTION 05 12 13
ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: General requirements for structural steel members, including AESS framing specified in this section.

B. Section 05 21 00 - Steel Joist Framing: Alignment and location of bridging where joists are visible.

C. Section 05 31 00 - Steel Decking: Erection requirements relating to exposed steel decking and its connections.

D. Section 05 50 00 - Metal Fabrications: Loose steel bearing plates and miscellaneous steel framing.

1.03 SCOPE

A. This specification shall apply to exposed architectural steel fabrications which shall be constructed, handled, and erected as directed in specification 05 12 13 except as noted below, in conformity with the American Institute of Steel Construction Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings. Because these members so designated are subject to close inspection by the public, the fabrication tolerances in this specification shall govern when such tolerances are in conflict with those of the AISC Specification.

1.04 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

B. AISC 360 - Specification for Structural Steel Buildings; 2010.

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2014.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2018.

F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).

G. ASTM A1085/A1085M - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS); 2015.

H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Submit shop drawings for items specified in this section to the Architect for approval in accordance with the requirements of the General Conditions and Section 01340. In addition to all other requirements in Section 05500 and 02832, shop drawings shall show all details, welds finish tolerances and finish standards

1.06 QUALITY ASSURANCE

A. General: 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 this section.

B. Mock-Up Panel: Prior to installation of exposed architectural steel components, build a mock-up example of each component approximately 4'-0" wide for each condition. Upon written approval of the Architect on the mock-up, fabrication on the component for the building may proceed. The mock-up will stand as the standard of quality to be achieved in all subsequent work. Any work which fails to meet the level of quality of the approved mock-up will be removed and replace without additional cost to the Owner.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle finished pieces in accordance with Section 10 of AISC 303, using nylon-type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Comply with Section 05 12 00, except as amended in this section for aesthetic purposes.

2.02 FABRICATION

A. Fabricate and assemble AESS in shop to greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Permissible tolerances for member depth, width, out of square, and camber and sweep shall not exceed 1/2 of the standard tolerances in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M. Overall profile dimensions of built-up members shall be adequate to provide for the accumulated permissible overrun of the component parts.

C. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.

D. Bolted Connections:
   1. Make in accordance with Section 05 12 00. Provide bolt type and finish as noted herein.

E. Welded Connections:
   1. Comply with AWS D1.1/D1.1M and Section 05 12 00.
   2. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding tolerances of this section.

F. Surface Preparation:
   1. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
   2. Remove backing and run out tabs.

G. Fabricate AESS in accordance with categories defined in AISC 303, as follows:

2.03 PAINT SYSTEM

A. Compatibility: All components/procedures of AESS paint system to comply with coating system specified, submitted, and approved per Section 09 90 00. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating, and finish coating to be from a single manufacturer combined in a system documented by manufacturer with adequate guidance for fabricator to procure and execute.

2.04 SHOP PRIMING

A. Surface Preparation:
   1. Coordinate required surface profile with approved paint submittal prior to beginning surface preparation.
   2. Remove weld spatter, slivers and similar surface discontinuities.
   3. Ease sharp corners resulting from shearing, flame cutting or grinding.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted with slip-critical connections.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer92s instructions to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

2.05 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by hot-dip process to AESS indicated for galvanizing according to ASTM A123/A123M. Fabricate such that all connections of assemblies are made in the field with bolted connections where possible.

B. All exposed Exterior Steel shall be galvanized.

2.06 MATERIALS

A. General: Meet requirements of 05 12 00 as amended below.

PART 3 - EXECUTION

3.01 FABRICATION

A. Fabrication shall be performed with special care and necessary straitening to maintain the condition of material as described above in 2.01 B. and C.

B. Shop details shall show clearly the required fabrication tolerances. Erection plans and /or anchor bolt plans shall show the required tolerances for setting embedded items.

C. All copes, miters, and butt cuts in surfaces exposed to view shall be made with uniform gaps of 1/8” if shown by the Architect to be open joints, or uniform contact if shown without a gap.

D. Where the fit up of adjacent members is such that permissible tolerances specified in Section 2 may result in an unsightly joint, the Architect shall specify on the design plans the tolerances required. These tolerances shall be maintained by special attention in detailing the joint, or if necessary by refined fabrication techniques.

E. Components in an assembly shall fit together tightly and welded on all sides.

3.02 WELDING

A. Fillet Welds: Faces of welds exposed to view shall have as-welded surfaces that are smooth and uniform in grain. Welds shall be even in dimension, free of slag, and sharp ridges. If a weld quality is poor than finishing or grinding shall be required.

B. Butt and Plug Welds: Faces of butt and plug welds exposed to view shall be ground smooth to the face of metal to create a smooth even surface with now appearance of a joint.

C. Surfaces and finish materials within 2” of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done. If shop painted, surface to be welded shall be wire brushed in the field before welding to reduce the paint film to a minimum. If field welding near finishes or flammable materials, thoroughly cover and protect the area with fireproof mats.

3.03 EXAMINATION

A. Erector to check all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of appearance of member. Coordinate remedial action with fabricator prior to erecting steel.

3.04 PREPARATION

A. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain appearance of AESS through process of erection.

3.05 ERECTION

A. The erector shall use special care in unloading, handling and erecting the steel components and assemblies to avoid bending, twisting, scratching galvanized or painted surfaces or otherwise distorting the steel members.

B. The erector shall plan and execute the erection in such a way that the close fit and neat appearance of the joints and the structure as a whole will not be impaired.

C. Use only compatible fastener and clips to fix galvanized fabrications in position.

D. If temporary braces or erection clips are employed, care shall be taken to avoid any unsightliness upon removal. Tack welds shall be ground smooth and holes shall be filled with weld metal or body solder and smoothed by grinding or filling.

E. If steel fabrication has been primed and is planned to be painted, inspect every surface prior to painting. Repair all flaws prior to applying finish coats of paint. See Section 09900 Painting for painting products and procedures.

F. If galvanized steel fabrications are to remain unfinished, protect the surface throughout the construction process by wrapping exposed edges with protective material such as craft paper securely taped down.

G. All scratches welds flaws in the galvanized steel finish shall be painted with zinc rich paint. See Section 09900 Painting.

H. If galvanized steel fabrications are to be painted, clean surface completely with solvent to remove all oil residue. Paint according to Section 09900 Painting.

3.06 SHOP CLEANING

A. After fabrication each component and all joints shall be inspected for conformance to quality standards. All non-conforming work shall be repaired or replaced. After inspection is complete and before leaving the shop all steelwork shall be cleaned by hand wire brushing, or by other means elected by the fabricator in order to remove all loose mill scale, loose rust, loose slag. Solvent shall remove any flux deposits or oil.

B. Touch-up Painting: Complete cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint to blend with adjacent surfaces of AESS. Perform touch-up work in accordance with manufacturer's instructions and as specified in Section 09 91 13, 09 91 23, and 09 96 00.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas. Repair galvanized surfaces in accordance with ASTM A780/A780M.

3.07 PAINTING

A. If steel work is to be painted, after the clean down all steel work shall be given one coat of shop primer applied thoroughly and evenly to dry surfaces by brush, spray roller coating, or dipping at the election of the fabricator.

3.08 CLEANING AND REPAIRING

A. After erection inspect the work by running hands over all joints, repair any flaws. Repair any scratches or flaws in the galvanized surface.

B. Clean down all work with Murphy’s Oil soap.

END OF SECTION

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SECTION 05 21 00
STEEL JOIST FRAMING

PART 1 GENERAL

1-01 SECTION INCLUDES

A. Open web steel joists, with bridging, attached seats, and anchors.

1-02 RELATED SECTIONS

A. Section 05 12 00 - Structural Steel Framing.

B. Section 05 31 00 - Steel Decking.

C. Section 09 90 00 - Painting and Coating.

1-03 REFERENCES

A. ASTM A307 - Carbon Steel Threaded Standard Fasteners.

B. AWS D1.1 - Structural Welding Code.

C. FS TT-P-636 - Primer Coating, Alkyd, Wood and Ferrous Metal.

D. SJI - Standard Specifications for Open Web Steel Joists, K Series.

E. SSPC - Steel Structures Painting Council.

1-04 SUBMITTALS

A. Shop Drawings:
   1. Indicate standard designations, configuration, sizes, spacing, locations of joists, joist leg extensions.
   2. Bridging, connections.
   3. Cambers.

B. Welder's Certificates: Submit manufacturer's certificates that welders employed on the Work have met AWS verification within the previous 12 months.

1-05 QUALITY ASSURANCE

A. Perform Work in accordance with SJI Standard Specifications, Load Tables, and Weight Tables.

B. Maintain one copy of each document on site.

1-06 STRUCTURAL SPECIAL INSPECTIONS AND TESTING

A. Contractor shall coordinate and schedule in a timely manner with the Testing Laboratory to perform the following tests and inspections:
   1) Inspection of all welds or bolts of steel joist to other steel members.

1-07 DELIVERY, STORAGE AND HANDLING

A. Store and protect products to SJI requirements.

B. Protect joists from distortion or damage.

PART 2 PRODUCTS

2-01 MATERIALS

A. Open Web Joists Members: SJI Type K open web.

B. Nuts and Washers: ASTM A307.

C. Primer: FS TT-P-636.

D. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36.

E. Welding Materials: AWS D1.1; type required for materials being welded.

2-02 FABRICATION

A. Provide bottom and top chord extensions as indicated.

2-03 FINISH

A. Shop prime joists. Do not prime surfaces that will be field welded.

PART 3 EXECUTION

3-01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means erector accepts existing conditions.

3-02 ERECTION

A. Erect and bear joists on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment until completion of erection and installation of permanent bridging and bracing.

C. Coordinate placement of anchors in masonry.

D. After joist alignment and installation of framing, field weld joist seat to bearing plates.

E. Position and field weld joist chord extensions and wall attachments after dead load is applied.

F. Do not permit erection of decking until joists are braced, bridged, and secured.

G. Do not field cut or alter structural members without approval of joist fabricator.

H. After erection, prime welds, abrasions, and surfaces not shop primed.

3-03 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Alignment: 1/2 inch.

END OF SECTION

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SECTION 05 31 00
STEEL DECKING

PART 1 GENERAL

1-01 SECTION INCLUDES

A. Steel deck and accessories.

1-02 RELATED SECTIONS

A. Section 05 12 00 - Structural Steel Framing.

1-03 REFERENCES

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

B. ASTM 36 - Structural Steel.

C. ASTM A466 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

D. ASTM A525 - Steel Sheet, Zinc-Coated, Galvanized by the Hot Dip Process.

E. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.

F. AWS D1.1 - Structural Welding Code.

G. SDI - Design Manual for Composite Decks, Form Decks, Roof Decks.

1-04 PERFORMANCE REQUIREMENTS

A. Design metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks.

1-05 SUBMITTALS

A. Shop Drawings: Indicate decking plan, support locations, projections, openings and reinforcement, pertinent details, and accessories.

B. Product Data: Provide deck profile characteristics and dimensions, structural properties and finishes.

C. Manufacturer's Installation Instructions: Indicate specific installation sequence.

1-06 DELIVERY, STORAGE AND HANDLING

A. Store and protect products from damage.

B. Cut plastic wrap to encourage ventilation.

C. Separate sheets and store decking on dry wood sleepers; slope for positive drainage.

1-07 STRUCTURAL SPECIAL INSPECTIONS AND TESTING

A. Inspection of all welds and/or other attachment to steel members.

PART 2 PRODUCTS

2-01 MATERIALS

A. Sheet Steel: ASTM A446, Grade A Structural Quality; with G90 galvanized coating conforming to ASTM A525.

B. Bearing Plates: ASTM A36 steel.

C. Welding Materials: AWS D1.1.

D. Touch-Up Primer: Zinc chromate type.

2-02 FABRICATION

A. Metal Decking: Sheet steel, configured as follows:

Span Design:	Multiple
Minimum Metal Thickness (Excluding Finish):	as shown on drawings
Nominal Height:	as shown on drawings

B. Metal Closure Strips, Cover Plates, and Related Accessories: 20 gage galvanized sheet steel; of profile and size as required.

C. Fasteners: Galvanized hardened steel, steel-tapping.

D. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter.

PART 3 EXECUTION

3-01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means installer accepts existing conditions.

3-02 INSTALLATION

A. Erect metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks.

B. Bear decking on steel supports with 1-1/2 inch minimum bearing. Align and level.

C. Fasten deck to steel support members per drawings.

D. Weld in accordance with AWS D1.1.

E. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.

F. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

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SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extent of cold formed metal framing is shown on drawings.

B. Types of Formed steel stud exterior wall and interior wall framing units include the following:
   1. "C" shaped, 6 inch structural studs; 14 gauge galvanized.
   2. "C" shaped, 6 inch structural studs; 16 gauge galvanized.
   3. "C" shaped, 6 inch structural studs; 20 gauge galvanized.
   4. "C" shaped, 3-5/8 inch structural studs; 20 gauge galvanized.
   5. 1-1/2 inch galvanized cold formed channel.
   6. Hat Channels -20 gauge galvanized.
   7. See 2.02, B for stud types required in typical assemblies and conditions.
   8. Shaft Wall C-H studs.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking and miscellaneous framing.

B. Section 06 10 00 - Rough Carpentry: Roof and wall sheathing.

C. Section 07 21 00 - Thermal Insulation: Insulation within framing members.

D. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

D. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members; 2018.

E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a (Reapproved 2015).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations and installation instructions.

C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Include placing drawings for typical framing member conditions showing size and gauge designations, number, type, locations and spacing. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.
   2. Indicate typical fasteners, fastening patterns for each structural condition.
   3. Submit verification that stud assemblies to be provided for each span and condition meet the load parameters indicated on the structural drawings.
   4. Design data:

a. Shop drawings signed and sealed by a professional structural engineer.

1.05 QUALITY ASSURANCE

A. Component Design: Calculate structural properties of studs and joists in accordance with American Iron and Steel Institute (AISI) "Specification for Design for Cold-Formed Steel Structural Members."

B. Welding: Use qualified welders and comply with American Welding Society (AWS) D1.3, "Structural Welding Code-Sheet Steel".

C. Fire Rated Assemblies: Where framing units are componetns of assembled indicated for a fire resistance rating, includign those required for compliance with governing regulations provide units which have been approved by governing authorities having jurisdiction.

D. Design deflection: For studs at exterior conditions and interior partitions, verify that stud assemblies to be provided for each span and condition, meet a maximum L/360 deflection at specified wind loads as inidcated in the structural drawings.

E. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Mississippi.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopended containers or bundles, fully identified with name, brand, type, and grade. Store off gound in a dry ventilated space or protect with breathable waterproof tarpaulins.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing:
   1. Clarkwestern Dietrich Building Systems LLC; _____: www.clarkdietrich.com.
   2. Marino Ware Industries Corp.; _____: www.marinoware.com.
   3. Unistrut or equal for Unistrut components..

B. Framing Connectors and Accessories:

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Requirements: Provide completed framing system having the following characteristics:
   1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
   2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
   3. Design Loads: In accordance with applicable codes.
   4. Live load deflection meeting the following, unless otherwise indicated:
      a. Floors: Maximum vertical deflection under live load of 1/360 of span.
      b. Roofs: Maximum vertical deflection under live load of 1/240 of span.
      c. Exterior Walls: Maximum horizontal deflection under wind load of 1/180 of span.
   5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, C- or Sigma-shaped with punched web; U-shaped track in matching nominal width and compatible height.

B. Framing Connectors: Factory-made, formed steel sheet.
   1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gauge, 0.1345 inch (3.42 mm), and factory punched holes and slots.
   2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.04 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

2.05 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

2.06 FABRICATION

A. General: Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion.

B. Fabricate panels in jib templates to hold members in proper alignment and position to assure consistent component placement.

C. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer. Wire tying of framing components is not permitted.

D. Fabrication Tolerances: Fabricate panels to a maximum allowable tolerance variation from plumb, level and true to line of 1/8" in 10'-0".

PART 3 EXECUTION

3.01 INSPECTION AND PREPARATION

A. Prior to start of installation of metal framing systems, meet at project site with installers of other work including door and window frames and mechanical and electrical work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

3.02 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners as recommended by stud manufacturer for type of construction involved, except do not exceed 6 inches (____ mm) on center spacing for nail or power driven fasteners, or 12 inches on center for other types of attachment. Provide fasteners at corners and ends of tracks.

C. Set framing plumb, straight, except as needed for diagonal bracing or required for non-flat plane or warped surfaces and similar requirements.

D. Where framing system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.

E. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

F. Install load bearing studs full length in one piece. Splicing of studs is not permitted.

G. Install supplementary framing, blocking and bracing in metal framing system wherever soffit of furring are indicated to suppor fixtures, equipment, services, heavy trim and similar work requiring attachment to the system. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering wight or loading resulting from item supported.

H. Frame both sides of expansion and control joint, with separate "C" sections; do not bridge the joint wtih components of system.

I. Erection Tolerances: Bolt or weld wall panels (at both horizontal and vertical junctures) to produce flush, even, true to line joints.

J. Step in face and job in alignment between panels not to exceed 1/16"

K. Installation of Joists: Install level and plumb, complete with bracing and reinforcing as indicated on drawings. Provide not less than 1-1/2" end bearing. Reinforce ends with end clips, steel hangers, steel angle clips, steel stud section, end grain wood block, or as otherwise recommended by joist manufacturer. Where required reinforce joists at interior supports with single short length of joist section located directly over interior support, snap-on shoe, 30% side-piece lapped reinforcement, or other method recommended by joist manufacturer. Secure joists to support system to prevent lateral movement of bottom flange.

L. Install intermediate stud headers in all openings that are larger than the stud spacing in that wall. If by design the header is low in the wall, the less than full height studs (cripples) that occur over the header shall be designed to carry all imposed loads.

M. Holes that are field cut into steel framing members shall be within the limitations of the product and its design. Provide reinforcement where holes are cut through load bearing members in accordance with manufacturer's recommendations and as approved by the Architect.

N. Gypsum board shall be attached to steel studs in accordance with ASTM C840.

O. Add additional studs at intersections, corners, doors, windows, control joints, etc., and as required for securing sheathing and finish boards.

P. Touch-up field welds and damaged galvanized surfaces with primer.

END OF SECTION

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. Aluminum Window Shrouds

C. Steel Pit Ladders

D. Steel Roof Access Ladder

E. Miscellaneous Steel Angles, Embeds, Wall Braces, Loose Lintels and other steel and alluminum items that are not structural supports.

F. Stair, Ramp Handrails and Guradrails

G. Bollards and safety barriers

H. Steel frame and braces for coordinated mock up

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 05 12 00 - Structural Steel Framing: Structural steel column anchor bolts.

C. Section 05 12 13 - Architecturally-Exposed Structural Steel Framing.

D. Section 05 51 33 - Metal Ladders.

1.03 REFERENCE STANDARDS

A. Comply with requirements and recommendations of applicable portions of Standard as published by the following:
   1. American Institute of Steel Construction (AISC).
   2. American Society for Testing and Materials (ASTM).
   3. American Welding Society (AWS).
   4. Steel Structures Painting Council (SSPC).

B. Comply with all requirements of Section 05 12 13 Exposed Architectural Steel.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

D. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

H. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

I. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014 (Editorial 2017).

J. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

K. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

L. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

M. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

N. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

P. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2008.

Q. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; 2017.

R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

S. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

T. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: For all items in this Section, Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

D. Product infromation for each product used in this section.

E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

A. Welders shall be certified within the previous 12 months as qualified operators according to requirements of the American Welding Society, with copies of certificates furnished to the Architect.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548. Perform a visual inspection of all welds for conformance with above standards.

PART 2 PRODUCTS

2.01 ANCHORS

A. Expansion shields to meet Federal Specification FF-S-325.

B. Toggle bolts to meet Federal Specification FF-B-588.

2.02 FASTENERS

A. Screws to meet Federal Specification FF-S-85, FF-S-92, or FF-S-11 as best for intended use.

B. Aluminum Plate Panel Fasteners: Stainless Steel, #3 Point, #12 Diameter, +5/16" Thread Depth, Fine Thread Pitch for Thread Engagement in Metal Thicknesses Shown, PWH Head Style for Flush Countersink.

2.03 WASHERS

A. Lock washers to meet Federal Specification FF-W-84.

B. Flat washers as best for intended use.

C. Flat 3/4" Washers at all Guardrail Panel Fasteners and Bolts.

2.04 ADHESIVE ANCHORS

A. Hilti Chemical Anchors: Hilti.com
   1. Hilti HIT-HY Systems. Size per location and load requirments.

2.05 POWER DRIVEN FASTENERS

A. Use only when approved in writing by Architect.

2.06 MATERIALS - STEEL

A. Steel Angles, Channels, Plates: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Loose Lintels: Provide loose structural steel lintels for all openings and recesses in masonry walls and partitions as shown. Weld adjoining members together to form a single unit where indicated. Provide not less than 8" bearing at each side of openings, unless otherwise indicated.

F. Miscellaneous Framing & Support Items: Provide all miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work. See Drawings.

G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

H. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.07 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5005 alloy, H32 or H22 temper.

C. Bolts, Nuts, and Washers: Stainless steel.

D. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.08 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.09 FABRICATED ITEMS

A. Interior Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. General: Fabricate ladders for the locations shown, with dimensions, spacing, details, and anchorage as indicated in drawings or as listed below. Comply with requirements of ANSI A14.3 and OSHA Standards. Exterior roof ladder shall be galvanized.
      a. Side Rails: Continuous steel 1” x 2” flat bars and C3x5 steel channels or as shown on drawings, with capped ends, spaced as shown on drawings. Channel side rails shall face open side out.
      b. Bar Rungs: Round steel bars, 1" O.D., spaced 12" o.c.
      c. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
      d. Support each ladder at top and bottom and at intermediate points spaced not more than 5'- 0" o.c. and at structure as shown on drawings by means of welded or bolted steel brackets.
      e. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7".
      f. Extend side rails 42" above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.
      g. Provide non-slip surface on top of each rung, either by coating the rung with aluminum oxide granules set in epoxy resin adhesive, or by using a type of manufacturing rung which is filled with aluminum oxide grout.

B. Bollards (Exterior): Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

C. Pre-Fabricated Bollards (Interior): O.D. as shown on Drawings. Surface Mounted Carbon Steel, Powder Coat Finish, Anchor Plate and Bolts for heavy duty installation.
   1. Surface Mounted Security Bollard by TrafficGuard or approved equal. www.traficguard.net.

D. Dock Chain Barrier Bollard System: Provide at doors indicated on the Door Schedule. 4 1/2" steel pipe bollards with post hanging brackets and dual safety chains, painted caution yellow. Add painted metal "WARNING" sign.
   1. Dock Chain Barrier Bollard System - DCBB-42-4.5 by Vestil Manufacturing or approved equal. www.vestilmgh.com.

E. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; prime paint finish.

F. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.

G. Scupper and Downspouts: As detailed; painted carbon steel.

2.10 SECONDARY DRAIN OUTLET

A. Downspout Nozzle: All Nickel Bronze Body Lambs Tongue nozzel Model Z199 as manumfactured by Zurn Indstries LLC. 1801 Pittsburgh Avenue Erie, Pa. 16502. 855-663-9876 www.zurn.com

B. Provide downspout nozzle on each overflow roof drain. See drawings for pipe size, material and locations.

2.11 HAND RAILING AND GUARD RAILING

A. Hand railings and guard railings shall be standard steel solid shapes of sizes indicated on drawings. All connections shall be welded, ground smooth, uniformly sand blasted. All interior handrails and guardrails shall be primed with primer as specified. All surfaces are to be smooth to the touch and free of all scratches, scale, slag, weld imperfections and sharp edges.

2.12 MISCELLANEOUS FRAMING & SUPPORT ITEMS

A. Provide all miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work. See Drawings.

2.13 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
   2. Exceptions: Galvanize all exposed exterior steel.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft (530 g/sq m) galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.14 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I color anodized.

B. Exterior and Interior Aluminum Surfaces: Powder Coat to Match Window Frame Champain Color as approved by Architect.

C. Interior Aluminum Surfaces: Class I natural anodized.

D. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

E. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.

2.15 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

C. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

D. Coordinate & furnish anchorage's, setting drawings, diagrams, templates, instruction, and directions for installation of anchorage's, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

E. Deburr all aluminum extrusions prior to installation.

F. Pre-drill all holes.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

D. Material and workmanship not conforming to the provisions of these specifications shall be rejected any time during the progress of the work. Rejected workmanship or material shall be corrected immediately after notification.

E. Conceal all fastenings where practicable. Thickness of metal and detail of assembly and supports to give ample strength and stiffness. Form joints exposed to weather to exclude water. Drill weep holes to prevent containment of water in hollow elements.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 FABRICATION

A. Provide workmanship equal to the best modern practice conforming to industry standards in accordance with latest requirements of American Institute of Steel Construction. All joints to be welded unless bolts are shown on the Drawings. Do all fitting and assembly at work shop and deliver to job ready for erection insofar as possible.

3.05 ERECTION

A. Erect all work square and plumb, accurately fitted with tight joints and intersections. Adequately reinforce all work and anchor into place.

B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

C. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plus, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.

3.06 METALS IN CONTACT

A. Insulate like metals in contact or in contact with other metals in such a manner as to prevent corrosion. Use materials required for such results approved by Architect.

3.07 MISCELLANEOUS BOLTS, ANCHORS AND FASTENINGS

A. Securely attach all such work in the most appropriate manner and in accordance with best workmanship as herein specified.

3.08 MISCELLANEOUS METAL ITEMS

A. Furnish all miscellaneous items in strict accordance with manufacturer's printed specifications and directions.

3.09 GALVANIZED TOUCH UP REPAIR

A. Touch up all exterior galvanized steel with Galv-weld regalvanizing bar. Cover scratches, welds, or other flaws in the galvanic surface. Apply in accordance with manufacturer's specifications and directions and as follows:
   1. Clean surface of the heat damaged or abraded galvanized area with a stiff wire brush.
   2. Apply heat (per manufacturer's instructions) to the resurfacing area. The residual heat of an existing weld may be used. No flux is required. Too much heat will cause Galv-weld to gasify or burn; too little heat will cause Galv-weld to not spread properly.
   3. Continue applying heat until the Galv-weld become viscous enough to be spread with a wire brush.
   4. Apply enough Galv-weld to fully cover damaged area.

3.10 METAL SAFETY TREADS/NOSINGS

A. Install Safty nosings into plastic concrete. Ensure full and level setting of nosing into conctete. Puddle the concrete and tamp the safety nosings to insure propoer concrete formation around the anchors.

3.11 TOLERANCES

A. Maximum Variation From Plumb: 1/8 inch (_____ mm) per story, non-cumulative.

B. Maximum Out of Level 1/16 inch per 10 feet.

C. Maximum Out of Alignment at running component joint 1/16 inch.

D. Maximum Offset From True Alignment: 1/8 inch (_____ mm).

E. Maximum Out-of-Position: 1/8 inch (_____ mm).

END OF SECTION

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SECTION 05 51 33
METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Alternating Tread Steel Stairs

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A269 Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014 (Editorial 2017).

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2018.

F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.

C. Shop Drawings:
   1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.02 PREFABRICATED LADDERS

A. Prefabricated Alternating Tread Stair
   1. Performance Requirements:
      a. Alternating Tread StairTreads shall be capable of withstanding a single 1000 pound load without permanent deformation.
      b. Alternating Tread Stair Guard/Handrail shall be capable of withstanding a single concentrated load of 200 pounds or a uniform load of 50 pounds per

linear foot applied in any direction at any point on the rail without exceeding the allowable working stress of the material.

c. Alternating Tread Stair Stringers shall be capable of withstanding a single concentrated load of 1000 pounds at any point on the stair without permanent deformation.

2. Dimensions
   a. Alternating Tread Stair Angle shall be 68 degrees from horizontal.
   b. Provide Vertical Drop which is the change in elevation, as shown on the drawings, between the upper finished floor surface where the top landing will be attached and the lower finished floor surface where the base of the alternating tread stair will be secured.
      1) For Drops 15 feet or more, provide intermediate platform with two stairs of equal heights and sway bracing.
3. Basis of Design
   a. Alternating Tread Stair as manufactured by Lapeyre Stair, Inc., 5117 Toler St., Harahan, LA, 70123, LS.SALES@LAPEYRESTAIR.COM, WWW.LAPEYRESTAIR.COM.
      1) Material & Finish: Stainless Steel, AISI Grade 304, Natural Finish
      2) Treads: 13 Gauge
      3) Landing & Foot Stampings: 11 Gauge
      4) Stringers: U Section designed to meet the performance requirements herein.
      5) Handrails: 1 1/2" OD Stainless Steel tubes designed to meet the performance requirements herein.
      6) Fasteners: Designed to meet the performance requirements herein.
      7) Miscellaneous Materials:
         (a) Rubber Spine: Hollow neoprene
         (b) Rubber Foot Divider: Solid Santoprene
      8) Fabrication: Fabricate to conform to performance and construction requirements in accordance with approved shop drawings. Fabricate and shop-assemble. Welded connections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Confirm that the ladder structure to which the ladder safety system is installed is capable of withstanding the loads applied by the system in the event of a fall.

3.02 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Install to meet performance requirements herein.

END OF SECTION

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rough opening framing for doors, windows, and roof openings.

B. Sheathing.

C. Roofing nailers.

D. Preservative treated wood materials.

E. Concealed wood blocking, nailers, and supports.

F. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Sill flashings.

C. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2015.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2015.

F. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

G. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems; 2014 (editorially revised 2017).

H. PS 1 - Structural Plywood; 2009.

I. PS 20 - American Softwood Lumber Standard; 2010.

J. SPIB (GR) - Grading Rules; 2014.

1.04 SUBMITTALS

A. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

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.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. 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.
2. 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.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.

2.04 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.

B. Termite-Resistant Sill Plate Barrier: Self-adhesive, film-backed barrier with release sheet; adheres to concrete substrates and blocks termite access.
1. Thickness: 68 mils (0.068 inch) (1.7 mm).
2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.

2.05 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. Manufacturers:
a. Lonza Group; _____: www.wolmanizedwood.com/#sle.
b. Hoover Treated Wood Products, Inc; _____: www.frtw.com/#sle.
c. Substitutions: See Section 01 60 00 - Product Requirements.
2. 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. Do not use treated wood in direct contact with the ground.

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 in contact with roofing, flashing, or waterproofing.
c. Treat lumber in contact with concrete.
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.

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 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes, AWC (WFCM) Wood Frame Construction Manual, and _____.

E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.03 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 metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. 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.

D. 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. Wall paneling and trim.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.05 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.

END OF SECTION

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SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood door frames, glazed frames.

C. Wood casings and moldings.

D. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 06 41 00 - Architectural Wood Casework: Shop fabricated custom cabinet work.

C. Section 08 14 16 - Flush Wood Doors.

D. Section 09 90 00 - Painting and Coating.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Interior Woodwork Items:

1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

3.03 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

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SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Cabinet hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 09 90 00 - Painting and Coating.

C. Section 12 36 00 - Countertops.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

D. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
   2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.

2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
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.
6. Arrange and pay for inspections required for certification.
7. Replace, repair, or rework all work for which certification is refused.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom grade.
1. Exposed parts shall be 3/4" plywood core or 3/4" MDF core as indicated on the drawings with High Pressure Decorative Laminate on all exposed sides.
2. Semi-exposed parts shall be 3/4" plywood core or 3/4" MDF core where indicated on the drawings with High Pressure Decorative Laminate on all exposed and semi-exposed sides.
3. Concealed parts shall be 3/4" plywood core.
4. High Pressure Decorative Laminate shall be:
   a. 0.7mm minimum thickness at all other locations.

C. Cabinets at all locations:
1. Finish - Exposed Exterior Surfaces: High Pressure Decorative laminate.
2. Finish - Exposed Interior Surfaces: Decorative laminate.
3. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
4. Casework Construction Type: Type A - Frameless.
5. Cabinet Design Series: As indicated on drawings.
6. Adjustable Shelf Loading: 50 lbs. per sq. ft.
7. Cabinet Style: Flush overlay.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LAMINATE MATERIALS

A. Manufacturers:
1. Formica Corporation; : www.formica.com/#sle.
2. Panolam Industries International, Inc; Nevamar; : www.nevamar.com/#sle.
3. Wilsonart LLC; : www.wilsonart.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. High Pressure Decorative Laminate (HPDL) Type (1): NEMA LD 3, types as recommended for specific applications - where indicated.
1. Formica Surf- Plex Finish, 923-PX.

C. High Pressure Decorative Laminate (HPDL) Type (2): NEMA LD 3, types as recommended for specific applications - where indicated.
   1. Formica Pearl- Plex Finish, 837-PX.

2.04 COUNTERTOPS

A. Countertops are specified in Section 12 36 00.

2.05 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

E. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.06 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Display case hardware and components:
   1. For Custom Trophy display cases, furnish and install the following listed Knape & Vogt (or equal) and components. See Drawings for installation details.
      a. Channel: #993ZC channel for top and ends of openings.
      b. Shoe: #995ZC for 1/4" glass with lightly curved bottom.
      c. Carrier: #997ZC ball bearing carrier with free rolling balls at 3" o.c.
      d. Track: #999ZC lower track, 1" high X 1" wide.
      e. Shelves: 3/8" tempered glass shelves
      f. Doors: 1/4" tempered glass, size as detailed.
      g. Locks: Each door shall have one rachet lock # 963CHR, polished chrome with all doors keyed alike.
      h. Removable parabolic diffuser ceiling panels.

C. Adjustable Shelf Supports:
   1. Product Knape & Vogt No. 255 and 239.

D. Drawer and Door Pulls: Stainless Steel..
   1. Product: Model No. SN70/S manufactured by Sugatsune America, Inc. or equal..

E. Drawer Slides:
   1. Type: Model No. 1300.
   2. Static Load Capacity: Commercial grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Manufacturers:
      a. Knape & Vogt Manufacturing Company; : www.knapeandvogt.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Hinges: European style concealed self-closing type, CLIP top, steel with polished finish.
   1. Manufacturers:
      a. Blum, Inc; : www.blum.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet (600 mm) from sink cut-outs.

2.08 SHOP FINISHING

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

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SECTION 07 05 53
FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.02 REFERENCE STANDARDS

A. ICC (IBC) - International Building Code; 2015.

PART 2 PRODUCTS

2.01 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).

PART 3 EXECUTION

3.01 INSTALLATION

A. Locate markings as required by ICC (IBC).

B. Install neatly, with horizontal edges level.

C. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

END OF SECTION

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SECTION 07 11 13
DAMPPROOFING

PART 1 GENERAL

1.01 SCOPE

A. The work required in this section consists of dampproofing and related items necessary to complete the work as indicated in the contract documents.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Submit manufacturer's literature, fact sheets, verification of ASTM standards and installation instructions.

C. Product Data: Provide properties of primer, bitumen, and mastics.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.03 QUALITY ASSURANCE

A. Install damproofing per manufacturer instructions and as directed in the drawings.

B. Dammproofing with Waterproofing systems shall provide a barrier to moisture penetration by liquid flow, air transport, or diffusion. Contractor shall ensure that the integrity of all surfaces and conditions that define the damproofing / waterproofing enclosure /barrier are appropriately sealed to achieve a moisture barrier system.

PART 2 PRODUCTS

2.01 DAMPPROOFING NO. 1 (D.P. #1) (VAPOR BARRIER)

A. Vapor Barrier Wrap 15 mil , by Stego Insustriioes LLC., 877-464-7834, www.stegoindustries.com <http://www.stegoindustries.com>, or equal. Vapor Barrier shall meet ASTM Vapor Transmission Rates of .008 WVTR or lower per ASTM E96. Water Vapor Barrier Class A, ASTM E 1745.

1. Accessories: Compatible Seam Tape with Water Vapor Transmission Rate of .03 perms or lower par ASTM E96.
2. Compatible Vapor Proofing Mastic with Water Vapor Transmission Rate of .03 perms or lower par ASTM E96. Mastic by Stego Insustriioes LLC., 877-464-7834, www.stegoindustries.com <http://www.stegoindustries.com>, or equal.
3. Pipe Boots shall be constructed from vapor barrier material, pressure sensitive tape and or mastic per manufacturers instructions.

PART 3 EXECUTION

3.01 DAMPPROOFING NO. 1 (D. P. #1) (VAPOR BARRIER)

A. Apply a complete sealed vapor barrier under concrete slabs grade beams and other areas that would expose the interior of the building to moisture from beneath the foundation system. Lap all joints a minimum of 6"and seal all joints with manufactures compatible pressure sensitive tape. Patch all tears or punctures using sensitive tape before concrete is placed. Seal all penetrations, including pipe penetrations per manufactures instructions with compatible tape and or compatible mastic. All patches and penetration seals shall extend a minimum of 6” beyond the breach and be taped to maintain the integrity of the surface. (No penetration of the vapor barrier is permitted except for utilities which must be sealed.)

B. Vapor barrier shall be installed in strict accordance with manufacturer's printed instructions and recommendations and ASTM E 1643-98. Prior to concrete pour notify Architect for inspection. Do not cover without approval of the Vapor Barrier surface.

END OF SECTION

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SECTION 07 13 00
SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet membrane waterproofing:
   1. Cross laminated Polyethylene with bonded self-adhesive rubberized asphalt.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Insulation used for protective cover.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal counterflashing.

C. Section 07 92 00 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not required to be treated in this section.

1.03 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).

B. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2010).

C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2013.

D. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems; 2014.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

F. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Install membrane materials in strict accordance with all safety and either conditions required by the manufacturer or as modified by applicable rules and regulations. Coordinate the installation of materials to achieve the full performance of the enclosure systems.

B. Install waterproofing and components from one manufacturer to insure a complete tested and warranted system application.

1.06 MOCK-UP

A. Locate where directed.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application and until liquid or mastic accessories have cured.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective Work within a seven year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.
   1. Installer shall warrant in writing that air & vapor barrier, flashings and accessories have been installed in accordance with manufacturer's instructions and Specification requirements, and that a full and complete moisture barrier has been achieved.
   2. Installer shall provide a seven year full replacement guarantee.

C. Provide seven year manufacturer warranty for waterproofing failing to resist penetration of water and moisture, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 WATERPROOFING NO. 1 (W.P. #1) (THRU WALL FLASHING AT SITE WALLS) - NOT USED

2.02 WATERPROOFING NO. 2 (W.P. #2) (ROOF/EAVE/VALLEY & BLOCKING AT COPING & FASCIA - WATERPROOF MEMBRANE) -

A. W.P. # 2 shall be "Grace" Ice and Water Shield or equal, a cold applied self-adhered membrane underlayment, 40 mils thick, comprised of a cross laminated, high density polyethylene film coated on one site with a layer of rubberized asphalt adhesive and interwound with a disposable release sheet.

2.03 WATERPROOFING NO. 4 (W.P. #4) (MEMBRANE AIR - VAPOR BARRIER FOR ALL DRAINAGE PLANE SURFACES - EXTERIOR SHEATHING) - NOT USED

2.04 WATERPROOFING NO. 5 (W.P. #5) (MEMBRANE THRU WALL FLASHING) -

A. WP # 5 shall be Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products or equal.

B. Wall Flashing Accessories:
   1. Surface Conditioner:
      a. Description: Water-based latex liquid for substrate preparation.
         1) Flash Point: No flash to boiling point
         2) Solvent Type: Water
         3) VOC Content: Not to exceed 125 g/L
         4) Application Temperature: -4ºC (25ºF) and above
         5) Freeze/Thaw Stability: 5 cycles min.
         6) Freezing point (as packaged): -10ºC (14ºF)
   2. Termination Mastic:
      a. Description: Rubberized asphalt-based mastic with 200 g/L max. VOC Content.
      b. Product: Bituthene® Mastic manufactured by Grace Construction Products.
   3. Primer:
      a. Description: Water-based latex primer
         1) Specially designed for glass mat surfaced exterior gypsum boards
         2) VOC Content: Not to exceed 10 g/L
      b. Product: Perm-A-Barrier WB Primer by Grace Construction Products.
   4. Primer for damp conditions and concrete:

a. Description: Rubber-based primer in solvent with 440 g/l max. VOC content.
b. Product: Bituthene Primer B2 by Grace Construction Products.

2.05 WATERPROOFING NO. 6-8 (SEE SECTION 07 14 00)

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

B. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.

3.03 INSTALLATION - W.P. #2

A. Apply W.P. #2 underlayment on clean and dry plywood sheathing and wood blocking or under cast stone coping at locations shown on the drawings. Remove plastic release film from the back of the membrane and adhere directly to plywood sheathing. Lap over seams 6” Min. in the direction of water flow.

B. Do not leave exposed to sunlight.

C. Use and install per manufactures instructions.

3.04 INSTALLATION - W.P. #5 -

A. Examine conditions, with installer present, for compliance with requirements for installation, tolerances and other specific conditions affecting performance of flashing. Remove all deleterious materials from surfaces to be flashed.

B. Install flashing to dry surfaces at air and surface temperatures of -4ºC (25ºF) and above in accordance with manufacturer’s recommendations at locations indicated on Construction Documents.

C. Apply primer by brush or heavy nap, natural-material roller at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application.

D. Flexible Wall Flashing: Install flashing in exterior walls above all openings, at all breaks in masonry back-up, at wall base, and all other locations indicated on plans. Through wall flashing/ membrane flashing shall always be sealed or lapped (2”) by air & vapor membrane or counter flashed by air & vapor membrane with a minimum of 2” lap.
   1. Precut pieces of flashing to easily handled lengths for each location.
   2. Remove silicone-coated release paper and position flashing carefully before placing it against the surface.
   3. When properly positioned, place against surface by pressing firmly into place by hand roller. Fully adhere flashing to substrate to prevent water from migrating under flashing.
   4. Overlap adjacent pieces (2 in.) and roll all seams with a steel hand roller.
   5. Trim bottom edge (1/4 in.) back from exposed face of the wall. Flashing shall not be permanently exposed to sunlight.

6. At heads, sills and all flashing terminations turn up ends a minimum of (2 in.) and make careful folds to form an end dam, with the seams sealed. Flashing shall installed 8" minimum wider than opening.
7. Fold and lap and seal all inside and outside corners. Seal from top to bottom of corner conditions.
8. Do not allow the rubberized asphalt surface of the flashing membrane to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.
9. Do not expose flashing membrane to sunlight for more than thirty days prior to enclosure.
10. Architect and General Contractor must inspect installation prior to enclosing.
11. Repair punctures, damaged areas and inadequately lapped seams with a patch of the membrane sized to extend 150 mm (6 in.) in all directions from the perimeter of the affected area.

E. Accessories:
1. When required by dirty or dusty site conditions or by surfaces having irregular or rough texture, apply surface conditioner by spray, brush, or roller at the rate recommended by manufacturer, prior to flashing installation. Allow surface conditioner to dry completely before flashing application.
2. Apply a bead or trowel coat of mastic along flashing top edge, seams, cuts, and penetrations.

3.05 PROTECTION & CLEANING

A. Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed work using procedures as recommended by manufacturer.

B. Perm-A-Barrier Liquid is not suitable for permanent exposure and should be protected from the effects of sunlight.

C. Schedule work to ensure that the Perm-A-Barrier Liquid system is covered as soon as possible after installation. Protect Perm-A-Barrier Liquid system from damage during subsequent operations. If the Perm-A-Barrier Liquid system cannot be covered within 60 days after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins.

D. Clean stains from adjacent surfaces with and remove any foreign matter from finished membrane surface.

3.06 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

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SECTION 07 14 00
FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-Applied Waterproofing:

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.

B. Section 04 20 00 - Unit Masonry: Masonry joints prepared to receive flashings.

C. Section 07 21 00 - Thermal Insulation: Insulation used for protective cover.

D. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal parapet covers, copings, and counterflashings.

E. Section 09 29 00 - Drywall: Sheathing.

F. Section 07 92 00 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not part of work in this section.

1.03 REFERENCE STANDARDS

A. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective Work within a seven year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no cost to Owner.

C. Provide seven year manufacturer warranty for waterproofing failing to resist penetration of water and moisture, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 WATERPROOFING NO. 6 (W.P. #6) (FLUID APPLIED AIR & VAPOR BARRIER MEMBRANE FOR DRAINAGE PLANE SURFACES - WOOD AND GYPSUM BOARD SHEATHING, AND METAL)

A. W.P. No. 6 shall be PERM-A-BARRIER NPL Air & Vapor Barrier System as manufactured by GCP Applied Technologies or equal.

B. Air & Vapor Barrier System Components:
   1. Sealant:
      a. Description: one part neutral curing, ultra-low modulus siicone sealant for detailling and joint treatments.

b. Product: S100 Sealant manufactured by GCP Applied Technologies or equal.

2. Liquid Membrane:
   a. Description: two component, trowel greade, asphalt modified urethane for sealing patches, terminations, brick ties, etc.
   b. Product: BITUTHENE Liquid Membrane manufactured by GCP Applied Technologies or equal.
3. Wall Flashing:
   a. Description: heavy duty, fully-adhered membrane for through-wall flashing detailing.
   b. Product: PERM-A-BARRIER Wall Flashing manufactured by GCP Applied Technologies or equal.
4. Detail Membrane:
   a. Description: flexible, fully adhered membrane for detail flashing areas.
   b. Product: PERM-A-BARRIER Detail Membrane manufactured by GCP Applied Technologies or equal.
5. Aluminum Flashing:
   a. Description: flexible, aluminum faced, fully adhered membrane for detail flashing areas.
   b. Product: PERM-A-BARRIER Aluminum Flashing manufactured by GCP Applied Technologies or equal.

2.02 WATERPROOFING NO. 7 (W.P. #7) (FLUID APPLIED VAPOR PERMEABLE AIR BARRIER MEMBRANE) (NOT USED)

2.03 WATERPROOFING NO. 8 (W.P. #8) (COLD APPLIED, WATERPROOFING SYSTEM FOR ELEVATED DECKS)

A. W.P. No. 8 shall be BITUTHENE Deck System(US Version) or equal.

B. W.P. No. 8 components:
   1. Bituthene System 4000 Low Temperature membrane - self-leveling adhesive, waterproofing membrane
   2. Bituthene Deck Prep - low viscocity, two component surface treatment coating designed to level and prepare surface prior to installing Bituthene membrane.
   3. Bithuthene Liquid Membrane - accomodates minor structual movement and will bridge shrinkage cracks
   4. Hydroduct 660 Drainwall Composite - high compressive strength, high flow, geocomposite horizontal drainage board and protection layer.

2.04 ACCESSORIES

A. Provide Accessories as required for full and complete systems and as shown in the Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

B. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.

C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions.

D. Remove Contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid applied waterproofing.

E. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.

F. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

3.03 INSTALLATION - W.P. #6

A. A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Do not proceed with work until Architect has inspected and accepted the preparedness of the substrate.

B. Adhere to all manufacturer's requirements for preparation of substrates.

C. Application shall be spray or roller applied. Adhere to manufacturer’s recommendations for installation, including application at joints and transitions, control of thickness, application temperature, coverage rate and drying.

3.04 INSTALLATION - W.P. #7 (NOT USED)

3.05 INSTALLATION - W.P. #8

A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Do not proceed with work until Architect has inspected and accepted the substrates.

B. Adhere to manufacturer’s requirements for preparation of substrates.

C. Application of Bituthene Deck Prep shall be squeegee applied to manufacturers recommended thickness (minimum thickness of 80mil) - do not exceeded 1/2". Apply Bithuthene directly to cured Bituthene Deck Prep - no priming or conditioning necessary. Adhere to manufacturer’s recommendations and requirements for installation for each particular component, including application at joints and transitions, corners, control of thickness, application temperature, coverage rate, drying and protection.

3.06 PROTECTION & CLEANING

A. Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed work using procedures as recommended by manufacturer.

B. PERM-A-BARRIER NPL is not suitable for permanent exposure and should be protected from the effects of sunlight.

C. Schedule work to ensure that the PERM-A-BARRIER NPL system is covered as soon as possible after installation. Protect PERM-A-BARRIER NPL system from damage during subsequent operations. If the PERM-A-BARRIER NPL system cannot be covered within 120 days after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins.

D. Clean stains from adjacent surfaces with and remove any foreign matter from finished membrane surface.

END OF SECTION

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SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation over roof deck and exterior wall behind metal, cementitious, and composite wall finish.

B. Batt insulation in exterior wall, ceiling, and roof construction.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Board insulation as wall sheathing.

B. Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2018.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2018a.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

I. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

J. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2011.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation in Second Floor Concrete Slabs: Expanded polystyrene (ESP) board.

B. Insulation Over Metal Stud Frames Walls, Continuous: Mineral wool insulation.

C. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

D. Insulation Over Roof Deck: Polyisocyanurate board.

2.02 FOAM BOARD INSULATION MATERIALS

A. Expanded Polystyrene (EPS) Board Insulation: Complies with ASTM C578.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Complies with fire resistance requirements indicated on Drawings as part rated and non-rated floor assemblies.
   4. Board Size: 48 inch by 18 inch (___ mm by ___ mm).
   5. Board Thickness: 1 inch (___ mm).
   6. Type and Thermal Resistance, R-value (RSI-value): Type VIII, 3.8 (0.67) per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
   7. Manufacturers:
      a. Dyplast Products; Holey Board Insulation: www.dyplast.com
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Roof Assembly: Polyisocyanurate (ISO) Board Insulation with Facers Both Sides and Water-Resistive Barrier: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type II:
         1) Class 2 - Faced with coated polymer-bonded glass fiber mat facers on both major surfaces of core foam.
         2) Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.
         3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inch (38.1 mm) thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F (24 degrees C).
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Water Vapor Permeance: 1 perm (57.5 ng/(Pa s sqm)), maximum, at 1 inch (25 mm) thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.
   5. Manufacturers:
      a. Johns Manville; Flat & Tapered ENRGY 3 CGF Polyiso: www.jm.com..
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 FIBERBOARD INSULATION MATERIALS

A. Mineral Fiberboard Insulation: Rigid or semi-rigid mineral fiber, ASTM C612 or ASTM C553; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   2. Board Thickness: 2 inches (50 mm).

3. Thermal Resistance: R-value (RSI-value) of 4.3 (0.76) per inch at 75 degrees F (24 C), minimum, when tested according to ASTM C518.
4. Maximum Density: 4.5 pounds per cubic foot (___ kg/cu m), nominal.
5. Manufacturers:
   a. Thermafiber, Inc; Rainbarrier 45: www.thermafiber.com/#sle.
   b. Or approved equal.

2.04 EXTERIOR BATT INSULATION MATERIALS

A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.

B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   4. Formaldehyde Content: Zero.
   5. Thermal Resistance: R-value (RSI-value) of 21 (_____).
   6. Manufacturers:
      a. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
      b. Or approved equal.

C. Mineral Fiber Batt Insulation: Semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   2. Manufacturers:
      a. Thermafiber, Inc; Thermafiber RainBarrier 45: www.thermafiber.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 SOUND BATT INSULATION

A. 3 1/2” x 16” and 5-1/2”x16” Sound Attenuation Batt Insulation Unfaced by Owens Corning or equal. Flame Spread 10 (Class A). Locate in Toilet room walls (when studs), above ceilings and as other wise shown in the drawings.

2.06 ACCESSORIES

A. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.

B. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

C. Insulation Fasteners: Appropriate for purpose intended and approved by Manufacturer.
   1. Length as required for thickness of insulation material and penetration of deck substrate.

D. Adhesive: Type recommended by insulation manufacturer for application.

E. Penetration and Gap Filler
   1. Products:

2. GREAT STUFF PRO by The Dow Chemical Company,or equal, for gaps 1/4" to 3".
3. FROTH-PAK Foam Insulation two component quick-core polyurethane foam by the Dow Chemical company, or equal, for gaps 2" to 4".

F. Exterior Insulation Joint Treatment
1. Products:
a. LIQUIDARMOR CM spray flashing and sealant (for gaps <1/4") by The Dow Chemical Company or equal..
b. LIQUIDARMOR LT flexible single component silione flashing (for gaps < 1/4") by The Dow Chemical Company or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Apply adhesive to back of boards:
1. Three continuous beads per board length.

B. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches (406 mm) on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inch (102 mm) wide sealant tape; comply with ASTM E2357.

C. Install boards horizontally on walls.
1. Install in running bond pattern.
2. Butt edges and ends tightly to adjacent boards and to protrusions.
3. **Coordinate layout with "z" sub-girts for metal wall planels - See Section 07 41 13 Metal Wall Panels.**

D. Extend boards over expansion joints, unbonded to wall on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
1. Seal around penetrations using Penetration and Gap Filler material.
2. Maintain continuity of air barrier by sealing the roof/wall juncture with Roof/Wall Juncture Sealing material.

F. Seal board joints with Manufaturer's recommended sealant product, consistent with ASTM E2357 testeed assembly.

G. Tape insulation board joints.

3.03 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

A. Installation of board insulation over low slope roof deck as specified in Section 07 41 13 Metal Roof Panels.

B. Board Installation Over Roof Deck, General:
1. See applicable roofing specification section for specific board installation requirements.
2. Fasten insulation to deck in accordance with roofing manufacturer's written instructions and applicable Factory Mutual requirements.
3. Do not apply more insulation than can be covered with roofing in same day.

3.04 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Install Mineral Wool Batts by using impaling clips where used in continuous insulation applications.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

3.06 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

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SECTION 07 41 13
METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural roofing system of preformed steel panels.

B. Attachment system.

C. Factory Finishing.

D. Accessories and miscellaneous components.

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Roof framing and purlins.

B. Section 07 21 00 - Thermal Insulation: Rigid roof insulation.

C. Section 07 42 13 - Metal Wall Panels: Preformed wall panels.

D. Section 07 92 00 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

B. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Summary of test results, indicating compliance with specified requirements.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Specimen warranty.
   5. Standard Details.
   6. Certified product test results.
   7. General recommendations as applicable to materials and finishes for each component and for total panel system.
   8. Furnish copy of SMACNA details to confirm details submitted conform to requirements.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, joints, corners, panel profiles, supports, anchorages, trim, spacing and type of connections, flashings, underlayments, gutters, and special conditions.
   1. Distinguish between factory work and work to be field-fabricated or field-assembled.

D. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

E. Certificate of each roofing personnel certifying qualifications, see 1.05.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
   1. The manufacturer has been regularly engaged in the fabrication of metal standing seam roof systems for not less than 10 years of documented

experience. A brief list of similar projects shall be submitted with the shop drawings.

2. The manufacturer maintains a certified installer program for its products and maintains an up-to-date authorized roofing contractor list.
3. The manufacturer has a written warranty covering durability, color, and weathertightness of its roof system. Sample warranties shall be provided with the bid proposal.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

1. Installation of the standing seam metal wall and roofing panels and roof related accessories shall be performed by roofers authorized and qualified by the manufacturer as trained and qualified to erect the manufacturer's product.
2. The Installing Contractor performing the work described in this section shall hold a Certificate of Responsibility Number and be classified as roofing and sheetmetal.
3. All personnel installing metal roofing system shall hold a certificate from the Roofing Manufacturer, certifying that he/she has been trained by the Roofing Materials Manufacturer and certifiying he/she has been trained by Manufacturer and is qualified to install the approved system.

1.06 DESIGN CRITERIA

A. The following standards and criteria shall be used where applicable in the structural design of the roofing system covered herein (this section and all related sections).

B. Wind Up-Lift shall comply with Underwiriter's Laboratory Label UL90 and bear UL label.

C. Water penetration through the standing seam system when tested in accordance with ASTM E331-86, ASTM E1680/ASTM E 1648.

D. International Building Code.

E. Design Loads: As described in the Structural Drawings and the International Building Code.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.08 WARRANTY

A. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of twenty years from Date of Substantial Completion.

B. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, signed by metal roofing manufacturer and his authorized installer agreeing to repair or replace roofing that fails to keep out water within specified warranty period of twenty years from Date of Substantial Completion, but not to exceed the original cost of installation including labor or materials. The Warranty shall include all components consisting of, but not limited to roof panels, anchoring devices, metal flashing, ridge flashing, roof curbs, plumbing vent flashing and all

other items furnished by the manufacturer and other items installed by their approved installer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Roof Panels:
   1. Morin Corporation; SLR Standing Seam: www.morincorp.com/#sle.
   2. Or approved equal.

2.02 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels (Type 1): Factory-formed panels with factory-applied finish.
   1. Steel Panels:
      a. Zinc-coated steel complying with ASTM A653/A653M; minimum G60 (Z180) galvanizing.
      b. Steel Thickness: Minimum 22 gage (1/40 inch) (.51 mm).
   2. Profile: Double-lock Standing seam, with minimum 2.0 inch (51 mm) seam height; concealed fastener system for field seaming with special tool. The Concealed attachment system shall eliminate all through fastener penetrations of the exposed metal panel surface into structural supports and allow the metal panel covering to move independently of any differential thermal movement by the framing system.
   3. Texture: smooth profile or as approved by the Architect from range of manufacturer's standard textures.
   4. Length: As indicated on drawings.
   5. Width: Maximum panel coverage of 16 inches (406 mm).
   6. The panel-to-structural clip shall be designed to accomodate thermal movement in both expansion and contraction-floating clips system.
   7. The standing seam panel shall have symmetrical interlocking ribs and seams with a plant applied vinyl weather seal strip, and the seams and cap shall be continuously locked together with mechanical seamer during installation.
   8. Panels shall have flush horizontal and vertical surfaces, to facilitate sealing at terminations. Panel configurations which create voids requiring supplemental closure devices shall not be considered acceptable.
   9. Fabricate sheet metal panels to allow for expansion in running work sufficient to prevent buckling, damage, and deterioration of the work. Form exposed sheet metal work to fit over substructure without excessive oil canning, buckling, and tool marks, true to line and levels indicated.
   10. Panels shall be fastened to the support framing members with a concealed clip or backing device of steel having a protective metallic coating.
   11. Panel termination and perimeter flashing shall be sealed with sealants recommended and furnished by the manufacturer.
   12. Required closures shall be metal. Non-metal closures will not be acceptable.

C. Trim Systems:
   1. Trims shall be designed to provide for expected movement of roof panels due to thermal expansion and contraction. Details shall conform to the suggested details provided by the manufacturer, conforming with SMACNA - "Architectural Sheet Metal Manual", complying with Warranty Requirements and as shown on the drawings.

2. Metal and finish shall match metal panels. Finish on manufacturer's standard trim items and flat sheets used for on-site fabrication shall conform to specifications for panels.
3. Trim components formed by the roofing contractor shall conform to details submitted and approved by the Architect.

2.03 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.04 FABRICATION

A. Panels: Provide factory fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.05 PANEL FINISH

A. Fluoropolymer Coating System: Manufacturer's standard multi-coat thermocured coating system, including minimum 70 percent fluoropolymer color topcoat with minimum total dry film thickness of 0.9 mil (0.023 mm); color and gloss as selected from Manufacturers Premium Metallic Colors..

B. Solar Reflectance Index (SRI): 78.

2.06 ACCESSORIES AND MISCELLANEOUS ITEMS

A. Miscellaneous Sheet Metal Items: Except as indicated as work of another specification section provide components required for a complete roof or wall panel system including but not limited to: flashings, gutters, trim, closure strips, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam. Cut or pre-mold to match configuration of roof and wall panels. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Sealants:
1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
3. Seam Sealant: Factory-applied, non-skinning, non-drying type.
4. Sealant Tape: Pressure-sensitive 100% solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.
5. Joint Sealant: Low to Medium Modullus Neutral curing sealant: equal to 795 Dow Corning and as recommended by the metal panel manufacturer.

D. Sheet Metal Flashing and Trim: See Section 07 62 00. Locations include but are not limited to eaves, corners, base, framed openings, ridges, fascia closers, and fillers. Finish flashing and trim with same finish as adjacent sheet metal roofing and wall panel.

E. Clips: Provide mechanically seamed (0.024") stainless steel clips with slider base designed to meet negative load requirements and provide for thermal movement in expansion and contraction. Supply with factory applied sealant and/or gaskets.

F. Cleats: Mechanically seamed cleats formed from galvanized steel. Install expansion cleats where required or where shown on the drawings.

G. Expansion Battens: Provide where shown on the drawings and construct per manufacturer's requirements, SMACNA, warranty requirements and as shown on the drawings.

H. Coverboard: DensDeck-StormX Prime Roof Board manufactured by Gerogia-Pacific Gypsum, LLC, or equal.
   1. Thickness: 5/8 inch.
   2. Core Compressive Strength: 1,800 PSI Nominal.
   3. Permeability: 26 Perms.

I. Underlayment: Waterproofing No. 2 - see 07 13 00 Sheet Waterproofing.

J. Underlayment: Rosin Paper slip sheeting over Waterproofing No. 2 and under roofing.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

B. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

D. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.02 STANDING SEAM METAL ROOF PANEL INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Contractor shall inspect all surfaces, area and other contingent construction in or to which his work is to be installed and insure himself that they are in proper condition to receive the work to be performed under this Section.
   2. Verify that sheathing surfaces are sound, dry, properly secured and that provision has been made for flashings, anchorage, and all other interface items attaching to or penetrating through the work of this Section.
   3. The Contractor shall notify the Architect in writing, before any work is installed, of any condition requiring correction. Failure to make such a report shall be construed as acceptance of the existing conditions and the responsibility to provide an acceptable installation.
   4. Field cutting of exterior panels by torch is not permitted.
   5. Install hold down clips at each support with self-drilling, self-tapping fasteners, except as otherwise recommended by manufacturer for specific circumstances.

6. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
7. Fabricate and install work with lines and corners of exposed units true and accurate.
8. Form exposed faces free of buckles, excessive waves, and avoidable tool marks considering temper and reflectivity of metal.
9. Separate non-compatible materials with a rubberized asphalt underlayment.
10. All seams shall be of uniform appearance and dimensions, straight and level with minimum exposure of solder and sealant.
11. Except as otherwise shown, fold back sheet metal to form a hem on concealed side of exposed edges.
12. At end laps of panels, install tape caulk between panels.
13. Seaming: Complete seaming of panel joints by operation of portable power-driven equipment of type recommended by panel manufacturer to provide a weather tight joint.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, trim, closure strips, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Install rigid insulation and coverboard over steel metal roof decking with required attachments in prescribed pattern to achieve UL-580 and FM Windstorm Class ratings specified above.

D. Install roofing underlayment and slip sheet on roof deck, rigid insulation or coverboard before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 3 inches. Offset seams in building paper and seams in roofing felt.

E. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.

F. Scupper, Gutter, Downspout, and/or Receiver:
1. Install as shown on the drawings.
2. Installation Tolerances:
   a. All fabricated corners shall be 90 degrees except those noted otherwise.
   b. All joints and assemblies shall meet or exceed AISC requirements for exposed architectural steel.

3.03 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

B. Damaged Units: Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch up or similar minor repair procedures.

3.04 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

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SECTION 07 42 13
METAL WALL PANELS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Wall panel substrate.

B. Section 06 10 00 - Rough Carpentry: Wall panel substrate.

C. Section 07 21 00 - Thermal Insulation.

1.02 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, _____, and methods of anchorage.

C. Samples: Submit two samples of wall panel and soffit panel, 12 inch by 12 inch (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. 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.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience.

1.05 MOCK-UP

A. Locate where directed by Architect. See drawings.

1.06 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.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Prefinished Wall Panels:

1. Durablity of the metalic coated and unpainted panels due to rupture, structual failure, or perforation shall be warrented for a period of twenty (20) years by the manufacurer.
2. The exterior color finish for painted wall panels shall be warranted by the manufacturer for twenty (20) years against blistering, peeling, cracking, flashing, checking, and chipping.
3. Excessive clor change and chalking shall be warranted for twenty (20) years. Color change shall not exceed 5 NBS unit per ASTM D2244-68T, chalking shall not be less than a rating of 6 (white) or 8 (other colors) per ASTM D-659.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Wall Panels - Concealed Fasteners:
   1. Wall Panel (Type 1): Morin Corporation; Architectural Metal Roof Systems SLR 16": www.morincorp.com/#sle.
   2. Wall Panel (Type 2): Morin Corporation; Matrix Wall Series MX 1.0 Panel: www.morincorp.com/#sle.
   3. Wall Panel (Type 3) Morin Corporation; Concealed Fastener Wall Series F-12 Panel: www.morincorp.com
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Metal Soffit Panels:
   1. Morin Corporation; Consealed Fastener Wall Series F-12 Panel: www.morincorp.com
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MANUFACTURED METAL PANELS

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Provide exterior wall panels, interior liner panels, soffit panels, and subgirt framing assembly.
   2. 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.
   3. Maximum Allowable Deflection of Panel: L/90 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 at longest practical lenghts, 10' minimum lengths.

B. Exterior Wall Panels (Type 1):
   1. Profile: Vertical; Standing Seam. 2" Rib - To Match Roof Panels. SLR (2").
   2. Side Seams: Mechanically Seamed, sealed with continuous factory applied sealant..
   3. Material: Precoated steel sheet, 22 gage, 0.0299 inch (0.76 mm) minimum thickness.
   4. Panel Width: 16 inches (___ mm).
   5. Color: As selected by Architect from manufacturer's Premium Metallic line.

C. Exterior Wall Panels (Type 2):

1. Profile: Vertical; Ribbed Panel. MX 1.0. (1 1/2").
2. Side Seams: Interlocking, sealed with continuous bead of sealant.
3. Material: Precoated steel sheet, 22 ga,
4. Panel Width: 12" nominal.
5. Color: As selected by Architect from manufacturer's Premium Metallic line.

D. Interior Liner Panels (Type 3):
1. Profile: Vertical; Flush. F-12 (1 1/2").
2. Side Seams: Interlocking, sealed with continuous bead of sealant.
3. Material: Precoated steel sheet, 22 gage, 0.0299 inch (0.76 mm) minimum thickness.
4. Panel Width: 12" inch (___ mm)nominal.
5. Color: As selected by Architect from manufacturer's premium Metallic line.

E. Soffit Panels (Type 3):
1. Profile: Flush. F-12 (1 1/2").
2. Material: Precoated steel sheet, 22 gage, 0.0299 inch (0.76 mm) minimum thickness.
3. Color: As selected by Architect from manufacturer's premium Metallic line.

F. Subgirt Framing Assembly:
1. 16 gage, 0.0598 inch (1.52 mm) thick formed non-precoated steel sheet.
2. Profile as indicated; to attach panel system to structural frame through gyp sheathing and in-between rigid insulation. See - 07-21-00 for insulation panels.

G. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required profile as shown on drawings.

H. Expansion Joints: Same material, thickness and finish as exterior sheets; ___ gage, ___ inch (___ mm) thick; manufacturer's standard brake formed type, of profile to suit system.

I. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

J. Anchors: Galvanized steel. Exposed anchor heads coated to match panel finish and color.

2.03 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 FINISHES

A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as selected by Architect from manufacturers Metallic line..

2.05 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.

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 intervals indicated.

3.03 INSTALLATION

A. Install panels on walls and soffits 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. All seams shall be of uniform appearance and dimensions, straight and level with minimum exposure of solder and sealant.

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. Damaged Units: Replace panels and other components of the work taht have been damaged or have deteriorated beyond successful repair by means of finish touch up or similar minor repair procedures.

B. Remove site cuttings from finish surfaces.

C. Remove protective material from wall panel surfaces.

D. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

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SECTION 07 42 13.23
METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior cladding consisting of formed metal composite material (MCM) sheet, secondary supports, and anchors to structure, attached to solid backup.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Panel support framing.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.

C. Section 07 92 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2016.

B. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2016.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

E. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

1.04 SUBMITTALS

A. 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.

B. 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.

C. 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. Indicate panel numbering system.
   2. Differentiate between shop and field fabrication.
   3. Indicate substrates and adjacent work with which the wall system must be coordinated.
   4. Include large-scale details of anchorages and connecting elements.
   5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches (1:10).

D. Selection Samples: For each finish product specified, submit at least three sample color chips representing manufacturer's full range of available colors and patterns.

E. Installer's Qualification Statement.

F. Maintenance Data: Care of finishes and warranty requirements.

G. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Manufacturer Qualifications: Company specializing in manufacturing wall panel systems specified in this section.
   1. With not less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section.
   1. With minimum three years of documented experience.

D. Mock-Up: Provide a mock-up for evaluation of fabrication workmanship.
   1. Locate where directed.
   2. Provide panels finished as specified.

1.06 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.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals for insulated metal wall panels.

C. 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.

D. MCM Sheet Manufacturer's Finish Warranty: Provide manufacturer's written warranty stating that the finish will perform as follows for minimum of 20 years:

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Composite Material (MCM) Sheet Manufacturers:
   1. 3A Composites USA; Alucobond: www.alucobondusa.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall Panel System Manufacturers:
   1. GM Horne LLC; Jackson, MS: www.gmhorne.com
   2. E. Cornell Malone Corp.; Jackson, MS: www.ecmalone.com
   3. CAD Systems, LLC; Gonzales, LA: www.cadsystemsllc.net

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.

B. PERFORMANCE REQUIREMENTS
   1. 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. Panels: Formed of.15625 inch (4 mm)) metal composite material sheet.
   1. 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.
   2. Fabricate panels under controlled shop conditions.
   3. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
   4. 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.

2.03 MATERIALS

A. 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 material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
   2. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.
   3. Stainless Steel Sheet Components: ASTM A480/A480M.
   4. Aluminum Components: ASTM B209 (ASTM B209M); or ASTM B221 (ASTM B221M).

2.04 FINISHES

2.05 ACCESSORIES

A. Anchors, Clips and Accessories: Use one of the following:
   1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.

B. Fasteners:
   1. Exposed Fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
   2. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
   3. Bolts: Stainless steel.

C. 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. Verify dimensions, tolerances, and interfaces with other work.

B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

3.03 INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

C. 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.

D. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

E. 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.

F. Replace damaged products.

3.04 PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 07 46 46
FIBER-CEMENT SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiber-cement siding.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Water-resistive barrier under siding.

B. Section 06 10 00 - Rough Carpentry: Siding substrate.

1.03 REFERENCE STANDARDS

A. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets; 2008 (Reapproved 2012).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
   1. Manufacturer's requirements for related materials to be installed by others.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods, including nail patterns.

C. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products under waterproof cover and elevated above grade, on a flat surface.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIBER-CEMENT SIDING

A. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying to ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Length (Height): 96 inches (2400 mm), nominal.
   2. Width: 48 inches (1220 mm).
   3. Thickness: 5/16 inch (8 mm), nominal.
   4. Finish: Factory applied stain.
   5. Color: As selected by Architect from manufacturers full range of available colors.
   6. Warranty: 50 year limited; transferable.
   7. Manufacturers:
      a. James Hardie Building Products, Inc; _____: www.jameshardie.com/#sle.

2.02 ACCESSORIES

A. Furring Strips: 3/8" x 1 1/2" wide crush resistant furring strips. Equal to Cor-a-Vent, Sturdi-Strip.

B. Trim: Same material and texture as siding.

C. Fasteners: Galvanized or corrosion resistant; length as required to penetrate minimum 1-1/4 inch (32 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.

B. Verify that water-resistive barrier has been installed over substrate completely and correctly.

C. Do not begin until unacceptable conditions have been corrected.

D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.
   1. Read warranty and comply with terms necessary to maintain warranty coverage.
   2. Use trim details indicated on drawings.
   3. Touch up field cut edges before installing.
   4. Pre-drill nail holes if necessary to prevent breakage.

B. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

3.03 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and sheet metal roofing.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.

B. Section 07 42 13 - Metal Wall Panels.

C. Section 07 52 00 - Modified Bituminous Membrane Roofing

D. Section 07 71 00 - Roof Specialties: Manufactured copings, flashings, and expansion joint covers.

E. Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

F. Section 08 43 13 - Aluminum-Framed Storefronts.

G. Drawings and General provisions of Contract, including General and Supplementary Conditions and Division 1.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

G. CDA A4050 - Copper in Architecture - Handbook; current edition.

H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Samples: Submit two samples 12" by 12" inch (____by____ mm) in size illustrating metal finish color.

C. Sample 20 Year Finish Warranty.

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.

1.06 MOCK UP

A. Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Construct mockups where directed by the Architect.
   2. Approved mockups may not become part of the completed Work.

1.07 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 MANUFACTURERS

A. Sheet Metal Flashing and Trim Manufacturers:
   1. Petersen Aluminum Corporation: www.pac-clad.com/#sle.
   2. Morin Corporation; www.morincorp.com..
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch (0.61 mm) and 22 gage, (.0270) inch thick base metal, shop pre-coated with PVDF coating.
   1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer's premium metallic colors to match wall and roof panel finishes.
   3. Strippable Film: Material shall be protected with a strippable film for protection of finish surface during shipping and fabrication.
   4. Sheet Metal shall be fabricated by same manufacturer as metal wall and metal roofing manufacturer.

2.03 FABRICATION, GENERAL

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Except as otherwise indicated; comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual".

C. Fabricate cleats of same type sheet metal, see drawing for minimum _____ inches (_____ mm) wide, interlocking with sheet.

D. Form pieces in longest possible lengths. 10'-0" minimum length unless otherwise noted.

E. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

F. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

G. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

H. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.

I. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

J. Sealed Joints: Form non-expansive but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

K. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

L. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

2.04 FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: When not a pre-fabricated system, fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Furnish with 6-inch- wide joint cover plates.
   1. Joint Style: Lap, 4 inches wide

B. Counter flashing: Fabricate from the following material:
   1. Precoated metal to match fascia, coping or roof: 22 ga., galvanized steel.

C. Flashing Receivers: Fabricate from the following material:
   1. Precoated metal to match fascia, or roof: 22 ga., galvanized steel.

D. Roof-Penetration Flashing: Fabricate from the following material:
   1. Precoated metal to match fascia, or roof: 22 ga., galvanized steel.

E. Drip Edges: Fabricate from the following material:
   1. Stainless Steel: 24 gage.

F. Base Flashing: Fabricate from the following material:
   1. Precoated metal to match fascia, or roof: 22 ga., galvanized steel.

2.05 GUTTER AND DOWNSPOUT FABRICATION, GENERAL

A. Gutters: SMACNA (ASMM), Rectangular profile.

B. Downspouts: Profile as indicated.

C. Gutters and Downspouts: Size indicated.

D. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Gutter Supports: Brackets. See drawings for internal gutter.
   3. Downspout Supports: Brackets. See drawings for bracket details.

E. Seal metal joints.

2.06 ACCESSORIES

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
   1. Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
   2. Nails for Copper Sheet: Copper or hardware bronze, 0.109 inch minimum and not less than 7/8 inch long, barbed with large head.
   3. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
   4. Blind Fasteners: High-strength stainless-steel rivets.

C. Slip Sheet: Rosin paper at copper..

D. Primer: Zinc chromate type.

E. Concealed Sealants: Non-curing butyl sealant.

F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

G. Plastic Cement: ASTM D4586/D4586M, Type I.

H. Solder: ASTM B32; Sn60 type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. 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. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Where applicable, solder metal joints for full metal surface contact, and after soldering wash metal clean with neutralizing solution and rinse with water.

E. Secure gutters and downspouts in place with concealed fasteners.

F. Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units.

G. Conceal fasteners where possible.

H. Set units true to line and level.

I. Set units to be permanently watertight and weatherproof.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

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SECTION 07 71 00
ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured roof specialties, including vents.

1.02 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim

B. Section 07 72 00 - Roof Accessories: Manufactured curbs, roof hatches, and snow guards.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

D. Samples: Submit two appropriately sized samples of coping.

E. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

F. Warranty Documentation: Submit manufacturer’s standard warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Pipe and Penetration Flashings:
   1. Portals Plus; _____: www.portalsplus.com/#sle.
   2. Or equal..

2.02 COMPONENTS

A. Pipe and Penetration Flashing: Base of rounded aluminum, compatible with sheet metal 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: To be selected by the Architect from manufacturer's full line .

2.03 FINISHES

A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as selected from manufacturer's standard colors.

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.

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 07 72 00 for information on roofing related accessories.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

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.

3.03 CLEANING

A. Clean coping system promptly after installation in accordance with manufacturer’s instructions.

B. Remove clear protective vinyl film.

C. Do not use harsh cleaning materials or methods that could damage finish.

3.04 PROTECTION

A. Protect installed coping system to ensure that, except for normal weathering, coping system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 07 72 00
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Curbs.

B. Roof penetrations mounting curbs.

C. Roof hatches, manual and automatic operation, including smoke vents.

1.02 RELATED REQUIREMENTS

A. Section 05 31 00 - Steel Decking.

B. Section 07 41 13 - Metal Roof Panels.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

D. Section 07 71 00 - Roof Specialties: Other manufactured roof items.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 ROOF CURBS

A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
   1. Roof Curb Mounting Substrate: Curb substrate consists of corrugated metal roof deck with insulation.
   2. Sheet Metal Material:

3. Galvanized Steel: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33 (230); G60 (Z180) coating designation; 18 gage, 0.048 inch (1.21 mm) thick.

B. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
   1. Provide preservative treated wood nailers along top of curb.
   2. Insulate inside curbs with 1-1/2 inch (38 mm) thick fiberglass insulation.

2.02 ROOF HATCHES AND VENTS, MANUAL AND AUTOMATIC OPERATION

A. Sound Rated Roof Hatch Manufacturers:
   1. BILCO Company; _____: www.bilco.com/#sle. See scheduled for size.
   2. Or approved equal.

B. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
   1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf (475 kPa) load.
   2. Hinges: Heavy duty pintle type.
   3. Hold open arm with vinyl-coated handle for manual release.
   4. Latch: Upon closing, engage latch automatically and reset manual release.
   5. Manual Release: Pull handle on interior.
   6. Locking: Padlock hasp on interior.

C. Ladder Saftey Post: At each roof hatch, furnish and install on the fixed ladder below the roof hatch cover one LadderUp Saftey Post manufactured by The Bilco Company or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 07 81 23
INTUMESCENT FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thin-film intumescent fire protection.

B. Compressible-rod intumescent fire protection.

C. Protective and/or decorative topcoats.

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing.

B. Section 05 21 00 - Steel Joist Framing.

C. Section 07 05 53 - Fire and Smoke Assembly Identification.

D. Section 09 90 00 - Painting and Coating

1.03 REFERENCE STANDARDS

A. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

E. SSPC-PA 2 - Procedure For Determining Conformance To Dry Coating Thickness Requirements; 2015.

F. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Performance characteristics and test results.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Selection Samples: For decorative top coat, color chips representing manufacturer's full range of available colors and sheens.

D. Certificates: Certify that intumescent fireproofing provided for this project meets or exceeds specified requirements in all respects.

E. Field Quality Control Submittals: Submit field test report.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company that specializes in manufacturing the type of products specified, with minimum of ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers with identification labels and testing agency markings intact and legible.

B. Store products in manufacturer's unopened packaging until ready for installation.
   1. Store at temperatures not less than 50 degrees F (10 degrees C) in dry, protected area.
   2. Protect from freezing, and do not store in direct sunlight.
   3. Dispose of any materials that have come into contact with contaminants of any kind prior to application.

C. Dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Protect areas of application from windblown dust and rain.

B. Maintain ambient field conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under ambient conditions outside manufacturer's absolute limits.
   1. Provide temporary enclosures as required to control ambient conditions.
   2. Do not apply intumescent fireproofing when ambient temperatures are below 50 degrees F (10 degrees C) without specific approval from manufacturer.
   3. Maintain relative humidity between 40 and 60 percent in areas of application.
   4. Maintain ventilation in enclosed spaces during application and for not less than 72 hours afterward.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Intumescent Thin-Film Fire Protection:
   1. Albi Manufacturing Division of StanChem Inc; Albi Clad TF: www.albi.com/#sle.
   2. Hilti, Inc; Fire Finish Steel Protection Spray CFP-SP WB: www.us.hilti.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SYSTEM REQUIREMENTS

A. Fireproofing: Provide intumescent thin-film and compressible-rod fire protection systems tested by an independent testing agency in accordance with ASTM E119 and acceptable to authorities having jurisdiction (AHJ).

B. Structural Steel Beams and Bar Joist where indicated on drawings: Fire resistance rating of 1 hour; Design Number UL X625 - Industry Standard for fireproofing on all surface areas.

2.03 MATERIALS

A. Fire Resistive Coating System: Thin-film intumescent fire protection system for structural steel.
   1. Surface Burning Characteristics: Tested in accordance with ASTM E84.
      a. Flame Spread Index (FSI): 25, maximum.
      b. Smoke Developed Index (SDI): 50, maximum.
   2. For Interior Use:
      a. Use only water-based products.
      b. Use only products without fiber content.
      c. Durometer Hardness, Type D: 45, minimum, in accordance with ASTM D2240.

B. Fire Resistive Compressible-Rod System: Compressible intumescent fire protection system for structural steel, gypsum board, wood, oriented strand board (OSB), concrete, and concrete masonry units (CMU).
   1. Surface Burning Characteristics: Tested in accordance with ASTM E84.
      a. Flame Spread Index (FSI): 5, maximum.
      b. Smoke Developed Index (SDI): 5, maximum.
   2. Size: As required for application.
   3. Fire Rating: As indicated on drawings for both static and dynamic joints in accordance with UL 2079.
   4. UL Assembly Rating: As indicated on drawings.
   5. Acoustic Test: Complies with ASTM E90, with STC rating of 40, minimum.

C. Protective and Decorative Top Coating: As recommended by fireproofing manufacturer for exposure and substrate conditions.
   1. Color and Gloss: As selected by Architect.
   2. Coordinate with paint as specified in Section 09 91 23 for color and sheen to match between intumescent fireproof coating and adjacent painted surfaces.

D. Sealers and Primer: As required by tested and listed assemblies, and recommended by fireproofing manufacturer to suit specific substrate conditions.

E. Reinforcement: Glass fiber fabric matching type used in tested and listed assemblies.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates to determine if they are in satisfactory condition to receive intumescent fire protection; verify that substrates are clean and free of oil, grease, incompatible primers, or other foreign substances capable of impairing bond to fireproofing system.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Thoroughly clean surfaces to receive fireproofing.

B. Repair substrates to remove surface imperfections that could effect uniformity of texture and thickness of fireproofing system, and remove minor projections and fill voids that could telegraph through finished work.

C. Cover or otherwise protect other work that might be damaged by fallout or overspray of fireproofing system, and provide temporary enclosures as necessary to confine operations and maintain required ambient field conditions.

3.03 APPLICATION

A. Comply with manufacturer's instructions for each particular intumescent fire protection system installation application as indicated.

B. Apply manufacturer’s recommended primer to required coating thickness.

C. Apply fireproofing to full thickness over entire area of each substrate to be protected.

D. Apply coats at manufacturer92s recommended rate to achieve dry film thickness (DFT) as required for fire resistance ratings designated for each condition.

E. Apply intumescent fire protection by spraying to maximum extent possible, and as necessary complete coverage by roller application or other method acceptable to manufacturer.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00 - Quality Requirements.
   1. Arrange for testing of installed intumescent fire protection by an independent testing laboratory using magnetic pull-off dry film thickness gage in accordance with SSPC-PA 2, and ensure it meets requirements of authorities having jurisdiction (AHJ).
   2. Submit field test reports promptly to Contractor and Architect.

B. Repair or replace intumescent fire protection at locations where test results indicate fireproofing does not meet specified requirements.

3.05 CLEANING

A. Immediately after installation of fireproofing in each area, remove overspray and fallout from other surfaces and clean soiled areas.

3.06 PROTECTION

A. Protect installed intumescent fire protection from damage due to subsequent construction activities, so fireproofing is without damage or deterioration before Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION ONLY TESTED FIRESTOP SYSTEMS SHALL BE USED IN SPECIFIC LOCATIONS AS FOLLOWS:

A. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

B. Safing slot gaps between edge of floor slabs and curtain walls.

C. Openings between structurally separate sections of wall or floors.

D. Gaps between the top of walls and ceilings or roof assemblies.

E. Openings and penetrations in fire-rated partitions or walls containing fire doors.

F. Openings around structural members which penetrate floors or walls.

1.04 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
   1. Section 03 30 00 - Cast-In-Place Concrete
   2. Section 07 92 00 - Joint Sealers
   3. Section 09 29 00 - Gypsum Drywall Systems
   4. Section 21 13 01 - Fire Suppression Sprinkler Systems
   5. Section 22 01 00 – Plumbing
   6. Section 23 01 00 - Basic Mechanical Materials and Methods
   7. Section 23 07 13 - Mechanical Insulation
   8. Section 26 00 10 - Basic Electrical Materials and Methods

1.05 REFERENCES

A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops"

C. Test Requirements: UL 2079, "Tests for Fire Resistance of Building Joint Systems"

D. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
   1. UL Fire Resistance Directory:
      a. Firestop Devices (XHJI)
      b. Fire Resistance Ratings (BXRH)
      c. Through-Penetration Firestop Systems (XHEZ)
      d. Fill, Voids, or Cavity Material (XHHW)

e. Forming Materials (XHKU)
f. Joint Systems (XHBN)
g. Perimeter Fire Containment Systems (XHDG)

2. Alternate Systems: "Omega Point Laboratories Directory" (updated annually).

E. Test Requirements: ASTM E 1966, "Standard Test Method for Fire Resistive Joint Systems"

F. Test Requirements: ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus"

G. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops"

H. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials"

I. ASTM G 21, "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi"

J. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

K. All major building codes: Arkansas Fire Prevention CodeNFPA 70 - National Electric Code

L. NFPA 285 – Standard fire test method of fire propagation characteristics of exterior non- load bearing wall assemblies containing combustible components.

1.06 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide through-penetration fire stop systems and fire- resistive joint systems that comply with specified requirements of tested systems.

B. Firestop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

F. Source Limitations: Obtain firestop products and systems from a single manufacturer.

1.07 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified tested firestop systems to be used and manufacturer's installation instructions to comply with Section 01 33 00.

B. Manufacturer's engineering judgment identification number and document details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in document.

C. Submit material safety data sheets and certificates of compliance provided with product delivered to job-site.

D. VOC Content Limitations: For firestop system products, submit documentation of conformance with LEED EQ Credit 4.1 "Low-Emitting Materials, Adhesives, and Sealants."

1.08 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the contractor or to an Installer engaged by the contractor does not in itself confer qualification on the buyer.

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in project to a single firestop specialty contractor.

C. The work is to be installed by a contractor with at least one of the following qualifications:
   1. Hilti Accredited Firestop Specialty Contractor
   2. UL Approved Contractor
   3. FM 4991 Approved Contractor

D. Firm with not less than 3 years experience with firestop installation.

E. Successfully completed not less that 3 comparable scale projects using similar systems.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet. For non-water resistant firestop materials, protect from exposure to water -- firestop materials that are water resistant shall be protected until fully cured.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
   1. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ), joint systems (XHBN), and perimeter firestop systems (XHDG) listed in Volume 2 of the UL Fire Resistance Directory; provide products of the following manufacturers as identified below:
   1. Hilti, Inc., Tulsa, Oklahoma
      a. 800-879-8000/www.us.hilti.com
         1) 3M, Inc.
            (a) STI
            (b) Provide products from the above acceptable manufacturers; Refer to ***Section 01 60 00 for Product or Manufacturer*** Substitutions.
      b. Source all firestop products from a single-source manufacturer.

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079, ASTM E 1966, ASTM E 2307 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire- rating involved for each separate instance.

B. Pre-installed firestop devices for use with noncombustible and/or combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors, the following products are acceptable:
   1. Hilti CP 680P or CP 680M Cast-In Place Firestop Devices:
      a. Add Aerator adapter when used in conjunction with an Aerator (Sovent system)
      b. Add metal deck adapter kit if utilizing CP 680P or M on corrugated metal deck.
      c. Add height extension if utilizing CP 680P or M in concrete slabs thicker then 8”.
      d. Add Hilti Water Module (2” up to 6”) to achieve UL W-Rating
      e. Add Hilti TOP SEAL (1/2” up to 2”) to achieve UL W-Rating
   2. Hilti CP 681 Tub Box Kit for use with bath tub installations.
   3. Hilti Toilet Flange for use with floor outlet water closets.
   4. Hilti coupling sleeve for use with floor, shower or general purposes drains
   5. Hilti CFS-DID Drop-in devise for use with cored holes.

C. Pre-installed firestop devices containing built-in self-sealing intumescent inserts for use with data and communication cabling which allow for cable adds or changes

without the need to remove or replace any firestop materials, the following product is acceptable:
1. Hilti CP 653 Speed Sleeve
2. Hilti CFS-CC Cable Collar for us in renovation work with existing cables.

D. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant
2. Hilti CFS-SIL SL: Self Leveling Silicone
3. Hilti CP 620 Fire Foam
4. Hilti CP 606 Flexible Firestop Sealant
5. Hilti CFS-SIL GG: Gun Grade Silicone

E. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
1. Hilti CFS-SIL GG: Gun Grade Silicone
2. Hilti CP 606 Flexible Firestop Sealant
3. Hilti FS-ONE Intumescent Firestop Sealant

F. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
1. Hilti CFS-SP WB Firestop Spray
2. Hilti CFS-SIL GG: Gun Grade Silicone
3. Hilti CP 606 Flexible Firestop Sealant
4. Hilti CFS-SIL SL: Self Leveling Silicone

G. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck as a backer for spray material, the following products are acceptable:
1. Hilti CP 777 Speed Plugs
2. Hilti CP 767 Speed Strips

H. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant
2. Hilti CFS-PL Firestop Plug

I. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant
    a. Hilti CP 620 Fire Foam
    b. Hilti CFS-SIL GG: Gun Grade Silicone
    c. Hilti CP 606 Flexible Firestop Sealant

J. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
1. Hilti CP 618 Firestop Putty Stick
2. Hilti-PL Firestop Plug

K. Wall opening protective materials for use with UL listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
1. Hilti CFS-P PA Firestop Putty Pad
2. Hilti Firestop Box Insert
3. Hilti CFS-BL Firestop Block

L. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
   1. Hilti CP 643 N Firestop Collar
      a. Hilti CP 644 Firestop Collar
      b. Hilti CP 648E Endless Wrap Strips
      c. Hilti CP 648S Single Wrap Strips

M. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
   1. Hilti CP 637 Firestop Mortar
   2. Hilti CFS-BL Firestop Block
   3. Hilti CP 620 Fire Foam
   4. Hilti CP 675T Firestop Board

N. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
   1. Hilti CFS-BL Firestop Block
      a. Hilti CP 675T Firestop Board

O. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:
   1. Hilti CFS-SP WB Firestop Spray
   2. Hilti CFS-SIL GG: Gun Grade Silicone
      a. Hilti CP 606 Flexible Firestop Sealant
      b. Hilti CFS-SIL SL: Self Leveling Silicone

P. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
   1. Hilti CFS-BL Firestop Block
   2. Hilti CFS-PL Firestop Plug

Q. Draftstopping at floor or roof bypass studs:
   1. 4” or 6”(fill depth of stud) thick mineral wool safing cut oversize to friction fit into place between studs at slab and roof edge.

R. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

S. Provide a firestop system with an Assembly Rating as determined by UL 2079 or ASTM E 1966 which is equal to the time rating of construction joint assembly.

T. **Curtainwall Spandrel Insulation & Firesafing Assembly** with an assembly rating as determined by NFPA 285 and UL System No. CW-D-1014, Basis of Design follows:
   1. Floor Assembly
      a. a. Minimum 4-1/2” thick reinforced lightweight or normal weight structural concrete.
   2. Curtain Wall Assembly — The curtain wall assembly shall incorporate the following construction features:
      a. Mullion Mounting Brackets (Option 1) — Min 3 in. (76 mm) by 3 in. (76 mm) by 1/4 in. (6 mm) steel angles attached through the mullion on each side with min 3/8 in. (10 mm) diam steel bolts with steel nuts and washers. The brackets are attached to a min 8 in. (203 mm) by 3-1/4 in. (83 mm) by 1/2 in. (13 mm) thick steel angles with a min 4 in. (102 mm) long with min 1/2 in. (13 mm) diam steel bolts with steel nuts and

washers. The 8 in. (203 mm) by 3-1/4 in. (83 mm) angle is secured to the top of floor with two min 1/2 in. (13 mm) diam steel masonry anchors in conjunction with steel washers.

b. Mullion Mounting Brackets (Option 2) — As an alternate to Item 2A, min 8 in. (203 mm) wide by 3/4 in. (19 mm) thick extruded aluminum Halfen mounting brackets with one nom 2 in. (51 mm) high leg for support and attachment of mullion and with one leg at least 6 in. (152 mm) longer than width of linear opening between floor assembly and mullion. Mounting bracket attached to top of floor with two min 1/2 in. (13 mm) diam steel masonry anchors in conjunction with washer plates supplied with mounting bracket.

c. Framing — The two-piece rectangular tubing mullions (vertical members) and transoms (horizontal members) shall be min 2-1/2 in. (64 mm) wide by 7-1/2 in. (191 mm) deep and shall be formed from min 0.100 in. (2.5 mm) thick aluminum. Mullions spaced max 60 in. (1.52 m) OC and secured to mullion mounting brackets (Item 2A) at each floor level. Interior face of mullions to be max 4 in. (102 mm) from edge of floor assembly. Transoms to be spaced min 24 in. (610 mm) OC. The minimum height from the top of the floor to the bottom of the vision panel sill is 0 in. The maximum height from the top of the floor to the bottom of horizontal transom is 3 in. (76 mm).

d. Spandrel Panels — The spandrel panels shall consist of one of the following types: Same as Vision Panels.

e. Vision Panels — Nom 1/4 in. (6 mm) thick transparent heat-strengthened glass or nom 1 in. (25 mm) thick insulated glass units with two layers of nom 1/4 in. (6 mm) thick transparent heat-strengthened glass separated by a 1/2 in. (13 mm) air space. Each panel secured in position with aluminum pressure plates in conjunction with glazing gaskets and steel screws.

f. Curtain Wall Insulation* — Min. 2 in. (51 mm) thick mineral wool batt insulation faced on one side with aluminum foil/scrim vapor retarder. Impasse® Horizontal Hangers are installed in the insulation batt 6 in. (152 mm) from each mullion end and spaced max 16 in. (406 mm) OC across at the window sill transom. One Impasse® Vertical Hanger is installed along both vertical mullion sides of the insulation batt at 6 in. (152 mm) up from the bottom of the insulation batt. Insulation batt is then installed in spandrel area flush with the interior surface of the framing with no vertical or horizontal seams. Impasse® Horizontal Hangers are screw attached to top horizontal transom, Impasse® Vertical Hangers are screw attached to vertical mullions using min No. 10 by min. 1/2 in. (13 mm) self-drilling/self-taping screws. No attachment to the lower horizontal transom is required.

g. THERMAFIBER INC — FIRESPAN® 90 - Mullion Covers - Curtain Wall Insulation* — Nom 2 in. (51 mm) thick mineral wool batt insulation faced on one side with aluminum foil/scrim vapor retarder, supplied in min 24 by 48 in. (610 by 1219 mm) boards. Min. 12 in. (305 mm) wide strips to be centered over mullions secured to curtain wall insulation (Item 2E) with a min. of four Spiral Anchors (Item 2G) spaced a max 12 in. (305mm) OC. Mullion covers to tightly abut the bottom of the forming material (Item 3A).

h. THERMAFIBER INC — FIRESPAN® 90 - Light Gauge Framing* - Spiral Anchor — Galv steel wire spiral anchors used to secure the curtain wall

insulation (Item 2F and 2G). Nom length of spiral anchors to be 3-3/4 in. (95 mm), spaced max 12 in. (305 mm) OC.

i. THERMAFIBER INC — Spiral Anchor - Aluminum Sandwich Panel — **(Option Shown On Drawings)** - Min 1/8 in. (3.2 mm) solid aluminum panel or aluminum composite panel installed on exterior surface of curtain wall insulation (Item 2E).

3. Safing System — Max separation between edge of floor assembly and face of framing members (at time of installation) is 4 in. (102 mm). The safing system is designed to accommodate vertical shear movement up to a max of 5 percent of its installed width. The safing system shall incorporate the following construction features:
   a. Forming Material* — Nom 4 pcf (64 kg/m3) density mineral wool batt insulation. Batt sections cut to a 4 in. (102 mm) width and stacked to a thickness which is min 25 percent greater than the width of the linear gap between the curtain wall insulation and the edge of the concrete floor slab. The forming material is compressed and inserted cut-edge-first into linear gap such that its top surface is flush with the top surface of the floor assembly. A max of one tightly- butted seam is permitted between mullions. Additional piece of forming material to be friction-fit into gap between batt sections above mullion mounting clip at each mullion location.
4. THERMAFIBER INC — SAF
   a. Fill, Void or Cavity Material* — Min 1/16 in. (1.6 mm) dry thickness of fill material spray-applied over top of forming material and lapping min 1/2 in. (13 mm) onto the top surface of the floor and onto the curtain wall insulation (Item 2E) and mullion covers (Item 2F). When SpecSeal Fast Tack Spray is used, dry thickness is 5/64 in. (2 mm).
5. SPECIFIED TECHNOLOGIES INC — SpecSeal AS200 Elastomeric Spray, SpecSeal Safing Spray or SpecSeal Fast Tack Spray

PART 3 EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
   1. Verify penetrations are properly sized and in suitable condition for application of materials.
   2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
   3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
   4. Comply with firestop manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
   5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate construction of openings, penetrations and construction joints to ensure that the firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to
   1. accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

2. Coordinate firestopping with other trades so that obstructions are not placed in the way prior to installation of the firestop systems.
3. Do not cover up through-penetration and joint firestop system installations that will become concealed behind other construction until each installation has been examined by the building inspector, per requirements of Section 110, IBC 2012.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL or Intertek approved systems.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
   1. Seal all holes or voids made by penetrations to ensure an air and water-resistant seal.
   2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
   3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

E. Manufacturer's Field Services: During initial installation, firestop manufacturer should be present to assure proper installation/application.

3.05 IDENTIFICATION & DOCUMENTATION

A. The firestop contractor is to supply documentation in the form of the Hilti [PK1]CFS-DM Documentation Manager
   1. The FTP is to include:
   2. Architectural details
   3. Firestop affidavit
   4. Firestop system snapshot
   5. Installation log
   6. Firestop systems
   7. IFC guidelines for Engineering Judgments
   8. Product Information of utilized products
   9. All other relevant documentation
   10. Building code excerpts

B. Copies (electronic) of the FTP are to be provided to the general contractor, architect, inspector & owner at the completion of the project.

C. Identify through-penetration firestop systems with self-adhesive, preprinted labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
   1. Installer/Contractor's name, address, and phone number.

2. Date of installation.
3. Through-Penetration firestop system and manufacturer's name.

3.06 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
   1. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

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SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Joint backings and accessories.

B. Buna-N Foam Sheet.

1.02 RELATED REQUIREMENTS

A. Section 07 13 00 - Sheet Waterproofing: Sealing cracks and joints in waterproofing substrate surfaces using materials specified in this section.

B. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.

C. Section 08 80 00 - Glazing: Glazing sealants and accessories.

D. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

E. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - 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.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five 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 JOINT SEALANT APPLICATIONS

A. Scope:
   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. Joints as described on the Drawings.
f. 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.
   c. Joints as described on the Drawings.
   d. 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. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
3. Sealant shall be Pecora 864 Architectural Silicone Sealant, TT-S-1543A, TT-S230-C, Class A, CGB-19GP-9, ASTM C920M Class 50, Type S, Grade NS, Use G,A,M, O, Primer P-150 as required by Manufacturer. other equal sealant by Sonneborn or Tremco acceptable.
4. Colors to be selected by Architect.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. One component high-performance polyurethane sealant as manufactured by Sonneborn (NP1) or similar and equal products as manufactured by Pecora or Tremco.
2. Colors to be selected by Architect.
3. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
4. Joints between door, window, and other frames and adjacent construction.

D. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".
1. Install acoustical sound sealant at all control and expansion joints, pipe or conduit penetrations, duct penetrations, and any open joints or cracks in sound-rated construction.
2. Install acoustical sound sealant at top of all masonry and drywall partitions at metal decking using material specified.

E. Gasket between dissimilar metals: See Drawings - A8.0.
1. Install 4" strip, of gasket material cut from sheet of "Extra Soft" 3/16" Smooth Textured sheet of the largest available dimension.
2. Manufacurer: McMaster-Carr; Neoprene Rubber Sheet Gaskets, www.mcmaster.com, or Equal.

2.02 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.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. 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.

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.

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. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. 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.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 LOCATION OF FIRE CODE SEALANT AND PUTTY

A. Install fire code sealant at all control and expansion joints, pipe or conduit penetrations, duct penetrations and any open joints or cracks in fire rated construction.

B. Install firecode sealant at top of all masonry and drywall partitions at metal decking using material specified. Fire Code Caulking Rating System shall be same as wall rating and to comply with UL published by Manufacturer.

END OF SECTION

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (R2011).

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2018.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

J. ASTM E413 - Classification for Rating Sound Insulation; 2010.

K. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

O. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

P. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2013.

Q. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.

R. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.05 QUALITY ASSURANCE

A. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
1. Curries, an Assa Abloy Group company; _____: www.assaabloydss.com.
2. Republic Doors; _____: www.republicdoor.com.
3. Steelcraft, an Allegion brand; _____: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
5. Finish: Factory primed, for field finishing. Exterior frames to be galvanized.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.

b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 2 - Seamless.
d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
f. U-Value: U-0.61 minimum.
2. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
3. Door Face Sheets: Flush.

C. Interior Doors, Non-Fire Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.
b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
2. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
3. Door Face Sheets: Flush.

D. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.
b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 2 - Seamless.
d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
a. Attach fire rating label to each fire rated unit.
4. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
5. Door Face Sheets: Flush.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. General:
1. Comply with the requirements of grade specified for corresponding door.
2. Finish: Same as for door.

C. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
3. Weatherstripping: Separate, see Section 08 71 00.

D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
2. Frame Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.

2.05 ACCESSORIES

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

2.06 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.

C. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Install door hardware as specified in Section 08 71 00.

D. Comply with glazing installation requirements of Section 08 80 00.

E. Coordinate installation of electrical connections to electrical hardware items.

F. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

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SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated, non-rated, acoustical, and special function.

1.02 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood door frames.

B. Section 08 11 13 - Hollow Metal Doors and Frames.

C. Section 08 71 00 - Door Hardware.

D. Section 08 80 00 - Glazing.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples: Submit two samples of door veneer, 8 inch by 9 inch (_____ by _____ mm) in size illustrating wood grain, stain color, and sheen.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Submit Manufacturer's written warranty (2 years for exterior doors, lifetime for interior doors) covering all solid core wood doors herein specified to the Architect and stating that during the year after installation manufacturer will replace without charge any door which becomes unserviceable/ unfit for use and pay reasonable rehanging and refinishing costs. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction. The Door Manufacturer to inspect doors after installation and note on warranty that no provisions have been voided or nullified after completion of installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Oshkosh Architectural Door Co., "GP" 5 ply Series: www.oshkoshdoor.com
   2. Masonite Wood Doors: www.masonite.com/#sle.
   3. Or approved equal.

2.02 DOORS AND PANELS

A. Doors: Refer to drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), AWMAC/WI (NAAWS) or WDMA I.S. 1A.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
   3. The moisture content of all wood components shall average from 6-9 percent at the time of fabrication and shall be at equilibrium with same relative humidity condition at the time of door fabrication.

B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Solid core doors shall be particle core, 5 ply construction, 1/16" thick hardwood crossbanding, "GP" series as manufactured by Oshkosh Architectural Door Co., or approved equal, pending compliance with requirements.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated. Core shall meet or exceed the requirements of grades "1 - LD - 1" and "1-LD-2" as described in ANSI A208.1.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.Veneer thickness prior to sanding shall be from 1/32 to 1/36. No veneer will be less than 1/50 of an inch thick after factory sanding. Each individual piece of veneer forming the door face will be edge glued together.
   1. Vertical Edges: Same species as face veneer over SCL.
   2. Color: As selected by Architect from Manufacture's full range.

B. Cross Banding: 1 ply 1/16" thick mill option; of HDF material with grain extending continuously from vertical edge to vertical edge. Grain Direction is at right angle to the face veneer.

C. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

C. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

D. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

B. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
   1. Transparent:
      a. System - TR-8, UV Cured Acrylated Polyester/Urethane.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.

2.07 ACCESSORIES

A. Door Window Frames: Door window frames with glazing securely fastened within door opening.

1. Metal Finish: Custom Color polyester powder coating or Field Painted to match frame.

B. Glazing: As specified in Section 08 80 00.

C. Glazing Stops: Door Manufacturer to furnish Rolled steel channel shape visual frames of size indicated on drawings, mitered corners; prepared for countersink style tamper proof screws. Frame shall comply with label requirement of door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Installer must examine doorframes and verify that frames are of the correct type and have been installed as required for proper hanging of corresponding doors. Installer shall notify the Contractor in writing of conditions detrimental to the proper and timely installation of wood doors; do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Verify existing conditions before starting work.

C. Verify that opening sizes and tolerances are acceptable.

D. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Condition doors to average prevailing humidity in installation area prior to hanging. Install wood doors in accordance with manufacturer's instructions and as shown. Fit doors to frame for proper fit and uniform clearance at each edge and machine for hardware. Seal cut surfaces after fitting and machining. Bevel non fire rated doors 1/8" in 2" at lock and hinge edges. Bevel fire rated doors 1/16" in 2" at lock edge.

B. Pre-fit Doors: Fit to frames and machine for hardware to whatever extent required for proper fit and uniform clearance at each edge. For non fire doors provide clearances of 1/8" at jambs and heads; 1/8" at meeting stiles for pairs of doors; and 1/2" from bottom of door to top of decorative floor finish or covering, except where threshold is shown or scheduled provide 1/4" clearance from bottom of door to top of threshold. For fire rated doors, provide clearances complying with the limitations of the authority having jurisdiction.

C. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

D. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

E. Use machine tools to cut or drill for hardware.

F. Coordinate installation of doors with installation of frames and hardware.

G. Coordinate installation of glazing.

3.03 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

C. Re-hang or replace doors which do not swing or operate freely as directed by Architect. Re-finish and/or replace doors damaged during installation, as directed by the Architect.

D. Protection of Completed Work: Installer shall advise Contractor of proper procedures required for protection of installed wood doors from damage or deterioration until acceptance of the work.

END OF SECTION

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SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall and ceiling mounted access units.

B. Floor access door and frame units, interior and exterior.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Mortise cylinder and core hardware.

B. Section 09 90 00 - Interior Painting

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall and Ceiling Mounted Units: Factory Fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Location: in any and all locations where access is required to concealed components or systems.
   2. Material: Steel. Finish: Primed.
   3. Style: Exposed frame with door surface flush with frame surface.
      a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
   4. Size: 12 inch by 12 inch (305 mm by 305 mm).
   5. Door/Panel: Single Thickness with rolled or turned edges.
   6. Primed and Factory Finish: Polyester power coat; color as selected by Architect from Manufacturer's standard colors.
   7. Hardware: Hinges for Non-Fire-Rated Units: Concealed, constand force closure spring type.

B. Fire-Rated Wall-Mounted Units:
   1. Location: As indicated on drawings.
   2. Wall Fire-Rating: As indicated on drawings.
   3. Material: Steel.
   4. Size: 12 inch by 12 inch (305 mm by 305 mm).
   5. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.

C. Fire-Rated Ceiling-Mounted Units:
   1. Location: As indicated on drawings.
   2. Ceiling Fire-Rating: As indicated on drawings.
   3. Material: Steel.
   4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.02 FLOOR ACCESS UNITS

A. Floor Access Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.

1. Size: As indicated on the drawings.
2. Hardware: Steel, hot-dipped galvanized.
   a. Hinges: Removable pin.

B. Interior Floor Access Units: Steel, minimum 1/4 inch (6 mm) thick.
1. Design Load: Design to support live load of 150 lb/sq ft (7.2 kPa) with deflection not to exceed 1/180 of span.
2. Operation: Manual opening, and manual closing.
3. Finish: Rust inhibiting primer.

C. Exterior Floor Access Units: Aluminum, minimum 1/4 inch (6 mm) thick.
1. Design Load: Design to support live load of 300 lb/sq ft (14 kPa) with deflection not to exceed 1/180 of span.
2. Operation: Manual opening, and manual closing.
3. Cover Pattern: Diamond tread plate.
4. Finish: Mill finish.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

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SECTION 08 36 13
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead sectional doors, electrically operated.

B. Operating hardware and supports.

C. Electrical controls.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Steel channel opening frame.

B. Section 08 71 00 - Door Hardware: Lock cylinders.

C. Section 09 91 13 - Exterior Painting: Finish painting.

D. Section 26 05 83 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

B. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2011.

C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

1.06 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for electric motor and transmission.

C. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sectional Doors:
   1. Wayne-Dalton, a Division of Overhead Door Corporation; Thermospan 200-20 Insulated Sectional Steel Doors: www.wayne-dalton.com/#sle.
   2. Or approved equal.

2.02 STEEL DOORS

A. Steel Doors: Flush steel, insulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.
   1. Door Nominal Thickness: 2 inches (51 mm) thick.

B. Door Panels: Steel construction; outer steel sheet of 20 gage, 0.0359 inch (0.91 mm) minimum thickness, flush profile; inner steel sheet of 20 gage, 0.0359 inch (0.91 mm) minimum thickness, flat profile; core reinforcement ___ inch (___ mm) sheet steel roll formed to channel shape, rabbeted weather joints at meeting rails; polyurethane insulation.

2.03 COMPONENTS

A. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.

B. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.

C. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

D. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

E. Head Weatherstripping: EPDM rubber seal, one piece full length.

F. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

G. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

H. Lock Cylinders: See Section 08 71 00.

2.04 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

B. Insulation: Foamed-in-place polyurethane, bonded to facing.

C. Finish: Manufacturer's pre-painted finish - Custom Color to match Architect's sample.

2.05 ELECTRIC OPERATION

A. See 08-73-10 Automatic Door Operators - Commercial for Overhead Garage Door Operators.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

D. Fit and align door assembly including hardware.

E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch (1.5 mm).

B. Maximum Variation from Level: 1/16 inch (1.5 mm).

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch (3 mm) from 10 ft (3 m) straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.04 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.05 CLEANING

A. Clean doors and frames and glazing.

B. Remove temporary labels and visible markings.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

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SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Weatherstripping.

D. Door hardware.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of contract including General and Supplementary Conditions and Division 1 specification sections apply to work of this section.

B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.

D. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

D. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

E. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

F. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

G. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2014.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Manufacturer's recommended installation procedures which, when approved, will become the basis for accepting or rejecting actual installation procedures used on the work.

E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Mississippi.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide Ten (10) year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Front-Set Style, Thermally-Broken:
   1. Basis of Design: Kawneer Company, Inc.; 451UT (Ultra Thermal) Framing Systems.
   2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (51 mm wide by 114 mm deep).

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. Trulite Glass & Aluminum Solutions, LLC; _____: www.trulite.com/#sle.
   2. YKK AP America Inc; _____: www.ykkap.com/#sle.

2.02 BASIS OF DESIGN -- SWINGING DOORS

A. Wide Stile, Insulating Glazing, Thermally-Broken:
   1. Basis of Design: Kawneer 500T Insulpour Thermal Entrances.
   2. Basis of Design: Tubelite, Inc.; Wide Stile Entrance: www.tubeliteinc.com..

3. Thickness: 1-3/4 inches (43 mm).

2.03 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Finish: Class I natural anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   2. Finish Color: Clear Anodized.
   3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements:
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
   3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.
   4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
   5. Overall U-value Including Glazing: 0.46 Btu/(hr sq ft deg F) (_____ W/(sq m K)), maximum.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Glazing Stops: Flush.

B. Glazing: As specified in Section 08 80 00.

C. Swing Doors: Glazed aluminum.

1. Thickness: 1-3/4 inches (43 mm).
2. Top Rail: 5 inches (____ mm) wide.
3. Vertical Stiles: 5 inches (____ mm) wide.
4. Bottom Rail: 10 inches (254 mm) wide.
5. Glazing Stops: Square.
6. Finish: Same as storefront.
7. Door stiles and rails shall be accurately joined at corners with heavy concealed reinforcement brackets secured with bolts and screws, and shall be MIG welded. Doors shall have beveled snap-in stops with mitered corners and bulb glazing vinyl on both sides of the glass. No exposed screws shall be permitted. Each door leaf shall be equipped with an adjusting mechanism located in the top rail near the lock stile which provides for minor clearance adjustments after installation. Weathering shall be installed in the hinge stiles of pairs or single center hung doors. The lock stile of a single center hung door, active meeting stile at a pair of butt hung, offset pivot, or center-hung doors shall have an adjustable astragal weather-strip. Door frame and sidelight framing shall be accurately joined at corners with unexposed screws. All glazing shall be flush, including the horizontal muntins and sills. Glass shall be held in place by EPDM glazing gaskets on both sides. No applied stops shall be permitted except at the transom bar of center hung doors. All butt-hung and offset pivot door frames shall have door stops at jambs and head with continuous weathering.
8. All doors shall be equipped with a maximum security hookbolt lock. Pairs of doors shall be equipped with lever type flush bolts in the top and bottom of the inactive meeting stile. Operating hardware shall be center pivots as supplied by the door manufacturer. Closers for center pivoted doors shall be door manufacturer's standard overhead concealed closers, where required. See Hardware Section for finish hardware cylinders for entrance doors.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. All door and framing sections shall be extruded aluminum alloy and tempered to meet or exceed finishing and structural criteria as specified. Provide all reinforcing if required. Door Stiles and rails, excluding glass stops, shall be tubular and have .125" wall thickness. All weathering shall be hardbacked silicone treated polypropylene. Any exposed fasteners shall be stainless steel.

C. Fasteners: Stainless steel.

D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.06 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

B. All exposed surfaces shall be free of unsightly scractches and blemishes. All exposed sections shall have a Class I Anodic Coating conforming with Aluminum Association Standard AAM12C22A42/44. Permanodic Color: # 17 Clear.

2.07 HARDWARE

A. Other Door Hardware: As specified in Section 08 71 00.

B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

C. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

D. Interior Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

E. Exterior Thresholds: ADA compliant interlocking ramp R075 with return closed ends for ramp RCE-9 as manufactured by National Guard Products Inc. 800-647-7874. Material: Aluminum, mill finish.

F. Hinges:Continuous hinge geared incorporating lubricated bearings between knuckle, attach 6”o.c. min, Finish: #14 Clear Alum. Ives Allegion 224XY CL LAR or approved equal.

G. Exterior Pulls: RM3300, with square ends 1” diameter, 3” projection, 49-1/4” overall length 48” center to center attachment. Finish Brushed Stain Stainless Steel US32D/630 as manufactured by Rockwood manufacturing 800-458-2424, www.rockwoodmfg.com, or equal. One each exit door – mount on exterior.

H. Rim Panic Exit Device: Von Duprin CD-98-NL-OP-630 or approved equal.

I. Door Closers: LCN 4040XP-CUSH-689 or approved equal.
   1. Accessories as Required: 4040XP-18-18G/TJ/PA/30-61 or approved equals.

J. Locks: 5 pin mortised; keyed cylinder outside. Provided by hardware per Section 08 71 00 subcontractor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Accurately scribe all cut outs, recessing and mortising and reinforce as necessary with backing plates to insure adequate strength of connections.

C. All openings shall be prepared plumb and square by others and shall be of sufficient size to provide clearance at jambs, head and sill as shown on the drawings.

D. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

E. Provide alignment attachments and shims to permanently fasten system to building structure.

F. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

G. Provide thermal isolation where components penetrate or disrupt building insulation.

H. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

I. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

J. Coordinate attachment and seal of perimeter air and vapor barrier materials.

K. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

L. Set thresholds in bed of sealant and secure.

M. Install glass and infill panels in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.

N. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Leave labels in place, intact and legible until review and approval by Architect.

C. Do not at any time remove required AAMA labels.

D. Prior to completion of the work, thoroughly clean all exposed surfaces of glass.
   1. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
   2. Do not scratch or otherwise damage the glass or the sash finish.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Upon completion of construction, Contractor shall be responsible for cleaning all aluminum, employing methods recommended by the manufacturer as follows:
   1. Anodized aluminum shall be cleaned with plain water containing a mild detergent, or a petroleum product such as white gasoline, kerosene or distillate.
   2. No abrasive agent shall be used.

END OF SECTION

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SECTION 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed curtain wall, with vision glazing and glass infill panels.

B. Associated extruded aluminum mullion caps for sunshading.

C. Firestopping between curtain wall and edge of floor slab.

1.02 RELATED REQUIREMENTS

A. Section 03 45 00 - Precast Architectural Concrete.

B. Section 05 12 00 - Structural Steel Framing: Steel attachment members.

C. Section 05 50 00 - Metal Fabrications: Steel attachment devices.

D. Section 07 62 00 - Sheet Metal Flashing and Trim.

E. Section 07 84 00 - Firestopping: Firestop at system junction with structure.

F. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

G. Section 08 43 13 - Aluminum-Framed Storefronts: Entrance framing and doors.

H. Section 08 80 00 - Glazing.

I. Section 09 21 16 - Gypsum Board Assemblies: Metal stud and gypsum board wall at interior of curtain wall.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

H. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2006 (Reapproved 2011).

I. ASTM C793 - Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants; 2005 (Reapproved 2010).

J. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2015.

K. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

L. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2000 (Reapproved 2011).

M. ASTM C1135 - Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants; 2000 (Reapproved 2011).

N. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2014.

O. ASTM C1249 - Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications; 2006 (Reapproved 2010).

P. ASTM C1401 - Standard Guide for Structural Sealant Glazing; 2014.

Q. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

R. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

S. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

T. ASTM E413 - Classification for Rating Sound Insulation; 2010.

U. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

V. UL System No. CW-D-1014.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, _____, and infill.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Shop Drawings: Provide details of weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.

E. Samples: Submit two samples _____by_____ inches (_____by_____ mm) in size illustrating finished aluminum surface, glazing, infill panels, and glazing materials.

F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

G. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

H. Structural Sealant Glazing (SSG): Submit product data and calculations showing compliance with performance requirements.

I. Test Reports: Submit results of full-size mock-up testing.

J. Field Quality Control Submittals: Report of field testing for water penetration.

K. Designer's Qualification Statement.

L. Installer's Qualification Statement.

M. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at Mississippi.

B. Full-Size Mock-up Testing: Have a specimen representative of project conditions tested by an independent testing agency for compliance with specified thermal, structural, air infiltration, water penetration, and sound attenuation criteria.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

D. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-ups.

B. Locate on-site where directed by Architect; mock-up may not remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide 20 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glazed Aluminum Curtain Walls:
   1. Kawneer North America; 1600 System 1: www.kawneer.com/#sle.
   2. Or approved equal.

2.02 CURTAIN WALL

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Outside glazed, with pressure plate and mullion cover, where indicated on drawings.
2. Finish: Class I natural anodized.
   a. Factory finish surfaces that will be exposed in completed assemblies.
   b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
3. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
6. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Design Wind Loads: Comply with the applicable code. See structural Drawings.
      a. Member Deflection: For spans less than 13 feet 6 inches (4115 mm), limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch (19 mm), whichever is less and with full recovery of glazing materials.
      b. Member Deflection: For spans over 13 feet 6 inches (4115 mm) and less than 40 feet (12.2 m), limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch (1/240 of span plus 6.4 mm), with full recovery of glazing materials.
   2. Movement: Accommodate the following movement without damage to components or deterioration of seals:
      a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.
      b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.
      c. Movement of curtain wall relative to perimeter framing.
      d. Deflection of structural support framing, under permanent and dynamic loads.
   3. Structural Sealant Glazing (SSG) System: For individual glass lites, design framing members to not exceed a deflection normal to the wall of L/175 between supports with 3/4 inch (19 mm) maximum, and a deflection parallel to the wall of L/360 with 1/8 inch (3.2 mm) maximum, whichever is less.

C. Water Penetration Resistance: No uncontrolled water on indoor face when tested as follows:
   1. Test Pressure Differential: 20 psf (960 Pa).
   2. Test Method: ASTM E331.

D. Air Leakage: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.

E. Thermal Performance Requirements:
   1. Condensation Resistance Factor of Framing: 65, minimum, measured in accordance with AAMA 1503.

F. Acoustical Performance Requirements:
   1. Sound Attenuation: STC of 31, minimum, from exterior to interior.
   2. Test Method: ASTM E90, with calculation in accordance with ASTM E413.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Cross-Section: As indicated on drawings.
      a. Curtain Wall Type 1: 2.5" x 7.5"
      b. Curtain Wall Type 2: 2.5" x 6"

B. Glazing: As specified in Section 08 80 00.

C. Sun Screens: Extruded aluminum mullion cover (cap) provided and engineered by curtainwall manufacturer as part of the enclosure system.
   1. Sun Screen Configuration: Vertical - As shown on Drawings.
   2. Louver Type: Kawneer 6063-T6 Extruded Alum. Cap.
   3. Finish: Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick. **MUST MATCH Curtain wall finish, and be fabricated by the same Manufacturer as the Curtain Wall system for compatability.**
   4. Design Criteria: Design and fabricate to resist the same loads as curtain wall system as well as the following loads without failure, damage, or permanent deflection:
      a. Support the mounting and design loads on and of the extruded mullion cap louvers.
      b. Thermal Movement: Plus/minus 1/8 inch (3.175 mm), maximum.

D. Firestopping Components: Comply with Section 07 84 00 Firestopping for Curtainwall Insulation and Firesafing Assembly.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Structural Steel Sections: ASTM A36/A36M; shop primed.

C. Structural Supporting Anchors: See Section 05 12 00.

D. Structural Supporting Anchors Attached to Structural Steel: Design for bolted attachment.

E. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.

F. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.

G. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch (0.43 mm) minimum thickness.

H. Firestopping: As specified in Section 07 84 00.

I. Structural Sealant Glazing (SSG) Adhesive: Neutral curing, silicone sealant formulated for SSG applications in compliance with ASTM C1184 and structural glazing industry guidelines, ASTM C1401.
   1. SSG adhesive in compliance with ASTM C920; Type S - Single-component, Grade NS, Class 50, Use NT, G, and A.
   2. Ultimate Tensile Strength: Minimum of 50 psi (345 kPa) as determined by test method ASTM C1135 under the following conditions.

a. Exposure to air temperatures of 190 degrees F (88 degrees C) and minus 20 degrees F (minus 29 degrees C).
b. Water immersion for seven (7) days, minimum.
c. Exposure to weathering for 5,000 hours, minimum.

3. Sealant Design Tensile Strength: 20 psi (139 kPa), maximum.
4. Hardness: 20 to 60 with Type A-2 durometer in compliance with test method ASTM C661.
5. Color: Black.
6. SSG sealant tested for compatibility with glazing accessories in compliance with ASTM C1087, tested for accelerated weathering in compliance with ASTM C793, and in compliance with insulating glass secondary sealant design standards of ASTM C1249.
7. Manufacturers:
   a. Dow Chemical Company; DOWSIL 983 Structural Glazing Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

J. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.

K. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.

L. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

M. Glazing Accessories: As specified in Section 08 80 00.

2.05 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install curtain wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Install firestopping at each floor slab edge in accordance with specified Curtain Wall INsulation and Firesafing Assembly.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Pressure Plate Framing: Install glazing in accordance with Section 08 80 00, using exterior dry glazing method.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. Provide services of curtain wall manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 01 40 00 - Quality Requirements, for general testing and inspection requirements.

C. Water-Spray Test: Provide water spray quality test of installed curtain wall components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as directed by Architect.

D. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance conforms to specified requirements.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes: Finish hardware except as otherwise specified or specifically omitted herein.

B. Related Sections:
1. Section 08 11 13 – Hollow Metal Doors & Frames.
2. Section 08 14 16 – Flush Wood Doors
3. Section 08 43 13 – Aluminum Framed Storefronts
4. Section 26 01 01 – Electrical General Provisions (Hold Open Doors)
5. Section 26 05 33 – Raceways and Boxes for Electrical Systems (Hold Open Doors)
6. Section 26 27 26 – Wiring Devices (Hold Open Doors)
7. Section 28 31 05 – Military Fire Alarm & Mass Notification System (Hold Open Doors)

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.
1. Windows
2. Cabinets of all kinds, including open wall shelving and locks.
3. Signs, except as noted.
4. Toilet accessories of all kinds including grab bars.
5. Installation.
6. Rough hardware.
7. Folding partitions, except cylinders where detailed.
8. Sliding aluminum doors.
10. Corner guards.

1.02 SUBSTITUTIONS & SUBMITTALS:

D. Requests for substitutions will not be considered until after the contract for construction has been awarded.

E. SUBMITTALS: Submit six copies of schedule at earliest possible date prior to delivery of hardware. Organize schedule into "Hardware Sets" with an index of doors and heading, indicating complete designations of every item required for each door or opening. Include the following information:

1. Type, style, function, size, quantity and finish of each hardware item.
2. Name, part number and manufacturer of each item.
3. Fastenings and other pertinent information.
4. Location of hardware set cross referenced to indications on drawings both on floor plans and in door schedule.
5. Explanation of all abbreviations, symbols, and codes contained in schedule.
6. Mounting locations for hardware.
7. Door and frame sizes and materials.
8. Submit manufacture's technical data and installation instructions for the electronic hardware.

9. Catalog cuts.

F. Templates: Where required, furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware.

1.03 QUALITY ASSURANCE:

A. Qualifications:
1. Obtain each kind of hardware (latch and locksets, exit devices, hinges, and closers) from only one manufacturer, although several may be indicated as offering products complying with requirements.
2. Hardware supplier shall be a direct factory contract supplier who has in his employment a certified hardware consultant (AHC) who is available at all reasonable times during the course of the Work, and for project hardware consultation to the Owner, Architect, and Contractor.

B. Schedule Designations: Except as otherwise indicated, the use of one manufacturer's numeric designation system in schedules does not imply that another manufacturer's products will not be acceptable, unless they are not equal in design, size, weight, finish function, or other quality of significance. See 1.02 A for substitutions.

C. Exit Doors: Openable at all times from the inside without the use of a key or any special knowledge or effort.

D. Fire-rated openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80. This requirement takes precedence over other requirements for such hardware. Provide only such hardware which has been tested and listed by UL for the type and size of door required, and complies with the requirements of the door and the door frame labels. Latching hardware, door closers, ball bearing hinges, and seals are required whether or not listed in the Hardware schedule.

1. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door UL label on exit device indicating "Fire Exit Hardware".

E. Electronic Security Hardware: Coordinate installation of the electronic security with the Architect and provide installation and technical data to the Architect and other related subcontractor(s). Upon completion of the electronic security hardware installation, verify that all components are working properly and state in the required guarantee that this inspection has been performed.

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Acceptance at the Site: Individually package each unit of finish hardware complete with proper fastening and appurtenances, clearly marked on the outside to indicate contents and specific locations in the Work.

B. Deliver packaged hardware items at the times and to the locations (shop or field) for installation, as directed by the Contractor.

1.05 PROJECT CONDITIONS:

A. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Upon request, check the Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.06 WARRANTY:

A. Provide guarantee from hardware supplier as follows:

1. Closers: Ten years; except electronic closers: Two years.
2. Exit Devices & Locksets: Three years
3. All other Hardware: Two years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Approval of manufacturers other than those listed shall be in accordance with paragraph 1.02 A.

Item:	Manufacturer:	Approved:	Approved	Approved
	Hinges	Ives Allegion	Hager	McKinney
	Continuous Hinges	Ives Allegion	Hager	McKinney
	Locks	Allegion Schlage	Allegion FAL	Best
	Cylinders	Schlage	Best	Medeco
	Exit Devices	Allegion VD 98	Sargent 8800	Allegion FAL25
	Elec. Exit Devices	Allegion VD 98	Sargent,	PHI
	Flush Bolts	Ives Allegion	Rockwood	Trimco
	Coordinators	Ives Allegion	Rockwood	Trimco
	Silencers	Glynn Johnson	Rockwood	Trimco
	Kickplates	Ives Allegion	Rockwood	Trimco
	Stops	Ives Allegion	Rockwood	Trimco
	Thresholds	NGP	Pemko	McKinney
	Seals & Bottoms	NGP	Pemko	McKinney
	Alum. Dr. Lock	Adams Rite	No Substitution	
	Push/Pulls	Ives Allegion	Rockwood	McKinney
	Closers	Allegion LCN/SC	Sargent 281	Stanley 4500
	Keypad Controller	Schlage	Hirsch	

B. Furnish all items of hardware required to complete the work in accordance with Specifications and plans.

C. Carefully inspect Project for the extent of the finish hardware required to complete the Work. Where there is a conflict between these Specification and the existing hardware, furnish finish hardware to specification. Furnish all items of hardware required to complete the work in accordance with Specifications and plans.

2.02 MATERIALS:

A. Locksets: Mortise Type Locks and Latches shall be heavy-duty with hinged, anti-friction, ¾ inch throw latchbolt with anti-friction piece made of self-lubricating stainless steel. Functions and design as indicated on the hardware groups. Deadbolt functions shall be 1 inch projection made of hardened stainless steel. Both deadbolt and latchbolt are to extend into the case a minimum of 3/8 inch when fully extended. Furnish locksets and latchsets with sufficient curved strike lip to protect door trim. Provide locksets with 7-pin patent protected interchangeable SFIC cylinders. All mortise cylinders shall have a concealed internal set screw for securing the cylinder to the lockset. The internal set screw will be accessible only by removing the core from the cylinder body. All mortise locksets and latchsets must conform to ANSI A156.13, Series 1000, Operational Grade 1 and be listed by UL. Lockset must fit ANSI A115.1 door preparation. Locksets and latchsets to have self-aligning, thru-bolted trim. Auxiliary deadlatch to be made of one-piece stainless steel, permanently lubricated. Lever handles must be of forged or cast brass, bronze or stainless-steel construction and conform to ANSI A117.1. Levers which contain a hollow cavity are not acceptable. Spindle to be such that if forced it will twist first, then break, thus preventing forced entry. Levers to be operated with a roller bearing spindle hub mechanism. Locksets with the IDH listed in the specifications will have Request to Exit Switch, Door Monitor Switch and Electric locking integrated into the lockset.

1. Locks shall have minimum 3/4 throw. All deadbolts shall have 1-inch minimum throw.
2. Comply with requirements of local security/fire/life safety ordinances.
3. Lock Series and Design: Allegion Schlage L90-MA5 Mortise w/ Deadbol Electronic On-Line Card Reader: Galaxy. Modular Integrated Reader Galaxy
4. Electronic Panic Exit Device: Allegion Von Duprin/Fal EL-98/99/25 Exit. Series with EPT-10 & Any Wire Chases Required to be provided by Door Manufacturer.
5. Provide and Pull Access Control Cable back to the nearest IT/Comm Room

B. Hinges: Out swinging exterior doors shall have continuous pin. All hinge open widths shall be minimum, but of sufficient size to permit door to swing 180. Furnish hinges with five knuckles and flush bearing.
1. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30
inches in height or fraction thereof.
2. Provide hinges as listed in schedule.
3. Provide continuous hinges as scheduled.

C. Exit Devices: Furnish all sets at wood doors with sex bolts unless otherwise specified.

D. Surface Door Closers: Full rack and pinion type with removable non-ferrous cover. Provide sex bolts at all wood doors. Place closers inside building, stairs, and rooms. Closers shall be non-handed, non-sized and adjustable.
1. Provide multi-size 1 through 6 at all doors rated or not.
2. Flush transom offset brackets shall be used where parallel arm closers are listed
for doors with fixed panels over.
3. Drop brackets are required at narrow head rails.
4. Set exterior doors closers to have 8.5 lbs maximum pressure to open,

interior
non-rated at 5 lbs , rated openings at 12lbs.

B. Kickplates: Provide with four beveled edges, 10 inches high by width less 1.5 inches on single doors and 1 inch on pairs of doors. Furnish Type "A" screws to match finish.

F. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
G. Screws: All exposed screws shall be Phillips head.
H. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs.
I. Omit where any type of seals occur.
J. ADA Operators Besam SW200i, LCN 95-Series, Horton Series 7000, with remotes.

2.03 FINISH:

A. Generally to be BHMA 626 Satin Chrome where indicated.
B. Protection Plates, Push, Pulls shall be BHMA 630.
C. Spray door closers to match other hardware, unless otherwise noted.
D. Aluminum items shall be finished to match predominant adjacent material.
E. Seals to coordinate with frame color.

2.04 KEYING REQUIREMENTS:

A. Provide construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished on the same keyway (or key section) as the Owner's permanent keying system. Permanent cylinders/cores and keys (prepared according to the accepted keying schedule) will be furnished.

B. The Contractor shall include in their Bid Price the costs for all the Owner's Permanent Conventional Cylinders and SFIC-7pin Cores. Cores shall be keyed to the existing Master key system and provided to the Owner.

C. Furnish all Cylinders/SFIC-7pin cylinder housings for all locks and exit devices and as called for in Hardware Sets. Permanent keys and cores shall be stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts.
D Permanent keys will also be stamped "Do Not Duplicate."
E All permanent cores and keys shall be transmitted to the Owner by Registered Mail, return receipt requested.
F Furnish keys in the following quantities:
1 each Grand Masterkeys
4 each Masterkeys
2 each Change keys each keyed core
9 each Construction masterkeys
G each Control key
G. Upon installation of permanent cores by the Owner, the Owner will return the construction cores and keys to the Contractor.
H. Keying schedule: Submit three copies of separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

PART 3 – EXECUTION

3.01 HARDWARE LOCATIONS:

A. Provide locations as recommended by the Door and Hardware Institute.
B. All locations shall meet all state and local codes.

3.02 INSTALLATION:

A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
B. Installation shall conform to local governing agency security ordinance.

3.03 ADJUSTING:

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly.

B. Inspection: Hardware supplier shall inspect all hardware furnished within 10 days of contractor's request and include with his guarantee a statement that this has been accomplished. Inspector or Contractor shall sign off the hardware as being complete and correctly installed and adjusted. Further corrections of defective material shall be the responsibility of his representative.

3.04 SCHEDULE OF FINISH HARDWARE:

A. Legend of listed manufacturers:
Ives NGP National Guard Products
Schlage (SCH) Von Duprin (VON) Gynn Johnson (GJ) LCN

C. The items listed in the following "Schedule of Finish Hardware" shall conform throughout to the requirements of the foregoing specification. The last column of letters in the Hardware Schedule refers to the manufacturer abbreviation listed above, where applicable.

D. The Door Schedule on the Drawings indicates which Hardware Set is used with door.

D. HARDWARE SCHEDULE

MK - McKinney
RO - Rockwood
RU - Corbin Russwin
BE - Best Locking
RF - Rixson
NO - Norton
FAL/SC – Falcon
NGP –National Guard Products
PE – Pemko
PHI - Precision

SU - Securitron
SCH – Schlage Allegion
IVE – Ives Allegion
LCN—Allegion LCN
VON - Von Duprin
Contractor is responsible for providing the hardware schedule to be approved by the Owner and Architect. Upon submission of a draft Hardware Schedule Contractor is responsible for scheduling a Hardware Conference with the Architect and Owner for review and making corrections/resubmissions as required.

Hardware Schedule

Sets with Doors with "S" prefix indicate Satellite Building Doors. Main Building Doors do not have a prefix. "M" before a door number indicates it is on the Mezzanine/Platform level.

Hardware Set # 1 – DR #'s 100, 108 ALUM

(2 ea.) 1E72/74 626	BE	(Cylinder as Required)

NOTE: Balance of Hardware by Aluminum Storefront Door Supplier

Hardware Set # 2 – DR #'s 124

(1 ea.) 224XY CL LAR"	IVES	(FM Continuous Hinges)
(1 ea.) CD-98-NL-OP-630	VON	(Rim Panic Device)
(2 ea.) 1E72/74 626	BE	(Cylinder as Required)
(1 ea.) 8190EZHD-2 12" 630	IVES	(Offset Pull)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) 160V LAR	NGP	(Set of Gasketing)
(1 ea.) 101V LAR	NGP	(Sweep)
(1 ea.) 513/896V AL LAR	NGP	(Threshold)

Hardware Set # 3 – DR #'s 115

(2 ea.) 224XY CL LAR"	IVES	(FM Continuous Hinges)
(2 ea.) CD-98-NL-OP-630	VON	(Rim Panic Device)
(4 ea.) 1E72/74 626	BE	(Cylinder as Required)
(1 ea.) KR94-SP28 LAR	VON	(Keyed Removable Mull)
(2 ea.) 8190EZHD-2 12" 630	IVES	(Offset Pull)
(2 ea.) 4040XP HO CUSH 689	LCN	(Surface Closer with Hold-Open)
(2 ea.) 8400 30" x 34" 630	IVES	(Armored Plate)
(1 ea.) 160V LAR	NGP	(Set of Gasketing)
(1 ea.) 101V LAR	NGP	(Sweep)
(1 ea.) 513/896V AL LAR	NGP	(Threshold)

Hardware Set # 4 – DR #'s 101, 109

(3 ea.) 5BB1 x 4.5"x 4.5" 32D	IVES	(Standard Weight Hinges)
(1 ea.) F-98L-630	VON	(Rated Rim Panic Device)

(1 ea.) 1E72/74 626	BE	(Cylinder as Required)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) FS17/WS407-CCV630	IVES	(Floor/Wall Stop as required)
(1 ea.) 5050 BLK LAR	NGP	(Gasketing)

Hardware Set # 5 – DR #'s 111, 122, 126

(3 ea.) 5BB1 x 4.5"x 4.5" 32D	IVES	(Standard Weight Hinges)
(1 ea.) L9070-07L BDC 626	SCH	(Classroom Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) 4040XP HO CUSH 689	LCN	(Surface Closer with Hold Open)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(3 ea.) SR64-GY	IVES	(Silencers)

Hardware Set # 6 – DR #'s 110, 113, 114

(3 ea.) 5BB1 x 4.5"x 4.5" 32D	IVES	(Standard Weight Hinges)
(1 ea.) L9070-07L BDC 626	SCH	(Classroom Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required
(1 ea.) 4040XP HO 689	LCN	(Surface Closer with Hold Open)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(3 ea.) SR64-GY	IVES	(Silencers)

Hardware Set # 7 – DR #'s 112

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L460/463DC 626	SCH	(Mortise Deadlock as Required)
(1 ea.) 8200 8" x 16" 630	IVES	(Push Plate)
(1 ea.) 8303-10" 4" x 16" 630	IVES	(Pull Handle x Plate)
(1 ea.) 4040XP CUSH 689	LCN	(Surface Closer)
(1 ea.) 8400 32" x 34" 630	IVES	(Armored Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK 22' LAR	NGP	(Set of Gasketing)

Hardware Set # 8 – DR #'s 123, 126B, 206, 216

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9080-07L 626	SCH	(Storeroom Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK-LAR	NGP	(Set of Gasketing)

Hardware Set # 9 – DR #'s 201, 203

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9080-07L 626	SCH	(Storeroom Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) 4040XP CUSH 689	LCN	(Surface Closer)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)

(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK-LAR	NGP	(Set of Gasketing)

Hardware Set # 10 –DR #'s 127, 229

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9040/80-07L L583-363/L283-722 626	SCH	(Privacy Lever Lock w/ Indicator as Required)
(1 ea.) 4040XP CUSH 689	LCN	(Surface Closer)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK-17' LAR	NGP	(Set of Gasketing)

Hardware Set # 11 – DR #'s 207, 208, 209, 210, 211, 212, 213, 214, 215

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9044-07L L583-363/L283-722 626	SCH	(Privacy Lever Lock w/ Indicator as Required)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV/FS17 630	IVES	(Wall/Floor Stop as required)
(1 ea.) 5050BLK-LAR	NGP	(Set of Gasketing)

Hardware Set # 12 – DR #'s 221

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) CO100 KP-70-ATH 626	SCH	(Battery Keypad Lever Lock)
(1 ea.) 1C7-2-626	BE	(Cylinder as Required)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) 8400 6" x 34" 630	IVES	(Mop Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK-LAR	NGP	(Set of Gasketing)

Hardware Set # 13 – DR #'s 224

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) 8200 8" x 16" 630	IVES	(Push Plate)
(1 ea.) 8303-10" 4" x 16" 630	IVES	(Pull Handle x Plate)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(3 ea.) SR64-GY	IVES	(Silencers)

Hardware Set # 14 – 220, 235

(4 ea.) 5BB1 x 4.5"x 4.5" US26D	IVES	(Standard Weight Hinges)
(4 ea.) 3SP1 x 4.5"x 4.5" US26D	IVES	(Standard Weight Spring Hinges)
(1 ea.) F-98-L-BE-630	VON	(Rated Rim Panic Device)
(1 ea.) FB41P/42-WD-32D	IVES	(Auto Flush Bolts as required)
(1 ea.) COR60 626ANW/FL44	IVES	(Coordinator as required)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(2 ea.) WS407-CCV 32D	IVES	(Wall Stop)

(1 ea.) 5050 BLK LAR	NGP	(Gasketing)
(2 ea.) SEM-7850 689	LCN	(Magnetic Hold Opens)

NOTE: Astragal by door manufacturer
NOTE: Coordinate location of the Magnetic Hold Opens with Owner/Architect/Electrician

Hardware Set # 15 – DR #'s 200

(3 ea.) 5BB1 x 4.5"x 4.5" 652	IVES	(Standard Weight Hinges)
(1 ea.) 8200 8" x 16" 630	IVES	(Push Plate)
(1 ea.) 8303-10" 4" x 16" 630	IVES	(Pull Handle x Plate)
(1 ea.) 4040XP CUSH 689	LCN	(Surface Closer)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK 17' LAR	NGP	(Set of Gasketing)

Hardware Set # 16 – DR #'s 217

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9010-07L BDC 626	SCH	(Passage Set)
(3 ea.) SR64-GY	IVES	(Silencers)

Hardware Set # 17 – DR #'s 205, 218

(3 ea.) 5BB1 x 4.5"x 4.5" 652	IVES	(Standard Weight Hinges)
(1 ea.) 8200 8" x 16" 630	IVES	(Push Plate)
(1 ea.) 8303-10" 4" x 16" 630	IVES	(Pull Handle x Plate)
(1 ea.) 4040XP CUSH 689	LCN	(Surface Closer)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK LAR	NGP	(Set of Gasketing)

Hardware Set # 18 – DR #'s 224B

(3 ea.) 5BB1 x 4.5"x 4.5" 652	IVES	(Standard Weight Hinges)
(1 ea.) 8200 8" x 16" 630	IVES	(Push Plate)
(1 ea.) 8303-10" 4" x 16" 630	IVES	(Pull Handle x Plate)
(1 ea.) 4040XP HO CUSH 689	LCN	(Surface Hold Open Closer)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK LAR	NGP	(Set of Gasketing)

Hardware Set # 19 – DR #'s 222, 223, 225, 226

(3 ea.) 5BB1 x 4.5"x 4.5" 652	IVES	(Standard Weight Hinges)
(1 ea.) 8200 8" x 16" 630	IVES	(Push Plate)
(1 ea.) 8303-10" 4" x 16" 630	IVES	(Pull Handle x Plate)
(1 ea.) 4040XP CUSH 689	LCN	(Surface Closer)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) 8400 6" x 34" 630	IVES	(Mop Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK 17' LAR	NGP	(Set of Gasketing)

Hardware Set # 20 – DR #'s 227, 228, 232, 233, 234

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9050-07L 626	SCH	(Office Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK-LAR	NGP	(Set of Gasketing)

Hardware Set # 21 – DR #'s 204, 204B

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9050-07L 626	SCH	(Office Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK-LAR	NGP	(Set of Gasketing)

Hardware Set # 22 – DR #'s 219 ALUM

(2 ea.) 1E72/74 626	BE	(Cylinder as Required)

NOTE: Balance of Hardware by Aluminum Storefront Door Supplier

Hardware Set # 23 – DR #'s M00, M04

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9070-07L BDC 626	SCH	(Classroom Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) 4040XP CUSH 689	LCN	(Surface Hold Open Closer)
(1 ea.) 902H 32D	GLY	(Overhead Stop)
(1 ea.) COR54-626	IVES	(Coordinators)
(2 ea.) 8400 10" x 22" 630	IVES	(Kick Plate)
(1 ea.) 160V LAR	NGP	(Set of Gasketing)
(1 ea.) 97V LAR	NGP	(Sweep)
(1 ea.) 513/896V AL LAR	NGP	(Threshold as required)

Hardware Set # 24 – DR #'s M02

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9080-07L BDC 626	SCH	(Storeroom Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(3 ea.) SR64-GY	IVES	(Silencers)

Hardware Set # 25 – DR #'s M01, M03

(6 ea.) 5BB1 x 4.5"x 4.5" 32D	IVES	(Standard Weight Hinges)
(1 ea.) L9080-07L 626	SCH	(Storeroom Function Lever Lock)
(1 ea.) 1E74-0-626	BE	(Dummy on platform side as Required)
(1 ea.) COR52-626ANw/FL as required	IVES	(Door Coordinator Bar)
(2 ea.) 4040XP HO CUSH 689	LCN	(Surface Closer with Hold-Open)
(2 ea.) FB51P-12-626	IVES	(Auto Flush Bolts)

(1 ea.) DP1 26D	IVES	(Dust Proof Strike)
(2 ea.) 8400 30" x 34" 630	IVES	(Kick Plate)
(1 ea.) 160V LAR	NGP	(Set of Gasketing)
(1 ea.) 97V LAR	NGP	(Sweep)
(1 ea.) 513/896V AL LAR	NGP	(Threshold as required)

Hardware Set # 26 – DR #'s 125

(6 ea.) 5BB1 x 4.5"x 4.5" 32D	IVES	(Standard Weight Hinges)
(1 ea.) L9080-07L 626	SCH	(Storeroom Function Lever Lock)
(1 ea.) COR52-626ANw/FL as required	IVES	(Door Coordinator Bar)
(2 ea.) 4040XP HO CUSH 689	LCN	(Surface Closer with Hold-Open)
(2 ea.) FB458-12-626	IVES	(Flush Bolts)
(1 ea.) DP1 26D	IVES	(Dust Proof Strike)
(2 ea.) 8400 30" x 34" 630	IVES	(Kick Plate)
(1 ea.) 160V LAR	NGP	(Set of Gasketing)
(1 ea.) 97V LAR	NGP	(Sweep)
(1 ea.) 513/896V AL LAR	NGP	(Threshold as required)

Hardware Set # 27 – DR #'s S-100 Alum.

(2 ea.) 1E72/74 626	BE	(Cylinder as Required)

NOTE: Balance of Hardware by Aluminum Storefront Door Supplier

Hardware Set # 28 – DR #'s S-101, S-109

(3 ea.) 5BB1 x 4.5"x 4.5" 32D	IVES	(Standard Weight Hinges)
(1 ea.) L9010-07L BDC 626	SCH	(Passage Set)
(1 ea.) 4040XP CUSH 689	LCN	(Surface Closer)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 160V LAR	NGP	(Set of Gasketing)
(1 ea.) 97V LAR	NGP	(Sweep)
(1 ea.) 513/896V AL LAR	NGP	(Threshold as required)

Hardware Set # 29 –DR #'s S-102

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9040/80-07L L583-363/L283-722 626	SCH	(Privacy Lever Lock w/ Indicator as Required)
(1 ea.) 4040XP CUSH 689	LCN	(Surface Closer)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) 8400 6" x 35" 630	IVES	(Mop Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK-17' LAR	NGP	(Set of Gasketing)

Hardware Set # 30 – DR #'s S-103, S-104, S-105

(3 ea.) 5BB1 x 4.5"x 4.5" 32D	IVES	(Standard Weight Hinges)
(1 ea.) L9070-07L BDC 626	SCH	(Classroom Function Lever Lock)

(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) 4040XP HO CUSH 689	LCN	(Surface Closer with Hold Open)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(3 ea.) SR64-GY	IVES	(Silencers)

Hardware Set # 31 – DR #'s S-108

(1 ea.) 224XY CL LAR"	IVES	(FM Continuous Hinges)
(1 ea.) CD-98-NL-OP-630	VON	(Rim Panic Device)
(2 ea.) 1E72/74 626	BE	(Cylinder as Required)
(1 ea.) 8190EZHD-2 12" 630	IVES	(Offset Pull)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) 160V LAR	NGP	(Set of Gasketing)
(1 ea.) 101V LAR	NGP	(Sweep)
(1 ea.) 513/896V AL LAR	NGP	(Threshold)

Hardware Set # 32 – DR #'S S-M000

(6 ea.) 5BB1 x 4.5"x 4.5" 32D	IVES	(Standard Weight Hinges)
(1 ea.) L9080-07L 626	SCH	(Storeroom Function Lever Lock)
(1 ea.) 1E74-0-626	BE	(Dummy on platform side as Required)
(1 ea.) COR52-626ANw/FL as required	IVES	(Door Coordinator Bar)
(2 ea.) 4040XP HO CUSH 689	LCN	(Surface Closer with Hold-Open)
(2 ea.) FB51P-12-626	IVES	(Auto Flush Bolts)
(1 ea.) DP1 26D	IVES	(Dust Proof Strike)
(2 ea.) 8400 30" x 34" 630	IVES	(Kick Plate)
(1 ea.) 160V LAR	NGP	(Set of Gasketing)
(1 ea.) 97V LAR	NGP	(Sweep)
(1 ea.) 513/896V AL LAR	NGP	(Threshold as required)

Hardware Set # 33 – DR #'s S-M001, S-M002

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9070-07L BDC 626	SCH	(Classroom Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) 4040XP CUSH 689	LCN	(Surface Hold Open Closer)
(1 ea.) 902H 32D	GLY	(Overhead Stop)
(1 ea.) COR54-626	IVES	(Coordinators)
(2 ea.) 8400 10" x 22" 630	IVES	(Kick Plate)
(1 ea.) 160V LAR	NGP	(Set of Gasketing)
(1 ea.) 97V LAR	NGP	(Sweep)
(1 ea.) 513/896V AL LAR	NGP	(Threshold as required)

Hardware Set # 34 – S-200, S-213

(4 ea.) 5BB1 x 4.5"x 4.5" US26D	IVES	(Standard Weight Hinges)
(4 ea.) 3SP1 x 4.5"x 4.5" US26D	IVES	(Standard Weight Spring Hinges)

(1 ea.) F-98-L-BE-630	VON	(Rated Rim Panic Device)
(1 ea.) FB41P/42-WD-32D	IVES	(Auto Flush Bolts as required)
(1 ea.) COR60 626ANW/FL44	IVES	(Coordinator as required)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(2 ea.) WS407-CCV 32D	IVES	(Wall Stop)
(1 ea.) 5050 BLK LAR	NGP	(Gasketing)
(2 ea.) SEM-7850 689	LCN	(Magnetic Hold Opens)

NOTE: Astragal by door manufacturer
NOTE: Coordinate location of the Magnetic Hold Opens with Owner/Architect/Electrician

Hardware Set # 35 – DR #'s S-201

(3 ea.) 5BB1 x 4.5"x 4.5" 652	IVES	(Standard Weight Hinges)
(1 ea.) 8200 8" x 16" 630	IVES	(Push Plate)
(1 ea.) 8303-10" 4" x 16" 630	IVES	(Pull Handle x Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK 17' LAR	NGP	(Set of Gasketing)

Hardware Set # 36 – DR #'s S-202, S-203, S-204

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9044-07L L583-363/L283-722 626	SCH	(Privacy Lever Lock w/ Indicator as Required)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV/FS17 630	IVES	(Wall/Floor Stop as required)
(1 ea.) 5050BLK-LAR	NGP	(Set of Gasketing)

Hardware Set # 37 – DR #'s S-206

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9080-07L 626	SCH	(Storeroom Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK-LAR	NGP	(Set of Gasketing)

Hardware Set # 38 – DR #'s S-207, S-209

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9010-07L 626	SCH	(Passage Set)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK-LAR	NGP	(Set of Gasketing)

Hardware Set # 39 –DR #'s S-208, S-212

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9040/80-07L L583-363/L283-722 626	SCH	(Privacy Lever Lock w/ Indicator as Required)

(1 ea.) 4040XP CUSH 689	LCN	(Surface Closer)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) WS407-CCV 630	IVES	(Wall Stop)
(1 ea.) 5050BLK-17' LAR	NGP	(Set of Gasketing)

Hardware Set # 40 – DR #'s S-210, S-211

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9080-07L 626	SCH	(Storeroom Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) 5050BLK-LAR	NGP	(Set of Gasketing)

Hardware Set # 41 – DR #'s S-214

(3 ea.) 5BB1 x 4.5"x 4.5" 26D	IVES	(Standard Weight Hinges)
(1 ea.) L9050-07L 626	SCH	(Office Function Lever Lock)
(1 ea.) 1E72/74-626	BE	(Cylinder as Required)
(1 ea.) 4040XP-CUSH-689	LCN	(Closer Cush Stop)
(1 ea.) 8400 10" x 34" 630	IVES	(Kick Plate)
(1 ea.) fs17/WS407-CCV 630	IVES	(Floor/Wall Stop as required)
(1 ea.) 5050BLK-LAR	NGP	(Set of Gasketing)

Hardware Set # 42 – DR #'s S-215 ALUM

(2 ea.) 1E72/74 626	BE	(Cylinder as Required)

NOTE: Balance of Hardware by Aluminum Storefront Door Supplier

END OF SECTION

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SECTION 08 73 10
AUTOMATIC DOOR OPERATORS - COMMERCIAL

P1 GENERAL

1.01 SECTION INCLUDES

A. Trolley-Type Door Operators:
   1. Trolley-type continuous-duty door operators for standard lift sectional doors (LiftMaster Model GT-Basis of Design).

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Installation and requirements for blocking and nailers.

B. Section 16050 - Basic Electrical Materials and Methods: Installation and for electrical connections. requirements

1.03 REFERENCES

A. National Electrical Manufacturers Association (NEMA): NEMA ICS 6 - Industrial Control and Systems: Enclosures.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Cleaning methods.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, edge conditions, and accessories.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging with labels intact until ready

B. for installation.

C. Schedule delivery of door operator so that spaces are sufficiently complete that door operators can be installed immediately upon delivery.

1.06 WARRANTY

A. Manufacturer's standard limited 2-year warranty against material and manufacturing defects.

1.07 P2 PRODUCTS

1.08 MANUFACTURERS

A. Acceptable Manufacturer: LiftMaster; 845 Larch Avenue; Elmhurst, IL 60126-1196.

B. Toll-Free: 800.282.6225. Email: specs@LiftMaster.com. Web: LiftMaster.com.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

1.09 TROLLEY-TYPE DOOR OPERATORS

A. Heavy Industrial-Duty Operator: LiftMaster GT Heavy Industrial-Duty Trolley Operator, continuous-duty, high-starting torque motor with overload protection and emergency disconnect for manual door operation.
   1. Electric Operator: Heavy industrial-duty assembly, cULus listed and cULus labeled, complete with electric motor and factory-prewired motor controls, wormgear reduction unit, electric solenoid-actuated brake, 3-button

open/close/stop control station along with conduit-encased wiring from control circuit to motor, and accessories required for proper operation; operator shall be capable of driving door at a speed of approximately 11 to 12 inches (279 to 304 mm) per second.

a. Primary Drive Reduction: Wormgear-in-oil-bath gear reducer with synthetic "All Climate" oil with 20:1 speed reduction; adjustable torque limiter and quick- disconnect door arm to facilitate manual operation; permanently lubricated ball bearings on output shaft and output and door driven sprockets.
b. Brake: Electric solenoid-actuated brake that is capable of stopping and holding a door at any position.
c. Limit Switches: Fully adjustable, linear-driven limit mechanism synchronizing operator with door; low-friction nylon limit nuts fitted on treaded steel shaft that rotates on oil-tight self-lubricating bronze bushings; motor shall be removable without affecting limit switch settings.
d. Electric Motor: High-starting torque, continuous-duty, industrial-type protected against overload by current sensing and thermal overload devices. For single-phase applications, incoming voltage field-selectable between 115V and 230V, 60 Hz by properly positioning connector. For 3-phase applications, incoming voltage field-selectable between 208V, 230V and 460V, 60 Hz by properly positioning connector.
    1) Motor Specification:
        (a) 115/230V 60 Hz, single phase, 3/4 HP.
e. Motor Control and Enclosure: LiftMaster Logic 5.0 motor control shall be UL- approved microprocessor solid-state type and shall include the capability to select one of 7 wiring types; additional features shall include a maintenance alert diagnostic system, programmable Timer-to-Close with timer defeat input, mid-stop programming capabilities and a maximum run timer to provide motor overrun protection; motor control shall be housed in a NEMA 1 enclosure integral to the operator and shall conform to ANSI/NEMA ICS 6. (5 HP motor does not have Logic control features.)
    1) Radio Receiver: LiftMaster Logic 5.0 on-board, 3-channel receiver with standard external antenna; equipped to accept Security+ 2.0 rolling code technology remote controls and trinary DIP switch remote controls, with memory up to (30) 3-button remote controls (or 90 single-button remote controls) plus 30 wireless keypads, or an unlimited number of trinary DIP switch remote controls. Tri-band frequency (310/315/390 MHz) sends multiple radio signals to bypass radio interference. (Standard Security+ Radio Receiver for 5 HP operator.)
    2) Internet Connectivity: MyQ technology.
        (a) a) 902 to 928 MHz.
        (b) b) 50-channel FHSS (Frequency Hopping Spread Spectrum).
        (c) c) LiftMaster 828LM Internet Gateway enables monitoring and control of door operators and lighting controls via Internet-enabled smartphone, tablet or computer.
        (d) d) Provides two-way communication between commercial door operator and MyQ accessories to enable remote open, close and monitoring of commercial door.
    3) Contactor-Style (Mechanical) Motor Starter, Control and Enclosure: Motor starter shall be an across-the-line, mechanically interlocked, magnetic-reversing contactor; motor control shall be housed in a

4) NEMA 1 enclosure integral to the operator; control enclosures shall conform to ANSI/NEMA ICS 6. 5 HP operator offered in contactor-style (mechanical) only.

f. 3-Button Control Station: 3-button station providing open/close/stop functionality shall be NEMA Type 1 with maintenance alert indicator to signal intervals for routine door and operator maintenance.

g. Door Drive: Full #41 roller chain with emergency disconnect for manual door operation.

h. Track: Heavy-duty, double-angle, 11-gauge galvanized steel.

i. Trolley Assembly: 2 inches H x 2 inches W (51 mm H x 51 mm W) galvanized steel angle rails with cast aluminum trolley including plated steel rail spacers with nylon chain-guide assembly.

2. Primary Entrapment Protection Devices:
   a. NEMA 4X Monitored Photo Sensors: LiftMaster CPS-OPEN4 Monitored Photo Eyes (commercial thru-beam) and CPS-RPEN4 Monitored Retro-reflective Photo Eyes, fully monitored, non-contact, photo beam reversing photo sensor system with NEMA 4X watertight/corrosion-resistant enclosure shall reverse, in conjunction with the LiftMaster Logic 5.0 operator, a closing door to the full open position when an obstruction is sensed; photo sensors shall be mounted no higher than 6 inches (152 mm) maximum above the floor.
   b. Additional monitored primary entrapment protection devices may be added with the appropriate interface device or plug-in accessory card.
3. Ancillary Entrapment Protection Devices:
   a. Light Curtains: LiftMaster LC-36A light curtains to provide 36 inches of cross-beam infrared detection. Powered by the operator's A/C accessory power supply or via an optional 100MAPS External DC Power Supply as applicable.
4. Trolley Track: 2 inches H x 2 inches W (51 mm H x 51 mm W) galvanized steel angle rails with automatic reconnecting trolley and shall include plated steel rail spacers with nylon chain-guide assembly; nylon inserts will be provided on trolley mechanism and rail spacers to reduce vibration and chain noise.
5. Accessories
   a. Open-Only Push Button: LiftMaster 02-401M Mushroom Button Control Station
   b. Door-Position Indicator: LiftMaster RGL24LY Red/Green Traffic Light

1.10 P3 EXECUTION

1.11 EXAMINATION AND PREPARATION

A. Do not proceed with installation until substrates have been properly prepared and deviations from manufacturer’s recommended tolerances are corrected.

B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer’s recommended installation tolerances and conditions. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for

C. the substrate under the project conditions. Commencement of installation constitutes acceptance of conditions.

1.12 INSTALLATION

A. Install in accordance with manufacturer’s instructions and in proper relationship with adjacent construction. Test for proper operation and adjust until satisfactory results are obtained. Demonstrate operation to owner’s personnel.

1.13 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Metal Mesh Screen - Glazed into Curtain Wall at 2nd Floor Patios.

D. Plastic films.

E. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

B. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

C. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

C. ASTM C1036 - Standard Specification for Flat Glass; 2011.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

H. GANA (SM) - GANA Sealant Manual; 2008.

I. ITS (DIR) - Directory of Listed Products; current edition.

J. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

K. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.

L. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

M. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples 12 by 12 inch (___ by ___ mm) in size of glass units.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   3. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
   3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
   4. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.
   5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 test requirements for Category II.
   2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch (0.762 mm) thick, minimum.

2.03 INSULATING GLASS UNITS

A. Manufacturers:
   1. Guardian Glass, LLC: www.guardianglass.com/#sle.
   2. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
   3. Viracon, Apogee Enterprises, Inc: www.viracon.com.

B. Insulating Glass Units: Types as indicated.
   1. Spacer Color: Black.
   2. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
   3. Color: Black.
   4. Purge interpane space with dry air, hermetically sealed.

C. Type IG - 1A - Insulating Glass Units: Vision glass, double glazed.
   1. Applications: Exterior glazing unless otherwise indicated.
   2. Space between lites filled with air.
   3. Outboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick.
      a. Tint: Clear.
      b. Coating: Low-E (passive type), on #2 surface.
         1) Low-E coating shall be Vitro, Solarban 70 or equal.
   4. Inboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick.
      a. Tint: Clear.
   5. Total Thickness: 1 inch (25.4 mm).
   6. Thermal Transmittance (U-Value), Winter - Center of Glass:.29, nominal.
   7. Visible Light Transmittance (VLT): 60-70 percent, nominal.
   8. Solar Heat Gain Coefficient (SHGC):.25-.27 percent, nominal.

D. Type IG-1B - Insulating Glass Units: Laminated glazing. AT MAIN STATION ONLY.
   1. Applications: As shown on window elevations.
   2. Space between lites filled with air.
   3. Outboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick.
      a. Tint: Clear.
      b. Coating: Same as IG-1, on #2 surface.
   4. Inboard Lite: 2 layers of laminated-tempered float glass, 1/8" inch (_____ mm) thick.

a. Tint: Clear.
b. Transparent Film: Interlayer between glass layers
1) **Transparent Interlayer to be equal to 0.030" (.75-mm) Saflex, Vanceva, Color - clear**

5. Total Thickness: 1 inch (25.4 mm).

2.04 GLAZING UNITS AND EXTERIOR METAL MESH (GLAZED-IN SREEN AT EXTERIOR PATIOS)

A. Type G -1A - Monolithic Exterior Vision Glazing:
1. Applications: AS INDICATED ON DRAWINGS..
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal.

B. Type G-1B - Monolithic Exterior Vision Glazing: AT MAIN STATION ONLY.
1. Applications: AS INDICATED ON DRAWINGS..
2. Glass Type: Fully tempered float glass.
a. Transparent Film: Interlayer between (2) 1/8" glass layers
1) **Translucent Interlayer to be equal to .030" (.75mm) Saflex, Vanceva, Color- Clear.**

3. Tint: Clear.
4. Thickness: 9/16 inch (_____ mm), nominal.

C. Type G-2 - Monolithic Interior Vision Glazing:
1. Applications: All non-rated interior glazing including; side lites, and vision glazing in door assemblies. .
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal.

D. Type G-3 - Metal Mesh (Glazed-Into Curtaiwall Mullions)
1. Applications: At 2nd Floor Exterior Patios.
2. Metal Type: 6 Mesh T316 Stainless .035" Wire Diameter
3. Width: 48" Wide

E. Type G-4 - Glass Shelf at Display Case.
1. Applications: At 2nd Floor Display Case.
2. GlassType: 3/8: clear tempered glass (display shelves).
3. Width: See drawings.

2.05 PLASTIC FILMS

A. Type F-3 - Decorative Plastic Film: Polyester type.
1. Application: Locations as indicated on drawings.
2. Color: Acid Etch.

2.06 GLAZING COMPOUNDS

A. Provide Glazing Compounds as required for full and complete systems and as shown on the Drawings.

2.07 ACCESSORIES

A. Provide Accessories as required for full and complete systems and as shown on the Drawings.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

3.04 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

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SECTION 08 83 00
MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass mirrors.
   1. Tempered safety glass.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

1.05 QUALITY ASSURANCE

1.06 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F (10 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mirrors:
   1. Binswanger Mirror/ACI Distribution; _____: www.binswangerglass.com/#sle.
   2. Lenoir Mirror Co; _____: www.lenoirmirror.com/#sle.
   3. Trulite Glass and Aluminum Solutions; _____: www.trulite.com/#sle.

2.02 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass; Type 1: Clear, tempered safety glass; ASTM C1048, with copper and silver coatings, and protective overcoating.
   1. Thickness: 1/4 inch (6.4 mm).
   2. Edges: Arrised / Flat.
   3. Size: As indicated on drawings.

2.03 ACCESSORIES

A. Channel Frame: One piece, channel frame, stainless steel, Type 430, satin finish, 1/2 inch by 1/2 inch by 3/8 inch deep (12.7 mm by 12.7 mm by 9.5 mm deep) with 90 degree mitered corners.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 PREPARATION

3.03 INSTALLATION

A. Install mirrors in accordance with manufacturer's recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

3.04 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

END OF SECTION

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SECTION 08 91 00
LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim.

B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 23 31 00 - HVAC Ducts and Casings: Ductwork attachment to louvers.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.

1.04 SUBMITTALS

A. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

B. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.

C. Samples: Submit two samples 2 by 2 inches (50 by 50 mm) in size illustrating finish and color of exterior and interior surfaces.

D. Test Reports: Independent agency reports showing compliance with specified performance criteria.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
   1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Louvers:
   1. Ruskin Company 3900 Dr. Greaves Rd. Grandview, MO 64030, www.ruskin.com, 816-761-7476..

2.02 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

1. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
2. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers, Type ___: Horizontal blade, formed galvanized steel sheet construction, with intermediate mullions matching frame.
1. Free Area: 54%, minimum.
2. Blades: Straight.
3. Frame: 4 inches (100 mm) deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
4. Aluminum Thickness: Frame 12 gage, 0.0808 inch (2.05 mm) minimum; blades 12 gage, 0.0808 inch (2.05 mm) minimum.
5. Steel Finish: Superior performing organic coating, finished after fabrication.

2.03 FINISHES

A. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch (0.030 mm).

B. Color: Custom, to match approved sample.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Set sill members and sill flashing in continuous bead of sealant.

D. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

E. Secure louver frames in openings with concealed fasteners.

F. Coordinate with installation of mechanical ductwork.

3.03 ADJUSTING

A. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

3.04 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION

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SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.

B. Section 06 10 00 - Rough Carpentry: Building framing and sheathing.

C. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

D. Section 07 21 00 - Thermal Insulation

E. Section 07 42 13 - Metal Wall Panels (Soffit Panels).

F. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

G. Section 09 30 00 - Tiling: Tile backing board.

1.02 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

J. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

K. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing Board; 2013.

L. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2014.

M. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

P. GA-216 - Application and Finishing of Gypsum Board; 2013.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich; _____: www.clarkdietrich.com/#sle.
   2. Marino; _____: www.marinoware.com/#sle.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
   4. Resilient Furring Channels: 1/2 inch (12 mm) depth, for attachment to substrate through one leg only.

C. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

D. Drywall & Soffit Ceiling Suspension System Components
   1. All components shall be heavy-duty zinc-coated hot dipped galvanized steel with chemically cleansed, zinc-coated, prefinished exposed surfaces. All materials shall conform to the performance standards of ASTM C635, C645 and C653.
   2. Main beams with double-web construction, 1-11/16” height profile with peaked roof top bulb and 1-1/2” knurled flange spaced at 48” on center shall be Armstrong component HD8906 or approved equal.
   3. Primary Cross beams with double-web construction, 1-1/2” height profile with peaked roof top bulb and 1-1/2” knurled flange spaced at 28” on center shall be Armstrong component XL8945P or approved equal.
   4. Hemmed Angle Wall molding with 1-1/4”x1-1/4” nominal legs shall be Armstrong component KAM10 or KAM 12 or approved equals.
   5. Galvanized Hanger Wire: 8 gage.
   6. 18 gage Galvanized Tie Wire.
   7. Accessories including clips and screws per manufacturer’s recommendations

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company; _____: www.americangypsum.com/#sle.
   2. CertainTeed Corporation; _____: www.certainteed.com/#sle.
   3. Georgia-Pacific Gypsum; _____: www.gpgypsum.com/#sle.
   4. USG Corporation; _____: www.usg.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
      b. Mold resistant board is required at exterior walls, all toilets, and all other areas indicated on drawings.
   3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch (16 mm).
      b. Ceilings: 5/8 inch (16 mm).
   5. Paper-Faced Products:
      a. American Gypsum Company; LightRoc Gypsum Wallboard.
      b. American Gypsum Company; FireBloc Type X Gypsum Wallboard.
      c. USG Corporation; Sheetrock Brand Gypsum Panels..
      d. CertainTeed Corporation; ProRoc Brand Gypsum Board..
      e. Substitutions: See Section 01 60 00 - Product Requirements.
   6. Mold Resistant Paper Faced Products:
      a. American Gypsum Company; M-Bloc Type X.
      b. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
      c. USG Corporation; Moldtough Firecode Type X.

C. Backing Board For Wet Areas:
   1. Application: Surfaces behind tile in wet areas including toilet rooms.
   2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
      a. Thickness: 1/2 inch (12.7 mm).

D. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Ceilings, unless otherwise indicated.
   2. Thickness: 5/8 inch (___ mm).
   3. Edges: Tapered.
   4. Products:
      a. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board.
      b. Or equal..
      c. Substitutions: See Section 01 60 00 - Product Requirements.

E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
   1. Application: Exterior Wall Sheathing, unless otherwise indicated.
   2. Edges: Square.
   3. Glass Mat Faced Products:
      a. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com/#sle.
      b. or approved equal.

F. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665; Owens Corning Sound Attenuation Batt Insulation unfaced, preformed glass fiber, friction fit type. Flame Spread 10 (Class A). Locate in Toilet room walls (when studs), above ceilings and as other wise shown in plans. Thickness: 3-1/2 x 16 inch (_____ mm) and 5-1/2 x 16 inch.

B. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
   1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   2. Tape Thickness: 1/4 inch (6 mm).

C. Water-Resistive Barrier: As specified in Section 07 25 00.

D. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel, unless noted otherwise.
   1. Corner Beads: Low profile, for 90 degree outside corners.
   2. Architectural Reveal Beads:
      a. Reveal Depth: 1/2 inch (12 mm).
      b. Reveal Width: 5/8 inch (16 mm).
      c. Shapes: As indicated on drawings.
      d. Products:
         1) Fry Reglet Corporation, www.fryreglet.com.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
   2. Ready-mixed vinyl-based joint compound.

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

1. Install suspension system and panels in accordance with the manufacturer's instructions, in compliance with ASTM installation standard, and with applicable codes.
2. Main beams shall be suspended from the overhead construction with hanger wire, spaced as required for expected ceiling loads and as specified along the length of the main beams.
3. Install cross tees at 24" on center spacing.
4. Use angle molding to interface with drywall grid system to provide perimeter attachment or to obtain drop soffits, verticals, slopes, etc. as shown in drawings.
5. Use secondary framing cross tees as required to frame light fixtures and other ceiling mounted devices.

C. Studs: Space studs at 16 inches on center (at 406 mm on center).
1. Extend partition framing to structure where indicated and to ceiling in other locations.
2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
1. Orientation: Horizontal.
2. Spacing: As indicated.

E. Blocking: Install wood blocking for support of:
1. Framed openings.
2. Wall mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall mounted door hardware.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.05 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

C. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

D. Cementitious Backing Board: Install over wood framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.07 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

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SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Stone thresholds.

E. Ceramic accessories.

F. Ceramic trim.

G. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2013.1.

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.

C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

D. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).

E. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.

F. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).

G. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

H. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).

I. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).

J. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).

K. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).

L. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).

M. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior glue plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

N. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).

O. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2017.

P. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2012 (Revised).

Q. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).

R. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).

S. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2010 (Revised).

T. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).

U. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.

V. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.

W. ANSI A136.1 - American National Standard for Organic Adhesives for Installation of Ceramic Tile; 2008 (Reaffirmed 2013).

X. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.

Y. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles; 2014a.

Z. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Provide Samples for each selected tile type. Provide Samples of complete color range for Color Selection.

1.05 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.

B. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 MOCK-UP

A. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.

1. Minimum size of mock-up is indicated on drawings.
2. Approved mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.
   1. American Olean Corporation: www.americanolean.com/#sle.
   2. Dal-Tile Corporation: www.daltile.com/#sle.
   3. Anatolia Tile and Stone: http://www.anatoliatile.com/.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Mosaic Wall Tile, Type 3&4: ANSI A137.1, standard grade.
   1. Basis of Design: Segment Double Loaded Porcelain by Anatolia.
   2. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
   3. Size: 3 x 6 inch (____by____ mm), nominal.
   4. Shape: Square.
   5. Edges: Square.
   6. Surface Finish: Matte glazed.
   7. Color(s): To be selected by Architect from manufacturer's full range.
   8. Pattern: See drawings for extent and pattern.

C. Porcelain Wall Tile, Type 1: ANSI A137.1, standard grade.
   1. Basis of Design: Prima by Anatolia.
   2. Moisture Absorption: 0 to .5 percent as tested in accordance with ASTM C373.
   3. Size: 12 by 24 inch (____by____ inch), nominal.
   4. Edges: Square.
   5. Surface Finish: Matte glaze.
   6. Color(s): To be selected by Architect from manufacturer's full range.
   7. Pattern: See drawings for extent and pattern.
   8. Products:
      a. Anatolia Tile and Stone; Prima Porcelain Tile Line: http://www.anatoliatile.com/.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Porcelain Wall Tile, Type 2: ANSI A137.1, standard grade.
   1. Basis of Design: Segment Double Loaded Porcelain by Anatolia.
   2. Moisture Absorption: 0 to .5 percent as tested in accordance with ASTM C373.
   3. Size: 12 by 24 inch (____by____ inch), nominal.
   4. Edges: Square.
   5. Surface Finish: Matte glaze.
   6. Color(s): To be selected by Architect from manufacturer's full range.
   7. Pattern: See drawings for extent and pattern.
   8. Products:
      a. Anatolia Tile and Stone; Prima Porcelain Tile Line: http://www.anatoliatile.com/.

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile.
      b. Wall corners, outside and inside.
   2. Manufacturers:

a. Schluter-Systems: www.schluter.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Thresholds: Marble, white or gray, honed finish; 2 inches (51 mm) wide by full width of wall or frame opening; 1/2 inch thick (12.7 mm thick); beveled one long edge with radiused corners on top side; without holes, cracks, or open seams.
1. Applications:
a. At doorways where tile terminates.

C. Expansion Joint Sealant: Equal to Summitville #S-48. Mix sand from grout mixture into surface of sealant.

D. Tile Cleaner as acceptable to manufacturers of Tile and Grout.

2.03 SETTING MATERIALS

A. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.

B. Organic Adhesive: ANSI A136.1, thinset mastic type.
1. Applications: interior, non-wet location walls.
2. Use Type I in areas subject to prolonged moisture exposure.

C. Dry-Set Portland Cement Mortar Bond Coat: ANSI A118.1.

2.04 GROUTS

A. Manufacturers:
1. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
2. Or approved equal.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Standard Grout: ANSI A118.6 standard cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
3. Color(s): As selected by Architect from manufacturer's full line.
4. Products:
a. LATICRETE International, Inc; LATICRETE 1500 Sanded Grout: www.laticrete.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Applications: Use this type of grout at floors and walls.
2. Color(s): As selected by Architect from manufacturer's full line.
3. Products:
a. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
2. Color(s): As selected by Architect from manufacturer's full line.

2.06 ACCESSORY MATERIALS

A. Cementitious Self-Levelling Underlayment at Floors: Exceeding performance requirements of ASTM C627; Specifically designed for bonding to thin-set setting mortar; not primarily a waterproofing material and having the following characteristics:

B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch (12.7 mm) thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep control and expansion joints free of mortar, grout, and adhesive.

K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

B. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F205-16, unless otherwise indicated.

B. Mortar Bed Thickness: 5/8 inch (15.9 mm), unless otherwise indicated.

3.06 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.07 CLEANING

A. Clean tile and grout surfaces.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

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SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Acoustical insulation.

B. Section 23 37 00 - Air Outlets and Inlets: Air diffusion devices in ceiling.

C. Section 26 51 00 - Interior Lighting: Light fixtures in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components and acoustical units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustical Tiles/Panels:
   1. Armstrong World Industries, Inc; _____: www.armstrong.com/#sle.
   2. CertainTeed Corporation; _____: www.certainteed.com/#sle.
   3. Hunter Douglas Contract; _____: www.hunterdouglascontract.com.
   4. USG Corporation; _____: www.usg.com/#sle.

B. Suspension Systems:
   1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels Type 1: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. Size: 24 by 48 inches (600 by 1200 mm) and 4 by 48 inches - as shown in drawings.
   2. Thickness: 1 inches (_____ mm).
   3. Composition: Wet felted.
   4. Light Reflectance: 85 percent, determined in accordance with ASTM E1264.
   5. NRC Range: 0.70 to 0.75, determined in accordance with ASTM E1264.
   6. Articulation Class (AC): 170, determined in accordance with ASTM E1264.
   7. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   8. Sag/Humidity Resistance: HumiGuard Plus
   9. Edge: Square Tegular.
   10. Surface Color: White.

11. Surface Pattern: Ultima.
12. Suspension System: Exposed grid Type 1.
13. Products:
    a. Armstrong Optima Tegular.

C. Acoustical Panels Type 2: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
1. Size: 24 by 24 inches (600 by 600 mm) - as shown in drawings.
2. Thickness: 3/4 inches (19 mm).
3. Composition: Wet felted.
4. Light Reflectance: 85 percent, determined in accordance with ASTM E1264.
5. NRC Range: 0.70 to 0.75, determined in accordance with ASTM E1264.
6. Articulation Class (AC): 170, determined in accordance with ASTM E1264.
7. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
8. Sag/Humidity Resistance: HumiGuard Plus
9. Edge: Angled Tegular.
10. Surface Color: White.
11. Surface Pattern: Fine Fissured.
12. Suspension System: Exposed grid Type 1.
13. Products:
    a. Armstrong Fine Fissured Tegular.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

B. Exposed Steel Suspension System Type 1: Formed steel, commercial quality cold rolled; heavy-duty.
1. Profile: Tee; 15/16 inch (24 mm) wide face.
2. Construction: Double web.
3. Finish: White painted.
4. Products:
    a. 9/16 Prelude XL Suspension System by Armstrong World Industries, Inc..

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12-gage 0.08 inch (2 mm) galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.
1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
    a. Products:
        1) AX6STR by Armstrong World Industries, Inc.
    b. Dimensions: 120 x 3/4 x 6 inches
    c. Finish: Match Suspension System finish.

D. Acoustical Insulation: Specified in Section 07 21 00.

E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

B. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

D. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

I. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap corners.

3.02 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

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SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Resilient stair accessories.

D. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2015.

B. ASTM F1700 - Standard Specification for Solid Vinyl Tile; 2013a.

C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Verification Samples: Submit two samples, ___ by ___ inch (___ by ___ mm) in size illustrating color and pattern for each resilient flooring product specified.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Tile: Solid vinyl with color and pattern throughout thickness.
   1. Manufacturers:
      a. Mohawk Group; www.mohawkgroup.com, Hot and Heavy collection, Bolder.
      b. Or approved equal.
   2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
   3. Square Tile Size: 36 by 36 inch (___ by ___ mm).
   4. Wear Layer Thickness: 20 mil (0.5 mm).
   5. Total Thickness: _____ inch (5 mm).
   6. Color: To be selected by Architect from manufacturer's full range. Up to two colors may be selected for different areas of the building.

B. Rubber Tile: Homogeneous, color and pattern throughout thickness.
   1. Manufacturers:
      a. Johnsonite, a Tarkett Company; Solid Color Rubber: www.johnsonite.com/#sle.
      b. Or approved equal.
      c. Same manufacturer as Stair Treads and Risers.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
3. Size: 24 by 24 inch (___ by ___ mm) nominal.
4. Total Thickness: 0.125 inch (3.2 mm).
5. Texture: Rice Paper.
6. S
7. Color: To be selected by Architect from manufacturer's full range.

2.02 STAIR COVERING

A. Stair Treads: Rubber; full width and depth of stair tread in one piece; tapered thickness.
   1. Manufacturers:
      a. Johnsonite, a Tarkett Company; AngleFit Rubber Treads and Risers: www.johnsonite.com/#sle.
      b. Or qpproved equal.
      c. Same manufacturer as Rubber Tile.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Nominal Thickness: 0.1875 inch (4.75 mm).
   3. Nosing: Square.
   4. Striping: 2 inch (24 mm) wide contrasting color abrasive strips. Color to be selected from manufacturer's full range.
   5. Texture: Rice Paper.
   6. Color: To be selected by Architect from manufacturer's full range.

B. Stair Risers: Full height and width of tread in one piece, matching treads in material and color.
   1. Manufacturers:
      a. Johnsonite, a Tarkett Company; _____: www.johnsonite.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Thickness: 0.080 inch (2.0 mm).

C. Stair Stringers: Full height in one piece and in maximum available lengths, matching treads in material and color.
   1. Nominal Thickness: 0.080 inch (2.0 mm).

2.03 RESILIENT BASE

A. Resilient Base - Type 1: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Manufacturers:
      a. Johnsonite, a Tarkett Company; _____: www.johnsonite.com/#sle.
   2. Height: 6 inch (150 mm).
   3. Thickness: 0.125 inch (3.2 mm).
   4. Finish: Satin.
   5. Color: To be selected by Architect from manufacturer's full range. Up to three colors may be selected for different areas of the building.
   6. Accessories: Premolded external corners and internal corners.

2.04 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is fully cured.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 05 26 for grounding and bonding to building grounding system.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.06 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Install stringers configured tightly to stair profile.

C. Adhere over entire surface. Fit accurately and securely.

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

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SECTION 09 68 13
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

B. This Section shall include the furnishing of all carpet complete including carpets, binder bar, vinyl edge reducing and edge strip where required, and in sufficient quantity for a complete installation in all areas of the buildings as noted on finish schedule and herein specified.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:
   1. Mohawk Industries, Inc., 1975 West Oak Circle, Marietta, GA 30062, 800-554-6637..
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Tile Carpeting, Type 1: Colorstrand Nylon, manufactured in one color dye lot.
   1. Product: Nutopia MATRIX manufactured by Mohawk Industries, Inc..
   2. Tile Size: 12 by 36 inch (_____by_____ mm), nominal.
   3. Color: Urban Transit/Color to be selected from full range.
   4. Pattern: Brick Ashlar.
   5. Pile Weight: 20.0 oz/sq yd (_____ gm/sq m).
   6. Primary Backing Material: ExoFlex Matrix.

2.03 ACCESSORIES

A. Adhesives:
   1. Compatible with materials being adhered; maximum VOC content as specified in Section 01 61 16.

B. Use contact cement on vertical surfaces and as recommended by carpet manufacturer.

C. Edge Protection/Transition:
   1. Transition between floor finishes of different heights shall be Schluter RENO-U or equal with Aluminum, satin anodized finish (AE) with height as required for thickness of specified flooring materials. Edging component to have sloped exposed surface, integrated trapezoid-perforated anchoring let, and integrated joint spacer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. **Installer shall inspect all sub-flooring surfaces** which to determine that all are a smooth level plane, free from any imperfections and free from dirt and dust. Notify the General Contractor in writing, with copies to the Architect and/or Owner, if any conditions exist that would be detrimental to proper installation of the carpet. The application of any carpet shall be an indication of the Carpet Contractor's acceptance of the sub-surface conditions and he shall be held responsible for any defects after laying the carpet.

3.02 MEASUREMENT

A. The Carpet Contractor shall verify all dimensions for the carpet at the building site before supplying and cutting carpet.

3.03 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. The Carpet Contractor shall verify all dimensions for the carpet at the building site before supplying and cutting carpet.

3.04 INSTALLATION OF TEXTILE COMPOSITE FLOORING

A. Install flooring in strict accordance with the finish drawings and the manufacturer's written installation instructions.

B. ADHESIVE SYSTEM - use full spread adhesive or pre-applied adhesive for all flooring modules.
   1. Full Spread Adhesive: Spread using U-notched trowel or roller. Allow to dry until transparent or adehsive does not transfer to finger when touched. Drying time will vary with temperature, humidity and air velocity, however modules must be installed within two hours after adhesive has dried.
   2. Pre-Applied Adhesive
      a. Primer Application:
         1) Pour the diluted primer onto the substrate and roll on using 3/8" nap or foam roller. Do not puddle. Additional coats may be required upon visual inspection over extremely porous concrete.
         2) Allow the material to dry to the touch. Lower substrate temperatures and/or higher humid conditions could extend the drying time.
      b. Installing Textile Composite Flooring Modules:

1) After the primer has dried, begin the installation at the intersection of the central module anchor lines. Peel off the release film. Complete the installation one quarter area at a time laying the modules firmly and accurately along the anchor lines. Followed approved installation method(s) for each specific product.

C. MODULE PLACEMENT - Arrows are printed on the module backing to show pile/machine direction. A tight installation without compression is mandatory for optimum performance and appearance of the modular installation. It is critical that each module uniformly touch each adjoining module without a gap. To ensure a clean tight fit, do not pull/tug or slid-in modules, but instead lay each module into its location against the adjoining module. Use your hands to press/form the module into place where the new module meets the previously installed module. See specific product specifications for approved installation method(s).

3.05 CLEANING

A. On completion of the installation on each floor, all dirt, carpet scraps, etc., must be removed from the surface of the carpet.

B. Remove excess adhesive without damage, from floor, base, and wall surfaces.

C. Clean and vacuum carpet surfaces.

3.06 EXTRA STOCK

A. Deliver stock of maintenance materials to Owner. Furnish maintenance materials from same manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.

B. Tile Flooring: Furnish not less than one box for each 50 boxes or fraction thereof, for each type, color, pattern and size installed.

END OF SECTION

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SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, varnishes, and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Prime surfaces to receive wall coverings.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so 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. Floors, unless specifically so indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Manufacturer's installation instructions.

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.

1.04 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.

1.05 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 coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

C. Paints:
1. Benjamin Moore & Co: www.benjaminmoore.com/#sle.
2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
3. Farrell-Calhoun.

D. Transparent Finishes:
1. Benjamin Moore & Co: www.benjaminmoore.com..

E. Primer Sealers: Same manufacturer as top coats.

F. Block Fillers: Same manufacturer as top coats.

G. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
1. Provide paints and coatings 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.
2. 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.
3. Supply each coating material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
1. Gypsum Board: Interior Latex Primer Sealer; MPI #50.
2. Concrete: Same as top coats.
3. Wood: Latex Primer for Interior Wood; MPI #39.
4. Steel, Uncoated: Anti-Corrosive Alkyd Primer for Metal; MPI #79.

C. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint

base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.
   2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - All Exterior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including cement board and primed wood.
   1. Preparation as specified by manufacturer.
   2. Two top coats and one coat primer recommended by manufacturer.

B. Paint E-TR-C - Transparent Finish on Concrete Floors, Unless Otherwise Indicated:
   1. 2 coats sealer.
   2. Sealer: Water Based for Concrete Floors; MPI #99.
   3. Sealer Product(s):
      a. Euclid Chemical; Super Diamond Clear VOX.

C. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
   1. Touch-up with rust-inhibitive P06 Alkyd Metal Primer.
   2. Gloss: Two coats of alkyd enamel; Benjamin Moore Super Spec Urethane Alkyd Gloss Enamel P22 .

2.04 PAINT SYSTEMS - INTERIOR

A. Paint I-TR-C - Transparent Finish on Concrete Floors, Unless Otherwise Indicated:
   1. 2 coats sealer.
   2. Sealer: Water Based for Concrete Floors; MPI #99.
   3. Sealer Product(s):
      a. Euclid Chemical; Super Diamond Clear VOX.

B. Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:
   1. Once Coat: Benjamin Moore Moorecraft Super Spec Alkyd Enamel Under coater & Primer Sealer 245
   2. Satin: Two coats of latex enamel; Bejamin Moore Satin Impervo Enamel

C. Paint MI-OP-3A - Interior Ferrous Metals, Unprimed, Alkyd, 3 Coat:
   1. One coat of Benjamin Moore P06 Alkyd Metal Primer.
   2. Semi-gloss: Two coats of alkyd enamel; Benjamin Moore Super Spec Alkyd Semi-Gloss Enamel C271.

D. Paint MgI-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
   1. One coat Benjamin Moore P04 Acrylic Metal Primer.
   2. Semi-gloss: Two coats of alkyd enamel; Benjamin Moore Super Spec Alkyd Semi-Gloss Enamel C271.

E. Paint GI-OP-3L - Gypsum Board/Plaster Walls, Latex, 3 Coat:
   1. One coat of Benjamin Moore Moorecraft Super Hide Latex Prime Undercoater 284 primer sealer.
   2. Eggshell: Two coats of latex enamel; Benjamin Moore Moorecraft Super Spec Latex Eggshell Enamel C274.

F. Paint GI-OP-3LA - Gypsum Board/Plaster Ceiling, Latex-Acrylic, 3 Coat:
   1. One coat of Benjamin Moore Moorecraft Super Hide Latex Prime Undercoater 284 primer sealer.
   2. Flat: Two coats of latex enamel-acrylic; Benjamin Moore Moorecraft Super Spec Flat Latex Enamel 275. (Use Semi Gloss in wet areas where applicable.)

G. Paint: EXPOSED METAL CEILING DECK
   1. First Coat: Benjamin Moore P06 Alkyd Metal Primer
   2. Two Coats: Benjamin Moore Sweep Up Spray Latex Flat P53

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating 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 mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Concrete Floors and Traffic Surfaces to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

J. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

K. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

L. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

M. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

N. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

O. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

P. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

Q. 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.

R. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

S. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.02 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 instructions.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.03 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.04 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION

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SECTION 10 11 00
VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Markerboards

B. Tackboards (Bulletin Boards)

C. Tackable wall panels

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on chalkboard, markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Samples: Submit color charts for selection of color and texture of chalkboard, markerboard, tackboard, tackboard surface covering, and trim.

E. Manufacturer's printed installation instructions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Qualification of Installers: Use 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

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for chalkboard and markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.

B. Or approved equal.

2.02 VISUAL DISPLAY UNITS

A. Markerboards: Porcelain enamel on steel, laminated to core.
   1. Color: As selected from manufacturer's full range.
   2. Locations: North wall of Training Room.
   3. Height: 48 inches (1220 mm).
   4. Length: 8 feet (2440 mm), in one piece.
   5. Accessories: Provide marker tray and map rail.
   6. Product:
      a. Claridge Products and Equipment, Inc; Series 185, Type D: www.claridgeproducts.com.
      b. Or approved equal..

B. Tackboards (Surface Mounted): Fine-grained, homogeneous natural cork.
   1. Cork Thickness: 1/4 inch (6 mm).
   2. Color: As selected from manufacturer's full range.
   3. Backing: Hardboard, 1/4 inch (6 mm) thick, laminated to tack surface.
   4. Size: As indicated on drawings.
   5. Locations: As indicated on drawings.
   6. Product:
      a. Claridge Products and Equipment, Inc: 800 Series with Colored Cork, www.claridgeproducts.com.
      b. Or approved equal.

C. Tackable Wall Panels (Built-In, Recessed): PINacle 440 Standard; by Homasote Company, www.homasote.com or approved equal.
   1. Size: As indicated on drawings.
   2. Locations: As indicated on drawings.

2.03 ACCESSORIES

A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch (25 mm) wide overall, full width of frame.

B. Map Supports: Formed aluminum sliding hooks and roller brackets to fit map rail.

C. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in locations and at mounting heights as shown on the drawings,accordance with manufacturer's instructions. Provide all grounds, brackets, anchors, trim, blocking pads and accessories for a complete installation.

B. Secure units level and plumb.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

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SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Building identification signs.

C. Plaque.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Store tape adhesive at normal room temperature.

1.05 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
   1. Best Sign Systems, Inc; _____: www.bestsigns.com/#sle.
   2. Mohawk Sign Systems, Inc; _____: www.mohawksign.com/#sle.
   3. Gemini Inc.; www.geminisignproducts.com

B. Dimensional Letter Signs:
   1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.
   2. Inpro; _____: www.inprocorp.com.
   3. Gemini Inc.; www.geminisignproducts.com.

C. Plaques:
   1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: See signage schedule for locations.
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
   3. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
   4. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
   5. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
   6. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
   7. **Type 1: Aluminum Building Dedication Plaque 1**: (1) at Main Station and (1) at Satellite Station.
   8. **Type 2: Aluminum Building Plaque 2**: (1) at Main Station and (1) at Satellite Station.
   9. **Type 3: Typical Room ID ADA Signage:** (1) for every entry door to every room unless otherwise noted to receive another sign type.
   10. **Type 4: Typical Room ID ADA Signage**: (1) for every entry door for every single occupancy office, conference room, and meeting room.
   11. **Type 5: Typical Single Sex Toilet Signage:** (1) for every entry door for every single sex toilet.
   12. **Type 6: Typical Unisex Toilet Signage:** (1) for every entry door for every unisex toilet.
   13. **Type 7: Typical Egress Signage:** (2) at Main Station and (2) at Satellite Station.
   14. **Type 8: Interior Stairwell Level ID ADA Signage:** (4) at Main Station and (4) at Satellite Station.
   15. **Type 9: Storefront Exit Signage:** (4) at Main Station and (4) at Satellite Station.

C. All Satellite Station Signs shall be included in **ABI #1.**

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica.
   2. Character Case: Upper case only.

3. Background Color: As scheduled.
4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/16 inch (1.6 mm).

2.05 PLAQUES

A. Metal Plaques:
   1. Metal: Aluminum casting.

2.06 DIMENSIONAL LETTERS

A. Metal Letters:
   1. Metal: Aluminum casting.
   2. Finish: Brushed, satin.
   3. Mounting: Concealed or exposed screws.

2.07 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Exposed Screws: Stainless steel.

C. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Locate signs where indicated:see signage schedule.

E. Protect from damage until Substantial Completion; repair or replace damaged items.

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SECTION 10 15 00
VIDEO DISPLAY SYSTEMS

PART 2 PRODUCTS

1.01 MANUFACTURERS

A. LG Electronics: www.lg.com/us/business/#sle. BuyAmerican.

B. Sony Electronics; www.electronics.sony.com. BuyAmerican.

1.02 TELEVISIONS

A. Wall-Mounted Television - EQ1
   1. 65" 4K LED Smart Television.

B. Wall-Mounted Television - EQ2
   1. 65" 4K LED Smart Television.

C. Free-Standing Television - EQ3
   1. 43" 4K LED Smart Television.

PART 3 EXECUTION

2.01 INSTALLATION

A. Install in accordance with manufacturer's instructions .

2.02 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

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SECTION 10 21 13.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal and vestibule screens.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

B. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 4 inch (__ mm) in size illustrating panel finish, color, and sheen.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. Scranton Products (Santana/Comtec/Capital); Hiny Hiders Standard HDPE Solid Plastic: www.scrantonproducts.com/#sle.
   2. Or approved equal.

2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted headrail-braced.
   1. Color: Single color as selected.
   2. Doors:
      a. Thickness: 1 inch (25 mm).
      b. Width: 24 inch (610 mm).
      c. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
      d. Height: 55 inch (1397 mm).
   3. Panels:
      a. Thickness: 1 inch (25 mm).
      b. Height: 55 inch (1397 mm).
   4. Pilasters:
      a. Thickness: 1 inch (25 mm).
      b. Width: As required to fit space; minimum 3 inch (76 mm).

2.03 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches (76 mm) high; concealing floor fastenings.

B. Head Rails: Extruded aluminum, anti-grip profile.

C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

E. Hinges: Stainless steel, manufacturer's standard finish.
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.

F. Door Hardware: Stainless steel, manufacturer's standard finish.
   1. Door Latch: Thumbturn type with exterior emergency access feature.
   2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
   3. Provide door pull for outswinging doors.

G. Coat Hook with Rubber Bumper: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

END OF SECTION

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SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Corner guards fabricated from rolled metal sections or bent plate.

B. Section 06 10 00 - Rough Carpentry: Blocking for wall and corner guard anchors.

C. Section 09 21 16 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

1.04 SUBMITTALS

A. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

B. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
   1. Submit two sections of corner guards, 24 inches (610 mm) long.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
   1. Extra Stock Materials: One package(s) of minimum 96 inches (2438 mm) long unit of each kind of covers for corner guards, bumper rails, and protective corridor handrails.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards and Crash Rails:
   1. Construction Specialties, Inc; Acrovyn Solid Color and Chameleon Corner Guards and Crash Rails www.c-sgroup.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PRODUCT TYPES

A. Corner Guards - Flush Mounted:
   1. Material: Polyethylene terephthalate (PET or PETG); PVC-free with full height extruded aluminum retainer.
   2. Performance: Resist lateral impact force of 100 lbs (445 N) at any point without damage or permanent set.
   3. Model: SFS-20N for non rated walls. SFS-20RN for Fire Rated walls.
   4. Fire Resistance: Where fire rating is specified for the wall in which the guard is mounted, provide assemblies that have been tested in accordance with ASTM E119 for the same rating as the wall.
   5. Width of Wings: 2 inches (51 mm).
   6. Corner: Square.
   7. Color: As selected from manufacturer's standard colors. Up to two colors to be selected.
   8. Length: One piece, full height see RCP for ceiling heights.
   9. Locations: as indicated on Finish Plans.

B. Crash Rails:
   1. Acrovyn Rubstrips, 6"x .060", adhesive fastened.
   2. Color: As selected from manuafacutrer's standard colors. Up to three colors to two colors to be selected.

2.03 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

2.04 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard 6 inch (_____ mm) above finished floor to ceiling.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch (6 mm).

3.04 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

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SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Accessories for toilet rooms, showers, and utility rooms.

D. Diaper changing stations.

E. Utility room accessories.

F. Grab bars.

1.02 RELATED REQUIREMENTS

A. Section 08 83 00 - Mirrors: Other mirrors.

B. Section 09 30 00 - Tiling: Ceramic washroom accessories.

C. Section 10 21 13.13 - Metal Toilet Compartments.

D. Section 22 40 00 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM C1036 - Standard Specification for Flat Glass; 2011.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

G. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004 (Reapproved 2010).

H. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:

1. Bradley Corporation: www.bradleycorp.com/#sle.
2. BOBRICK Washroom Equipment, Inc.
3. Substitutions: Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

E. Adhesive: Two component epoxy type, waterproof.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. **Toilet Paper Dispenser (B):** Double roll, surface mounted bracket type, see basis of design product below.
   1. Products:
      a. Bradley Toilet Tissue Dispenser 5402 (172nd std).
      b. Substitutions: Section 01 60 00 - Product Requirements.

B. **Paper Towel Dispenser (I)**: Roll paper type, stainless steel, semi-recessed, with viewing slots on sides as refill indicator and tumbler lock.
   1. Capacity: 8 inch roll minimum.
   2. Products:
      a. Bradley Paper Towel Dispenser (172nd std).
         1) Model 2484-100000 Semi-Recessed when located on a wall above countertop or wall-mounted plumbing fixture.
         2) Model 2484-000000 Recessed (recessed 10 1/4") when located on a wall NOT above countertop or wall-mounted plumbing fixture.

C. **Paper Towel/Waste Receptacle (J):** Recessed see basis of design product below, stainless steel; seamless wall flanges, continuous piano hinges.
   1. Products:
      a. Basis of Design: BOBRICK Model No. B3974.
      b. Substitutions: Section 01 60 00 - Product Requirements.

D. **Soap Dispenser - Wall (G):** Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.
   1. Products:
      a. BOBRICK Model No. B-26627.
      b. Substitutions: Section 01 60 00 - Product Requirements.

E. **Mirror (D):** Stainless steel framed , 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
   1. Shelf: Stainless steel; gage and finish to match mirror frame, turned down edges, welded to frame; 5 inches (125 mm) deep, full width of mirror.

2. Products:
    a. Bradley Channel-Frame Mirror/Shelf Model 7815 (172nd std).
    b. Substitutions: Section 01 60 00 - Product Requirements.

F. **Mirror ADA (E):** Stainless steel Framed tilt mirror
1. Products:
    a. Bradley Fixed Tilt Mirror Model 740-2436 (172nd std)

G. **Mirror (F):** 1/4 inch thick annealed float glass; ASTM C1036
1. Products:
    a. Bobrick Model No. B165 2460 24 inches by 60 inches.

H. **Grab Bars (A):** Stainless steel, smooth surface.
1. Standard Duty Grab Bars:
    a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
    b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
    c. Finish: Satin.
    d. Length and Configuration: As indicated on drawings.
    e. Products:
        1) Bradley Grab Bar Series 832 (172nd std).
        2) Substitutions: Section 01 60 00 - Product Requirements.

I. **Sanitary Napkin Disposal (C):** Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Products:
    a. Bradley Surface-Mounted Napkin Disposal Model 4781-11 (172nd std).
    b. Substitutions: Section 01 60 00 - Product Requirements.

J. **Baby Changing Station (K):** Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285. Stainless Steel
1. Basis of Design: (172nd std) Bradley Stainless Steel Baby Changing Station 962. Recessed Mounted.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. **Shower Curtain Rod (N):** Stainless steel tube, 1-1/4 inch (32 mm) outside diameter, 0.05 inch (1.3 mm) wall thickness, satin-finished, with 3 inch (75 mm) outside diameter, minimum 0.04 inch (1.0 mm) thick satin-finished stainless steel flanges, for installation with exposed fasteners.
1. Products:
    a. Bradley Shower Curtain Rod Model 9531 (172nd std).
    b. Substitutions: Section 01 60 00 - Product Requirements.

B. **Shower Curtain (O):**
1. Material: Opaque vinyl,.014 inch (___ mm) thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
2. Size: coordinate with shower size inches (____ mm), hemmed edges.
3. Grommets: Stainless steel; pierced through top hem on 6 inch (150 mm) centers.
4. Color: White.
5. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.
6. Products:
    a. Bradley 9537 (172nd std).

b. Substitutions: Section 01 60 00 - Product Requirements.

C. **Shower Seat - Folding (P):** Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand seat.
1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of _____ color.
2. Size: ADA Standards compliant.
3. Products:
a. Bradley B9569 (172nd std).

D. **Soap Shelf - Wall (Q):** Heavy duty, seamless stainless steel, surface-mounted with drain holes, without grab bar, satin finish; with concealed mechanical fastening suitable for substrate and backplate.
1. Products:
a. Schluter Shelf - W - Pure SWS1 D7 EB Brushed Stainless Steel.

E. **Coat Hook (L):** Heavy-duty stainless steel, double-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.
1. Products: Bobrick Surface Mounted Robe Hook - B76727

2.06 UTILITY ROOM ACCESSORIES

A. **Combination Utility Shelf/Mop and Broom Holder (M):** 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
1. Products:
a. Bradley 9633, 4 Hooks/3 Holders (172nd std).
b. Substitutions: 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as correct, and that all required support blocking is installed..

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
1. Grab Bars: As indicated on drawings.
2. Mirrors: As indicated on drawings
3. Other Accessories: As indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

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SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

1.02 RELATED REQUIREMENTS

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

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Larsen’s Manufacturing Co..
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Larsen's Manufacturing Co; _____: www.larsensmfg.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
   1. UL rating 4A:80-B:C, equal to Larsen’s Manufacturing Company, MP10.
   2. Furnish all extinguishers complete with mounting bracket for both in cabinet and direct to wall mounting cabinets.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Configuration: Recessed type.
   1. At other walls: Recessed Cabinets shall be Architectural Series FS-2409-R2, or Equal, solid door with black die-cut letters with Type A lettering style, as manufactured by Larsen’s Manufacturing Company or approved equal. All Fire Extinguisher Cabinets shall comply with the Americans with Disabilities Act. (ADA)

B. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

C. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, at height indicated in drawings.
C. Secure rigidly in place.
D. Place extinguishers in cabinets in locations shown on the Drawings.

END OF SECTION

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SECTION 10 51 26
PLASTIC AND METAL LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic lockers.

B. Metal gear lockers.

C. Locker benches.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and nailers.

1.03 REFERENCE STANDARDS

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan.

D. Samples: Submit two samples 3 by 3 inches (___ by ___ mm) in size, of each color selected.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum [5] years experience in manufacture of solid plastic lockers with products in satisfactory use under similar service conditions.

B. Installer Qualifications: Minimum [5] years experience in work of this Section.

1.07 WARRENTIES

A. Provide manufacturer’s 15 year warranty against breakage, corrosion, and delamination under normal conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Lockers:
   1. Scranton Products; Tuff Tec: www.scrantonproducts.com/#sle.
   2. ASI Storage Solutions; Traditional Plus HDPE Solid Plastic: www.asi-storage.com.
   3. Or approved equal.

B. Metal Lockers:
   1. Penco Products, Inc.; Patriot Fully Framed Welded Gear Lockers; www.pencoproducts.com.
   2. Or approved equal.

2.02 LOCKERS

A. Wardrobe Lockers (at Restrooms and Dorms): Solid plastic lockers, wall mounted with matching closed base and anchored to wall. ST1 and ST3.

1. High impact, high density polyethylene (HDPE) formed under high pressure into solid plastic components with homogeneous color throughout, with smooth orange peel finish.
2. Width: 15 inches (381 mm) (ST1-dorms) and 18 inches (ST3 restrooms).
3. Depth: 18 inches (457 mm).
4. Height: 72 inches (1830 mm).
5. Locker Configuration: Single tier.
6. Locations: as indicated on drawings.
7. Fittings: Size and configuration as indicated on drawings.
8. Ventilation: Slotted Lattice Mesh.
9. Locking: Padlock hasps, for padlocks provided by Owner.
10. Shelves: 1/2"

B. Utility Gear Lockers (at PPE Storage): Heavy Duty Painted Steel, free-standing with matching closed base and anchored to walls. ST5.
1. Width: 24 inches (610 mm).
2. Depth: 18 inches (457 mm).
3. Height: 78 inches (1980 mm).
4. Locker Configuration: Single tier. Double Door.
5. Locations: as indicated on drawings.
6. Fittings:
   a. Upper shelf.
   b. Lock box.
   c. Coat rod.
   d. Hooks: Two double prong.
   e. Split with shelves on one side, wardrobe on the other.
   f. Bottom Drawer
7. Expanded Metal Sides and Doors.

C. Locker Benches: Stationary type; bench top of 1 1/4" lacquered hardwood seat and back; painted steel pedestals. ADA compliant size, height and configuration.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place and secure on prepared base.

C. Install lockers plumb and square.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds (445 N).

E. Install end panels, filler panels, and sloped tops.

F. Install fittings if not factory installed.

G. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

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SECTION 10 56 13
METAL STORAGE SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Four post shelving.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and reinforcement in walls for anchoring shelving units.

B. Section 09 21 16 - Gypsum Board Assemblies: Blocking and reinforcement in walls for anchoring shelving units.

C. Section 10 56 26 - Mobile Storage Shelving: Installation of metal storage shelving on mobile carriages.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Rated uniform shelf loads.
   2. Details of shelving assemblies, including reinforcement.
   3. Accessories.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect for dents, scratches, or other damage. Replace damaged units.

B. Store in manufacturer's unopened packaging until ready for installation.

C. Store under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Four Post Shelving:
   1. Penco Products, Inc; RivetRite: www.pencoproducts.com/#sle.
   2. Tennsco Storage; Z-Line Shelving: www.tennsco.com/#sle.
   3. Or approved equal..

2.02 SHELVING - GENERAL

A. See drawings for layout and sizes.

B. Anchors: Provide anchoring hardware to secure each shelving unit to floor and wall.
   1. Provide hardware of type recommended by manufacturer for substrate.

2.03 FOUR POST SHELVING

A. Four Post Shelving: Steel post-and-beam type with sway bracing, shelving brackets, shelving surfaces, and accessories as specified.
   1. Unit Width: as shown on drawings inches (___ mm), center to center of posts.
   2. Shelf Capacity: Uniform distributed load of 50 psf (2.4 kPa), minimum.
   3. Finish: Baked enamel, medium gloss.

B. Posts and Beams: Formed sheet members; perforations exposed on face of members are not acceptable.
   1. Metal Thickness: 16 gauge, 0.0598 inch (1.52 mm).

2. Post Shape: Tee intermediate posts, angle end posts forming corners.
3. Post Face Width: 2 inches (51 mm), maximum.
4. Connecting Hardware: Manufacturer's standard.

C. Bracing: Formed sheet members.
1. Back Sway Bracing: Either strap or panel; at back of each unit.
2. Side Sway Bracing: Either strap or panel; at each side of each unit.
3. Strap Sway Bracing: One strap installed diagonally, 16 gauge, 0.0598 inch (1.52 mm); welded, riveted, or bolted to uprights.
4. Panel Sway Bracing: Formed sheet metal panels, 20 gauge, 0.0359 inch (0.91 mm); welded, riveted, or bolted to uprights.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is level and that clearances are as specified.

B. Verify that walls are suitable for shelving attachment.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor and reinforce as specified, as indicated on drawings, and as recommended by manufacturer.

C. Install shelving with shelf surfaces level and vertical supports plumb; adjust feet and bases as required.

D. Out-Of-Square Tolerance - Four Post Shelving: Maximum of 1/8 inch (3 mm) difference in distance between bottom shelf and canopy top, measured along any post in any direction.

3.04 CLEANING

A. Clean shelving and surrounding area after installation.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 10 75 00
FLAGPOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete base and foundation construction.

B. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2012.

B. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles:
   1. American Flagpole; _____: www.americanflagpole.com/#sle.
   2. Or approved equal.

2.02 FLAGPOLES

A. Flagpoles: Designed in accordance with NAAMM FP 1001.
   1. Material: Aluminum.
   2. Design: Straight shaft.
   3. Mounting: Ground mounted type.
   4. Nominal Height: 25 ft (_____ m); measured from nominal ground elevation.
   5. Halyard: Interior type.
   6. Provide 1 Flagpole at Main Stations and 1 Flagpole at Satellite Station.

2.03 POLE MATERIALS

A. Aluminum: ASTM B241/B241M, 6063 alloy, T6 temper.

2.04 ACCESSORIES

A. Finial Ball: Aluminum, 6 inch (150 mm) diameter.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Cleats: 9 inch (230 mm) size, aluminum with galvanized steel fastenings, two per halyard.

D. Cleat Box: Aluminum, with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.

E. Halyard: 5/16 inch (8 mm) diameter polypropylene, braided, white.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 11 30 13
RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Kitchen appliances.

B. Laundry appliances.

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping: Plumbing connections for appliances.

B. Section 26 05 83 - Wiring Connections: Electrical connections for appliances.

1.03 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

A. **Main Station:**

1. SEE APPLIANCE LEGEND AND DRAWINGS FOR LOCATIONS AND QUANTITIES. (#) INDICATES NUMBER ON APPLIANCE LEGEND.
2. Range/Oven (1) : _____, _____, with _____.
    a. Manufacturers:
        1) WOLF MODEL GR484DG OR EQUAL.
            (a) 4 Dual-stacked sealed burners, infrared dual griddle
            (b) Stainless Steel
3. Dishwasher (2): _____, _____, and _____.
    a. Manufacturers:
        1) VIKING MODEL VDWU324 OR EQUAL.
            (a) Stainless Steel
4. Refrigerator (3): _____, _____, and _____.
    a. Manufacturers:
        1) HOSHIZAKI MODEL R1A-FS(L), or Equal..
            (a) One Section Reach-In
            (b) Solid Door
            (c) Stainless Steel
5. Freezer (4) : _____, _____, with _____.
    a. Manufacturers:

1) HOSHIZAKI MODEL F1A-FS(L)OR EQUAL.
(a) One Section Reach-In
(b) Solid Door
(c) Stainless Steel

6. Under Counter Refrigerator (5) : _____, _____, with _____.
a. Manufacturers:
1) WHIRLPOOL MODEL WUR35X24HZ OR EQUAL.
(a) Stainless Steel

7. Ice Maker (6) : _____, _____, with _____.
a. Manufacturers:
1) HOSHIZAKI MODEL IM-200BAA OR EQUAL.
(a) Self-Contained Square Cuber with Built-In Storage Bin
(b) Air-cooled
(c) Stainless Steel

8. Microwave Oven (7) : _____, _____, with _____.
a. Manufacturers:
1) VIKING MODEL VMOS501 OR EQUAL.
(a) 2.0 Cubic Ft
(b) Stainless Steel

B. **Satellite Station: ABI #1**
1. SEE APPLIANCE LEGEND AND DRAWINGS FOR LOCATIONS AND QUANTITIES. (#) INDICATES NUMBER ON APPLIANCE LEGEND.
2. Range/Oven (1) : _____, _____, with _____.
a. Manufacturers:
1) WOLF MODEL GR364G OR EQUAL.
(a) 4 Dual-stacked sealed burners, infrared griddle
(b) Stainless Steel

3. Dishwasher (2): _____, _____, and _____.
a. Manufacturers:
1) VIKING MODEL VDWU324 OR EQUAL.
2) Substitutions: See Section 01 60 00 - Product Requirements.

4. Refrigerator/Freezer (3): _____, _____, and _____.
a. Manufacturers:
1) LIEBHERR MODEL CS1400R-IM, OR EQUAL.
(a) Free Standing/Semi Built In Combination Refrigerator/Freezer
(b) Stainless Steel

5. Ice Maker (6) : _____, _____, with _____.
a. Manufacturers:
1) HOSHIZAKI MODEL IM-200BAA OR EQUAL.
(a) Self-Contained Square Cuber with Built-In Storage Bin
(b) Air-Cooled
(c) Stainless Steel

6. Microwave Oven (7) : _____, _____, with _____.
a. Manufacturers:
1) VIKING MODEL VMOS501 OR EQUAL.
2) 2.0 Cubic Ft
3) Stainless Steel

2.02 LAUNDRY APPLIANCES

A. **Main Station:**
1. SEE APPLIANCE LEGEND AND DRAWINGS FOR LOCATIONS AND QUANTITIES. (#) INDICATES NUMBER ON APPLIANCE LEGEND.

2. Clothes Washer/Extractor (10): Commercial.
   a. Manufacturers:
      1) UNIMAC MODEL UWT045N2 OR EQUAL.
3. Tumble Dryer (11): Commercial.
   a. Manufacturers:
      1) UNIMAC MODEL UTO55NVN OR EQUAL.
4. Clothes Washer (12): Residential..
   a. Manufacturers:
      1) ELECTROLUX MODEL EFLW427UIW OR EQUAL.
5. Clothes Dryer (13): Residential..
   a. Manufacturers:
      1) ELECTROLUX MODEL EFDE317TIW OR EQUAL.

B. **Satellite Station:**
1. SEE APPLIANCE LEGEND AND DRAWINGS FOR LOCATIONS AND QUANTITIES. (#) INDICATES NUMBER ON APPLIANCE LEGEND.
2. Clothes Washer (12): Residential..
   a. Manufacturers:
      1) ELECTROLUX MODEL EFLW427UIW OR EQUAL.
3. Clothes Dryer (13): Residential..
   a. Manufacturers:
      1) ELECTROLUX MODEL EFDE317TIW OR EQUAL.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor built-in equipment in place.

3.02 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION

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SECTION 12 24 00
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades at ALL Dorm Room Windows (Main and Satellite) and Training Room Windows at Main Station.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

A. WCMA A100.1 - Safety of Corded Window Covering Products; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

B. Selection Samples: Include fabric samples in full range of available colors and patterns.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.06 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
   2. Fabric: One year.
   3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Hunter Douglas Architectural; RB500 Manual Roller Shades: www.hunterdouglasarchitectural.com/#sle.
   2. Or approved equal.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades Type 1:
   1. Basis of Design: Hunter Douglas RB 500 Standard Duty+ .
   2. Description - Interior Roller Shades: Double roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
      a. Mounting: Window jamb mounted- inside, between jambs.

3. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
   a. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
4. Roller Tubes: As required for type of shade operation.
5. Hembars: Designed to maintain bottom of shade straight and flat.
6. Manual Operation for Interior Shades:
   a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
   b. Drive Chain: Continuous loop beaded ball chain, 95 pounds (43 kg) minimum breaking strength. Provide upper and lower limit stops.
   c. Chain Retainer:
      1) Chain tensioning device complying with WCMA A100.1.
7. Accessories:
   a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.
   b. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

A. Fabric for Light-Filtering Shades: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Manufacturers:
      a. Hunter Douglas Architecural; Sheerweave 3%. Or approved equal.
   2. Color: As selected by Architect from manufacturer’s full range of colors

B. Fabric for Room-Darkening Shades: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Manufacturers:
      a. Hunter Douglas Architecural; Sheerweave 0%. Or approved equal.
   2. Color: As selected by Architect from manufacturer’s full range of colors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

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SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework.

B. Section 22 40 00 - Plumbing Fixtures: Sinks.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 21 00 - Allowances, for cash allowances affecting this section.

B. See Section 01 23 00 - Alternates, for product alternates affecting this section.

1.04 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

E. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.

F. MIA (DSDM) - Dimensional Stone Design Manual; VII, 2007.

G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Installation Instructions: Manufacturer's installation instructions and recommendations.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

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/#sle.

2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
   1. Flat Sheet Thickness: 1-1/4 inch (32 mm), minimum.
   2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Manufacturers:
         1) BPI Prestigestone by Building Plastics Inc.; www.bpiprestige.com or approved equal.
      b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
      c. Finish on Exposed Surfaces: Polished.
      d. Color and Pattern: As selected by Architect from manufacturer's full line.
   3. Other Components Thickness: 3/4 inch (19 mm), minimum.
   4. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.

2.02 MATERIALS

A. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches (102 mm), unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.

C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 12 50 00
FURNITURE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Office Furniture.

B. Seating.

C. Dormitory Furniture.

D. Miscellaneous Furniture.

1.02 RELATED REQUIREMENTS

A. Section 23 01 01: Electrical General Provisions.

B. Section 26 05 33: Raceways and Boxes for Electrical Systems.

C. Section 26 27 26: Wiring Devices.

D. Section 27 10 05: Structured Cabling for Voice and Data.

1.03 PRICE AND PAYMENT PROCEDURES

A. Provide the scope of work described in this Section and in the Drawings utilizing the GSA Multiple Award Schedule Contract Program.

1. Upon General Contract Award, Owner will provide a Letter of Authorization to the General Contractor that:
    a. Authorizes the General Contractor to place orders under the GSA Multiple Award Schedule program as an alternative source in procuring equipment and supplies for services for the exclusive use and ownership of the Government.
    b. Requires the General Contractor to comply with the applicable acquisition policies and procedures prescribed in FAR 51.1, particularly FAR 51.103, regarding purchasing from GSA Multiple Award Schedule contracts.
    c. Required the General Contractor to reference the Letter of Authorization and the contract number on any delivery orders issued sugject to this authority.
    d. Provide the General Contractor with the statement required on the Schedule Purchase Order.
    e. Limits the authority to purchase under the Schedule to this Project.
    f. Requires the General Contrac to maintain records for all propserty or services acquired under this authorization, including orders, receipts, inspections, usage, and payments.

B. Price and Payment procedures will align with the GSA Multiple Award Schedule Contract Program.

1.04 SUBMITTALS

A. Design, Layout, and Shop Drawings.

B. Finishes have been specified for pricing purposes. Provide two Finish Samples for each specified finish for Architect's verification prior to order.

C. For Finishes specified by grade, provide full range of finishes/fabrics for Architect's selection prior to order.

D. Product Warranties.

E. Other Submittals as required by the GSA Multiple Award Schedule Contract Program.

F. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Provide the products described on the Furniture Schedules on the Drawings.

PART 3 EXECUTION

3.01 SCOPE OF WORK

A. Provide all furniture in these Specifications and in the Drawings. Proivde all design, production, fabrication, delivery, setup, coordination, installation, and cleanup as as required for complete and functioning furniture components and systems and as described herein.
   1. Design, Layout and Shop Drawings. Convert all products into developed plans and lists of components that are in complance with the Documents and with local, state, and federal code requirements. Provide plans and 3D renderings with product labels and finish selections for each typical furniture component or system. Include all product labels to align with the Documents.
   2. Coordination. Coordinate with the general construction including verifying as-built dimensions prior to fabrication and coordinating accessories and components with communications and electrical components and systems.
   3. Field Inspection. Inspect the site prior to installation and notify the Architect of any discrepancies or concerns prior to beginning installation.
   4. Installation. Provide full installation services utilizing qualified installers as described herein. Damaged and/or missing product will be provided/replaced by the contractor with no additional cost to the Owner.
   5. Clean Up. Remove all debris, packing, and crating materials.
   6. Protect In Place Construction. Protect in place construction from damage during furniture installation. Repair any damage at no additional cost to the Owner.

B. Integrated Power and Data. General Contractor shall provide the installation of appropriate whips at floor boxes and the connection of power and data to all furniture items specified with integrated power and data components.

3.02 PROTECTION

A. Protect installed furniture from subsequent construction operations.

END OF SECTION

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SECTION 14 24 00
HYDRAULIC ELEVATORS

P1 GENERAL

1.01 SUMMARY

A. This section specifies hydraulic elevators.

B. Work Required
   1. The work required under this section consists of all labor, materials and services required for the complete installation (including operational verification) of all the equipment required for the elevator(s) as herein specified.
   2. All work shall be performed in a first class, safe and workmanlike manner.
   3. In all cases where a device or part of the equipment is herein referred to in the singular, it is intended that such reference shall apply to as many of such devices or parts as are required to make complete installation.

1.02 RELATED SECTIONS

A. The following sections contain requirements that relate to this section and are performed by trades other than the elevator manufacturer/installer.
   1. Section 01 50 00 - Temporary Facilities and Controls: protection of floor openings and personnel barriers; temporary power and lighting.
   2. Section 03 30 00 - Cast-In-Place Concrete: elevator pit, elevator motor and pump foundation, and grouting thresholds.
   3. Section 04 20 00 - Unit Masonry: masonry hoistway enclosure, building-in and grouting hoistway doorframes, and grouting of sills.
   4. Section 05 50 00 - Metal Fabrications: pit ladder, divider beams, supports for entrances and rails, and hoisting beam at top of elevator hoistway.
   5. Section 23 50 00 - Heat Generation Equipment: ventilation and temperature control of elevator equipment areas.
   6. Section 26 05 00 - Common Work Results for Electrical:
      a. Main disconnects for each elevator.
      b. Electrical power for elevator installation and testing.
      c. Disconnecting device to elevator equipment prior to activation of sprinkler system.
      d. The installation of dedicated GFCI receptacles in the pit and overhead.
      e. Lighting in controller area, machine area and pit.
      f. Wiring for telephone service to controller.
   7. Section 26 30 00 - Emergency (Standby) Power Supply Systems: emergency generator for elevator operation.
   8. Section 27 30 00 - Voice Communications: ADAAG-required emergency communications equipment.
   9. Section 28 31 00 - Fire Alarm Systems: fire and smoke detectors at required locations and interconnecting devices; fire alarm signal lines to contacts in the machine area.
   10. Section 31 10 00 - Site Clearing: excavation for cylinder well casing.

1.03 REFERENCES

A. Comply with applicable building and elevator codes at the project site, including but not limited to the following:
   1. ASME A17.1/CSA B44, Safety Code for Elevators and Escalators.
   2. ASME A17.7/CSA B44, Performance-Based Safety Code for Elevators and Escalators.
   3. ADAAG, American Disabilities Act Accessibility Guidelines.

4. ANSI A117.1, Building and Facilities, Providing Accessibility and Usability for Physically Handicapped People.
5. ANSI/NFPA 70, (NEC) National Electrical Code.
6. CAN/CSA C22.1, (CEC) Canadian Electrical Code.
7. ANSI/UL 10B, Standard for Fire Test of Door Assemblies.
8. CAN/ULC-S104-10, Standard Method for Fire Test of Door Assemblies.
9. ANSI/NFPA 80, Standard for Fire Doors and Other Opening Protectives.
10. Building Codes IBC or NBCC.
11. All Local Jurisdictional applicable codes.

1.04 SYSTEM DESCRIPTION

A. Equipment Description: Hole-less Hydraulic elevator with remote machine room - See Drawings.

B. Equipment Control: Elevonic® Control System, or equal.

C. Quantity of Elevators: 1

D. Elevator Stop Designations: FIRST FLOOR, SECOND FLOOR

E. Stops: 2

F. Openings: (Select)
   1. In-Line

G. Travel (maximum): 17’-6”

H. Rated Capacity:
   1. 2100 lb.

I. Rated Speed:
   1. 100 fpm

J. Platform Size:
   1. 2100 Front (5’-9 ½” W x 4’-11 1/8” D)

K. Clear Inside Dimensions: (Select)
   1. 2100 Front (5’-8 5/16” W x 4’-3 9/16” D)

L. Cab Height: (Select)
   1. 7’-9”

M. Clear Cab Height: (Select)
   1. 7’-4 3/8” with 5/16” Floor Recess and Dropped 6 LED or Perimeter Lit Ceiling

N. Entrance Type and Width: (Select)
   1. 2100 (Single-Slide Door - 36” (914 mm))

O. Entrance Height: (Select)
   1. 7’-0” (2134 mm)

P. Main Power Supply: [208,] volts, three-phase, 60 Hz ± 5% of normal, with a separate equipment grounding conductor.

Q. Car Lighting Power Supply: 120 volts, single-phase, 15 amps, 60 Hz.

R. Machine Location: No machine-room required, tank and controller in hoistway pit.

S. Signal Fixtures: Manufacturer’s standard with stainless steel metal button targets (excluding CA).

T. Controller Location: Inside hoistway, accessible by a door in a side hoistway wall on the 1st or 2nd landing. (1st landing only if rear entrance). For front opening only, the machine and controller can be located at the rear of the hoistway.

U. Stopping Accuracy: ± 1/4” (6.4 mm) under any loading condition or direction of travel.

V. Operation:
   1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

W. Operation Features - Standard
   1. Full Collective Operation
   2. Anti-nuisance.
   3. Fan and Light Protection.
   4. Independent Service.
   5. Firefighters' Service Phase I and Phase II
   6. Top of Car Inspection.

X. Door Control Features:
   1. Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.
   2. Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person.
   3. Door protection shall consist of a two dimensional, multi-beam array projecting across the car door opening.
   4. Door nudging operation to occur if doors are prevented from closing for an adjustable period of time.

Y. Provide equipment according to seismic zone:
   1. Zone 1

1.05 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for each system proposed for use. Include the following:
   1. Signal and operating fixtures, operating panels and indicators.
   2. Cab design, dimensions and layout.
   3. Hoistway-door and frame details.
   4. Electrical characteristics and connection requirements.
   5. Expected heat dissipation of elevator equipment in hoistway (BTU).
   6. Color selection chart for Cab and Entrances.

B. Shop Drawings: Submit approval layout drawings. Include the following:
   1. Car, guide rails, buffers, and other components in hoistway.
   2. Maximum rail bracket spacing.
   3. Maximum loads imposed on guide rails requiring load transfer to building structure.
   4. Clearances and travel of car.
   5. Clear inside hoistway and pit dimensions.
   6. Location and sizes of access doors, hoistway entrances and frames.

C. Operations and Maintenance Manuals: Provide manufacturer's standard operations and maintenance manual.

1.06 QUALITY ASSURANCE

A. Manufacturer: Elevator manufacturer shall be ISO 9001 certified.

B. Manufacturer shall have a minimum of fifteen years experience in the fabrication, installation and service of elevators.

C. Installer: Elevators shall be installed by the manufacturer.

D. Permits, Inspections and Certificates: The Elevator Contractor shall obtain and pay for necessary Municipal or State Inspection and permit as required by the elevator inspection authority, and make such tests as are called for by the regulations of such authorities. These tests shall be made in the presence of such authorities or their authorized representatives.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Should the building or the site not be prepared to receive the elevator equipment at the agreed upon date, the General Contractor will be responsible to provide a proper and suitable storage area on or off the premises.

B. Should the storage area be off-site and the equipment not yet delivered, then the elevator contractor, upon notification from the General Contractor, will divert the elevator equipment to the storage area. If the equipment has already been delivered to the site, then the General Contractor shall transport the elevator equipment to the storage area. The cost of elevator equipment taken to storage by either party, storage, and redeliver to the job site shall not be at the expense of the elevator contractor.

1.08 WARRANTY

A. The elevator contractor's acceptance is conditional on the understanding that their warranty covers defective material and workmanship. The warranty period shall not extend longer than one (1) year from the date of completion or acceptance thereof by beneficial use, whichever is earlier, of each elevator. The warranty excludes: ordinary wear and tear, improper use, vandalism, abuse, misuse, or neglect or any other causes beyond the control of the elevator contractor and this express warranty is in lieu of all other warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.

1.09 MAINTENANCE AND SERVICE

A. Maintenance service consisting of regular examinations and adjustments of the elevator equipment shall be provided by the elevator contractor for a period of (6) six months after the elevator has been turned over for the customer's use. This service shall not be subcontracted but shall be performed by the elevator contractor. All work shall be performed by competent employees during regular working hours of regular working days. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator contractor. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.

B. The elevator control system must:
   1. Provide in the controller the necessary devices to run the elevator on inspection operation.
   2. Provide on top of the car the necessary devices to run the elevator in inspection operation.
   3. Provide in the controller an emergency stop switch. This emergency stop switch when opened disconnects power from the brake and prevents the motor from running.

C. Provide system capabilities to enable a remote expert to create a live, interactive connection with the elevator system to enable the following functions:
   1. Remotely diagnose elevator issues with a remote team of experts
   2. Remotely return an elevator to service
   3. Provide real-time status updates via email

4. Remotely make changes to selected elevator functions including:
   a. Control building traffic: Restrict floor access, remove car from group operation, shut down elevator, select up peak/down peak mode, activate independent service.
   b. Conserve energy: Activate cab light energy save mode, activate fan energy save mode, shut down car(s).
   c. Improve passenger experience: Extend door open times, change parking floor, activate auto car full, activate anti-nuisance, advance door opening, door nudging, extend specific floor extended opening time, release trapped passengers.

1.10 P2 PRODUCTS

1.11 MANUFACTURER

A. Manufacturer: Design based upon Otis HydroFit, OR EQUAL.

1.12 DESIGN AND SPECIFICATIONS

A. Provide holeless hydraulic elevators from Otis Elevator Company, or equal. The control system and car design based on materials and systems manufactured by Otis Elevator Company. Specifically, the system shall consist of the following components:
   1. OPTIONAL REMOTE MACHINE ROOM.
   2. Sleep mode operation for LED ceiling lights and car fan.
   3. LED lighting standard in ceiling lights and elevator fixtures.

1.13 EQUIPMENT: MACHINE COMPONENTS

A. The hydraulic system shall be of compact design suitable for operation under the required pressure. The power component shall be mounted in the hydraulic-fluid storage tank. The control valve shall control flow for up and down directions hydraulically and shall include an integral check valve. A control section including control solenoids shall direct the main valve and control: up and down starting, acceleration, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering. All of these functions shall be fully adjustable for maximum smoothness and to meet contract conditions. System to be provided with a low-pressure switch and a shut-off valve.

B. The entire hydraulic system with hydraulic-fluid storage tank, power component and valves shall be located in the hoistway pit and be easily accessible for maintenance through an access door in the hoistway wall. An optional remote machine room is available.

C. A microprocessor-based controller shall be provided, including necessary starting switches together with all relays, switches, solid-state components and hardware required for operation, including door operation, as described herein. A three (3) phase overload device shall be provided to protect the motor against overloading.

D. The controller shall be located together with the hydraulic system in the hoistway pit and be easily accessible for maintenance through the same access door that is also used for the hydraulic system. The controller will be located in the optional remote machine room if selected.

E. A manual lowering feature shall permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.

F. Pressure Switch

1.14 EQUIPMENT: HOISTWAY COMPONENTS

A. Plunger(s) and Cylinder(s): Each cylinder shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure. The top of each

cylinder shall be equipped with a cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing. Each plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. Each plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder. Each plunger and cylinder shall be installed plumb and shall operate freely with minimum friction.

B. Car Guide Rails: Tee-section steel rails with brackets and fasteners.

C. Polyurethane type buffers shall be used.

D. Wiring: Wiring for hoistway electrical devices included in scope of the elevator system, hall panels, pit emergency stop switch, and the traveling cable for the elevator car.

E. Hoistway Entrances:
   1. Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of UL fire rated steel.
   2. Sills shall be extruded:
      a. Aluminum
   3. Doors: Entrance doors shall be of metal construction with vertical channel reinforcements.
   4. Fire Rating: Entrance and doors shall be UL fire rated for 1-1/2 hour for M1, M2, M3, D1, and D2 entrance arrangements or 1 hour for D3 entrance arrangements.
   5. Entrance Finish:
      a. Finish:
      b. Satin Stainless Steel
      c. Color to be selected from the manufacturer's color chart.
   6. Entrance Marking Plates: Entrance jambs shall be marked with 4” x 4” (102 mm x 102 mm) plates having raised floor markings with Braille located adjacent to the floor marking. Marking plates shall be provided on both sides of the entrance.
   7. Sight Guards: Sight guards will be furnished with all doors painted to match with painted doors, painted black for stainless steel doors.
   8. (Optional) Fascia: Galvanized sheet steel shall be provided at the front of the hoistway.

1.15 EQUIPMENT: CAR COMPONENTS

A. Cab:
   1. Standard Cab Options:
      a. Steel Shell Cab with stainless steel wall panels

B. Car Front Finish: Satin Stainless Steel.

C. Car Door Finish: Satin Stainless Steel.

D. Ceiling Type: (Select)
   1. Drop Ceiling - LED Perimeter-Lit Ceiling

E. Ceiling Finish: (Select)
   1. Brushed Steel Finish

F. Emergency Car Lighting: An emergency power unit employing a 6-volt sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car in the event of building power failure.

G. Fan: A one-speed 120 VAC fan will be mounted to the ceiling to facilitate in-car air circulation, meeting A17.1 code requirements. The fan shall be rubber mounted to prevent the transmission of structural vibration and will include a baffle to diffuse audible noise. A switch shall be provided in the car-operating panel to control the fan.

H. Handrails shall be provided on the [side walls, rear wall, side and rear walls] of the car enclosure. Handrails shall be: (Select)
   1. 3/8" x 2" (9.5 mm x 51 mm) Flat Tubular Handrail with a Brushed Steel Finish

I. Threshold: (Select)
   1. Extruded Aluminum

J. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

K. Guides: Car roller type guides at the top and the bottom.

L. Platform: Car platform shall be constructed of metal.

M. The LED ceiling lights and the fan should automatically shut off when the system is not in use and be powered back up after a passenger calls the elevator and pushes a hall button.

1.16 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: A car operating panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. The car operating panel shall have a satin stainless steel finish.
   1. A car operating panel shall be furnished. It shall contain a bank of round stainless steel, mechanical LED illuminated buttons. Flush mounted to the panel and marked to correspond to the landings served. All buttons to have raised numerals and Braille markings with:
      a. Flat Flush Mounted or 1/8" (3mm) satin stainless steel button with blue or white LED illuminating halo
   2. The car operating panel shall be equipped with the following features:
      a. Raised markings and Braille to the left hand side of each push-button.
      b. Car Position Indicator at the top of and integral to the car operating panel.
      c. Door open and door close buttons.
      d. Inspection key-switch.
      e. Elevator Data Plate marked with elevator capacity and car number.
      f. Help Button: The help button shall initiate two-way communication between the car and a location inside the building, switching over to another location if the call is unanswered, where personnel are available who can take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
      g. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator.
   3. Note: Below are Standard for USA and optional in Canada.
      a. In car stop switch (toggle or key unless local code prohibits use)
      b. Firefighter's hat (standard USA)
      c. Firefighter's Phase II Key-switch (standard USA)
      d. Call Cancel Button (standard USA)

B. Car Position Indicator: A digital, LED car position indicator shall be integral to the car operating panel.

C. Hall Fixtures: Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Hall fixtures shall have a

1. Integral Hall fixtures shall feature round stainless steel, mechanical buttons marked to correspond to the landings. Hall fixtures to be located in the entrance frame face or the wall. Buttons shall be in vertically mounted fixture. Fixture shall be satin stainless steel finish.
2. Button Options:
   a. Flat Flush Mounted or 1/8" (3mm) satin stainless steel button with blue or white LED illuminating halo

D. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.

1.17 EXECUTION

1.18 PREPARATION

A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

1.19 INSTALLATION

A. Installation of all elevator components except as specifically provided for elsewhere by others.

1.20 DEMONSTRATION

A. The elevator contractor shall make a final check of each elevator operation with the Owner or Owner's representative present prior to turning each elevator over for use. The elevator contractor shall determine that control systems and operating devices are functioning properly.

END OF SECTION

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SECTION 21 13 00
FIRE PROTECTION SYSTEM

PART 1 GENERAL

1-01 SCOPE

A. The work under this section shall include furnishing and installing all materials for the complete installation of the following:

Wet Pipe Sprinkler System
Connections to Fire Alarm System

and shall apply to all phases of work specified, shown on the drawings or reasonably required to provide for the complete installation of approved fire protection systems for the project. This structure is classed as fully sprinklered.

B. Fire protection system shall be in accordance with the following industry standards:

AWWA C110	Ductile Iron and Gray Iron Fittings, 3 inch thru 48 inch, for Water and other Liquids
AWWA C151	Ductile Iron Pipe, Centrifugally Cast, for Water and other Liquids
AWWA C651	Disinfecting Water Mains
NFPA 13	Installation of Sprinkler Systems
NFPA 24	Installation of Private Fire Service Mains and Their Appurtenances
NFPA 70	National Electrical Code
IBC	International Building Code
UL FPED	Fire Protection Equipment Directory
UL 262	Gate Valves for Fire-Protection Service
UL 789	Indicator Posts for Fire-Protection Service
UFC 3-600-01	Fire Protection Engineering for Facilities

1-02 GENERAL

A. The contractor for the fire protection installation shall be a NICET III Certified, qualified Fire Protection Contractor, and regularly engaged in the installation of Automatic Fire Sprinkler Systems and other Fire Protection Equipment.

B. All materials, equipment valves and devices installed and/or furnished under this section shall be listed and/or approved for use in the fire protection installation by the authorities, agencies, codes and standards named in this section of the specifications.

C. Refer to: Underwriters' Laboratories Approved Fire Protection Equipment List.

D. Any permits for the installation or construction of any of the work included in this section which are required by any of the authorities and/or agencies having jurisdiction shall be obtained and paid for by the Fire Protection Contractor.

E. This project shall be installed to meet UFC 3-600-01, Fire Protection Engineering for Facilities. Where this specification or NFPA 13 conflicts with UFC 3-600-01 the UFC 3-600-01 shall prevail.

1-03 SYSTEM DESIGN

A. Design automatic wet pipe sprinkler system in accordance with the required and advisory provisions of NFPA 13 and UFC 3-600-01 (where conflicts arise between NFPA 13 and UFC 3-600-1 the UFC-3-600-1 shall prevail), by hydraulic calculations for uniform distribution of water over the design area. The fire protection system for this building shall be classified generally as Light Hazard, except for mechanical and storage rooms. Pipe sizes shall be determined by hydraulic calculation.

1-04 GUARANTEE

A. The entire fire protection installation, as specified under this section of the specifications, shall be guaranteed for one (1) year against defective equipment, materials and workmanship. The guarantee period is to begin on the date of acceptance of the project by the Owner.

B. The guarantee shall not be construed as requiring the Fire Protection Contractor to render service or maintenance required in the normal operation of the equipment, or to make repairs that may be needed due to normal wear and tear or the Owner's negligence, abuse, or breakage.

1-05 INSPECTIONS AND TESTS

A. All inspections, examinations and tests required by the authorities and/or agencies specified shall be arranged and paid for by the Fire Protection Contractor, as necessary to obtain complete and final acceptance of the Fire Protection System. The Fire Protection Contractor shall deliver certificates of all such inspections to the Project Engineer

1-06 EXISTING MAIN PRESSURES AT SITE

A. Use flow test information noted on the drawings.

B. The actual locations of mains, branch mains and sprinkler heads should be coordinated with other trades and shall meet all Code requirements.

C. The locations shown for items such as standpipes with hose valves, control valves, zone boundaries, etc., have been coordinated with the architectural and mechanical requirements, any deviations from the locations shown for this equipment should be verified.

1-07 SUBMITTALS

A. Hydraulic calculations

B. Manufacturer's Catalog Data

1. Pipe and fittings
2. Alarm valves
3. Valves, including gate, check and globe
4. Water motor alarms
5. Sprinkler heads
6. Pipe hangers and supports
7. Pressure or flow switch
8. Fire department connections

9. Mechanical couplings

C. Shop drawings

1. Sprinkler heads and piping system layout
2. Electrical wiring diagrams
   a. Sprinkler Heads and Piping System Layout: Prepare 30- by 42-inch detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)." Show data essential for proper installation of each system. Show details, plan view, elevations, and sections of the systems supply and piping. Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams. These drawings shall have reviewed, approved and stamped by the appropriate fire department prior to submission to Engineer.

1-08 SPRINKLER RISERS

A. Riser(s) to sprinkler system shall contain electric alarm which operates on either DC or AC when activated by water flow indicator. Water flow indicators shall be approved paddle type water flow alarm switch, instantaneously recycling with pneumatic retard with double set of contacts each rated at 15 amps 120 volt AC or .5 amps 120 volt DC. Switches shall be fully compatible with fire alarm system.

B. A standard installation of automatic sprinklers arranged as a wet pipe system should be installed as required by the computerized hydraulic analysis.

C. Connection to the water supply system shall be made where indicated on the drawings.

D. The water piping, valving, sprinkling equipment and hose connections shall be installed complete in all respects.

PART 2 PRODUCTS (all materials shall be of domestic manufacture)

2-01 ABOVEGROUND PIPING SYSTEMS: Provide fittings for changes in direction of piping and for connections. Make changes in piping sizes through tapered reducing pipe fittings; bushings will not be permitted. Perform welding in the shop; field welding will not be permitted. Conceal piping in areas with suspended ceiling and exposed in mechanical room.

A. Sprinkler Pipe and Fittings: NFPA 13, except as modified herein. Steel piping shall be Schedule 40/10 for sizes less than 8 inches. Fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded shall be welded, threaded, or grooved-end type. Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into the pipe when pressure is applied will not be permitted. Rubber gasketed grooved-end pipe and fittings with mechanical couplings shall be permitted in pipe sizes 1.5 inches and larger. Fittings shall be UL FPED listed for use in wet pipe sprinkler systems. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer. Steel piping with wall thickness less than Schedule 30 shall not be threaded. Side outlet tees using rubber gasket fittings shall not be permitted.

B. Sprinkler Heads: Provide nominal 0.50-inch or 0.53-inch orifice sprinkler heads. Release element of each head shall be of the intermediate temperature rating or higher as suitable for the specific application. Provide polished stainless steel ceiling plates or chromium-plated finish on copper alloy

ceiling plates, and chromium-plated pendent sprinklers below suspended ceilings. Ceiling plates shall not be more than 0.5 inch deep. Ceiling cups shall not be permitted. Provide upright sprinkler heads in spaces with no ceilings.

C. Cabinet: Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. The number and types of extra sprinkler heads shall be as specified in NFPA 13.

D. Alarm Valves: Provide variable pressure type alarm valve complete with retarding chamber, alarm test valve, alarm shutoff valve, drain valve, pressure gages, accessories, and appurtenances for the proper operation of the system.

2-02 ALARMS

A. Water Motor Alarm: Provide alarms of the approved weatherproof and guarded type, to sound locally on the flow of water in each corresponding sprinkler system. Mount alarms on the outside of the outer walls of each building, at a location as indicated.

B. Fire Alarm: Provide equipment for the automatic transmittal of an alarm over the building fire alarm system and arrange to actuate by detection system and by the flow of water in each sprinkler system. Provide supervision of detection and actuation circuits.

2-03 UNDERGROUND FIRE LINE

A. Contractor shall connect fire protection main to existing water main as indicated on Plans.

B. Underground pipe and fittings shall be listed in:
1. Underwriters' Laboratories - Approved Fire Protection Equipment List and shall be in accordance with AWWA C151.

C. Underground pipe shall be PVC AWWA C900 type, as required by the authorities having jurisdiction.

D. Underground fittings shall have joints and pressure class rating compatible with the pipe used.

E. All underground piping for fire mains shall be installed, clamped and anchored, flushed, and hydrostatically tested.

F. Where the underground supplies are exposed on the exterior of the building install 1” of fiberglass insulation with aluminum jacket.

2-04 VALVE PIT

A. Valve pits shall be furnished and constructed by the Fire Protection Contractor as shown on the drawings.

2-05 PROTECTION OF EXISTING UTILITIES

A. Existing utilities that are shown on the drawings or locations of which is made known prior to excavation shall be protected from damage during the excavation and backfilling of trenches, and if damaged, shall be repaired promptly by the Contractor at his expense.

B. Any existing utility that is not shown on the drawings or the location of which is not known in sufficient time to avoid damage, if inadvertently damaged during excavation, shall be repaired promptly by the Contractor. In any event, repair shall be made under the supervision of the utility concerned.

2-06 REPAIR OF PAVEMENT, DRIVES AND SIDEWALKS

A. Where necessary to cut pavements, drives, sidewalks, or other permanent surfaces, the cuts shall be made with neat lines and a minimum width of one foot greater than the width of the trench. Cut material shall be disposed of by the Contractor.

B. The surfaces that are cut shall be restored to a condition at least equivalent to the condition existing before the cut was made.

C. Concrete shall be finished to match surrounding surfaces as neatly as possible. Concrete for repair work shall be as specified hereinbefore.

2-07 FIRE DEPARTMENT HOSE CONNECTIONS

A. The fire department hose connection shall be provided. Threads on connection shall match local fire department threads.

B. Connection shall be plain finished with "AUTO SPKR" branded on top.

PART 3 EXECUTION

3-01 INSTALLATION

A. Installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with NFPA 13, except as modified herein. Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings. Keep the interior and ends of new piping and existing piping affected by Contractor's operations thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter. Inspect piping before placing into position.

B. Electrical Work: Provide electrical work associated with this section under Division 26-28, except for control and fire alarm wiring. Provide fire alarm system control and fire alarm wiring, including connections to fire alarm systems, in accordance with NFPA 70. Provide wiring in rigid metal conduit or intermediate metal conduit, except electrical metallic tubing conduit may be used in dry locations not enclosed in concrete or where not subject to mechanical damage.

C. Disinfection: Disinfect the new water piping affected by Contractor's operations in accordance with AWWA C651. Exercise caution when mixing chlorine disinfectant solutions. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit results prior to new water piping being place into service. Disinfection of system supplied by nonpotable water is not required.

D. Connections to Existing Water Supply Systems: Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure. Bolt sleeves around the main piping; bolt valve to the branch connection. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Engineer in writing at least 15 days prior to connection date; receive approval before any service is interrupted. Furnish materials required to make connections into existing water supply systems, and perform excavating, backfilling, and other incidental labor as required. Furnish the labor and the tapping or drilling machine for making the actual connections to existing systems. Please note that the existing water supply line is transite pipe. If tapping or drilling is not possible, the contractor shall provide a transition fitting.

E. Tests: Hydrostatically test each system at 200 psig for a 2-hour period with no leakage or reduction in pressure. Flush piping with potable water in accordance with NFPA 13. Piping above suspended ceilings shall be tested, inspected, and approved before installation of ceilings. Test the alarms and other devices. Test the water flow alarms by flowing water through the inspector's test connection. When tests have been completed and corrections made, submit a signed and dated certificate, similar to the specified in NFPA 13.

F. Guarantee: The entire fire protection installation, as specified under this section of the specifications, shall be guaranteed for one (1) year against defective equipment, materials and workmanship. The guarantee period is to begin on the date of acceptance of the project by the Owner.

G. The guarantee shall not be construed as requiring the Fire Protection Contractor to render service or maintenance required in the normal operation of the equipment, or to make repairs that may be needed due to normal wear and tear or the Owner's negligence, abuse, or breakage.

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SECTION 22 05 00
BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1-01 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Plans.

1-02 EXCAVATION, TRENCHING AND BACKFILLING

A. Excavate trenches for underground pipe lines to required depth and provide a separate trench for each utility sewer and water line except where otherwise noted on drawings. Lay all pipe in open trench unless noted otherwise on plans. Water lines shall be installed with a minimum of 24" cover unless otherwise approved by the Engineer.

B. After piping has been tested, inspected and approved by the Engineer, and prior to backfilling, remove forms and clean excavation of trash and debris.

1-03 GENERAL PIPING INSTALLATIONS

A. Arrange and install piping approximately as indicated, straight, plumb and as direct as possible; form right angles or parallel lines with building walls. Keep pipes close to walls, partitions, ceilings, offset only where necessary to follow walls as directed. Locate groups of pipes parallel to each other; space them at distance to permit applying full insulation and to permit access for servicing valves. The Engineer reserves the right to require this Contractor to make minor changes in pipe locations where conflicts occur with other trades or equipment. Such changes shall be made without extra cost to the Owner.

B. Install horizontal piping as high as possible without sags or humps. Grade drainage piping at uniform slope of 1/4 inch per foot minimum. Where this is impossible, maintain slope as directed, but in no case less than 1/8 inch per foot.

C. Locate valves for easy access and operation. Where concealed, provide access doors. Do not locate any valves with stems below horizontal.

D. Provide water supply, drain, vent and gas connections to equipment specified in other Sections, requiring such services. Indicated locations and sizes of piping, valves, shall conform to approved shop drawings and printed installation directions furnished by equipment manufacturer. Connection sizes shall not be smaller than equipment outlets.

E. Provide flanges or unions as applicable at all equipment connections. For steel and wrought iron pipe, use malleable iron unions 150 psi for standard pipe and 250 psi for extra heavy, with bronze to iron ground joints; cast iron flanged unions to be gasket type.

F. Sufficient space shall be allowed in erecting piping for proper application of thermal insulations including fittings. In no case shall any insulation be cut or reduced in thickness because of inadequate space.

G. If any piping is found installed without being reamed, cleaned, deburred, etc. or in any way contrary to above, it shall be sufficient reason for related erected piping to be removed, inspected by the Engineer, corrected and reinstalled, all at contractor's expense.

H. All piping to be of domestic (United States) manufacture and so certified by the Contractor.

I. In the installation of all pipe runs where shown or where necessary, install expansion joints as specified or as necessary to allow for expansion. Broken pipe or fittings due to rigid connections must be removed and replaced at no additional cost to the Owner.

J. All lines shall be securely anchored where required. Where such anchors occur, they shall be securely fastened to the structure of the building in a manner approved by the Engineer. Drawings shall be submitted before installation.

K. Exposed piping passing through walls, floors and ceilings, shall be fitted with escutcheons. Inside diameter shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve.

1-04 FLASHING

A. Vent pipes passing through roof shall be flashed with 4 pounds lead sheet, at least 20 inches square shall be extended up and turned down inside pipe with pipe at least 12 inches above roof at center line. Vents shall off-set in roof joist area if necessary so that no vent shall be closer than 4 feet from outside wall line.

1-05 BURIED PIPING

A. Provide detectable metal core plastic backed tape manufactured specifically for warning and identification of buried piping over all exterior piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 2 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be "CAUTION BURIED OIL PIPING BELOW" or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

PART 2 PRODUCTS

Not applicable

PART 3 EXECUTION

3-01 WORKMANSHIP, MATERIALS AND EQUIPMENT

A. All work shall be performed in a workmanlike manner and shall present a neat and mechanical appearance when completed. All materials shall be of type, quality and minimum rating prescribed therein or indicated on the Plans.

3-02 PROTECTION OF WORK

A. This CONTRACTOR shall protect his work at all times from danger by freezing, breakage, dirt, foreign materials, etc., and shall replace all work so damaged. The CONTRACTOR shall use every precaution to protect the work of others, and he will be held responsible for all damage to other work caused by his work or through the neglect of his workmen.

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SECTION 22 05 23
VALVES

PART 1 GENERAL

1-01 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation as specified herein and/or shown or scheduled on plans.

B. This section includes the installation of all valves.

C. Valves shall be in accordance with the following industry standards:

MSS SP-69	Pipe Hangers and Supports - Selection and Application
MSS SP-72	Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-80	Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	Steel Pipe Unions Socket-Welding and Threaded

D. Submittals

1. Provide submittal data showing product is in compliance with these specifications and the referenced industry standards.
2. Valves shall have name or trademark of manufacturer and working pressure cast or stamped on valve body.
3. Valve handwheels shall be oriented when installed to provide maximum accessibility for operation.
4. Valve discs shall be the manufacturer's standard material for the service in which the valve is used unless otherwise indicated under the individual type valve specification.
5. Each valve in the following indicated piping systems, shall have valve tag, minimum 1-1/4" size, 18 gauge brass, affixed assigning a number to the valve, except valve tags are not required on steam trap assemblies. Designation numbers shall be stamped in tags. Tags shall be as follows:

System	Tag Shape	Typical Designations
Natural Gas	Octagonal	NG-1, NG-2

Brass tags shall be attached to valves with nylon self-locking cable ties. A valve chart framed under glass and wall mounted shall be provided, which shall list each valve by number, its location in the piping system (including pipe line such as CH or CHR, and associated piece of equipment such as pump or chiller), and its function (shut-off, balancing, drain or quick-fill). Valve chart shall be mounted in the Mechanical Room or where directed by Engineer.

PART 2 PRODUCTS

2-01 Provide full port ball valves for the following piping systems:

A. Domestic water

1. Ball valves two inches (2”) diameter or less:
   a. Nibco S-850 or T-580 or equal

2-02 Provide check valves for the following systems:

A. Domestic water
   1. Swing check type, 2 inch diameter or less:
      a. Valves shall be bronze, swing type in accordance with MIL-V-18436. Valves shall be rated for 125# SWP. Valves shall be:
      Nibco S-413-Bq Stockham B-309
      Milwaukee 1509 Crane 1342

2-03 Valves for Natural Gas System

A. Plug Valves. Valves shall be iron-body (semi-steel) lubricated, with teflon coated plug. Flanged valves shall be installed between 150# ASA steel flat faced slip-on weld flanges. Valves over 1" size shall be wrench operated and wrench shall be furnished with each size valve. Each plug valve shall be serviced with the sealant recommended by the valve manufacturer.
   1. Valves 2" and smaller shall be short-pattern type with threaded end connections. Valves shall be rated at 175# WOG. Valves shall be:
      Nordstrom Fig. 142 Walworth No. 655
      Powell No. 2200

2-04 Copper Pipe

A. Models indicated in this Section are for steel pipe. If copper service is indicated, Contractor shall supply a valve of the same type specified, but for copper pipe.

PART 3 EXECUTION

3-01 INSTALLATION

A. Valves shall be installed in accordance with manufacturer's recommendations.

B. Install at equipment and as indicated on drawings to allow maintenance or isolation, and to establish proper and sequential operation of complete system. Shell and tube liquid coolers shall have fluid valves installed so that tubes are accessible for cleaning or replacing. Provide globe valves or plug cocks where required to regulate flow to obtain equal distribution of gas or fluid handled. Remove valve bonnets, where valve construction permits removal, when connecting valves by brazing to copper tubing. Install globe and angle valves with stems horizontal where necessary to avoid trapping of fluid.

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SECTION 22 05 29
MECHANICAL SUPPORTING DEVICES

PART 1 GENERAL

1-01 SCOPE

A. Provide supporting devices for mechanical systems as described herein.

B. Isolators shall be in accordance with the following industry standards:

ASTM D 2240	Rubber Property - Durometer Hardness
ARI 370	Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment
ARI 575	Measuring Machinery Sound Within an Equipment Space

C. Submittals

1. Provide submittal data showing product is in compliance with these specifications and the referenced industry standards.

1-02 PIPE HANGERS

A. All horizontal pipe are to be supported by adjustable hangers supported below structure. Use Fee and Mason 239, Grinnell, or Midland-Ross. Use Fee and Mason Figure 81, Grinnell or Midland-Ross protectors on all insulated pipe and install hangers on outside of insulation.

B. Where piping is grouped in parallel horizontal runs at same elevation, or as otherwise noted on plans, bar-type supports may be used using Fee and Mason Figure 8005, Grinnell, or Midland-Ross hangers or Unistrut channels.

C. All vertical risers shall be supported at the floor by Fee and Mason Figure 241, Grinnell, or Midland-Ross riser clamps in addition to adequate base supports.

D. Hangers are to be installed not more than ten feet (10') apart on 1-1/2 inch and larger pipe and not more than eight feet (8') apart on pipe smaller than 1-1/2 inches.

1-03 FOUNDATIONS AND EQUIPMENT SUPPORTS

A. This Contractor shall provide suitable foundations and supports, as indicated on drawings, specified herein, or as required to make a neat, substantial and workmanlike job. All foundations, supports, stands, etc., shall be approved by the Architect/Engineer prior to construction.

PART 2 PRODUCTS

2-01 GENERAL

A. All electrical connections, drain connections, piping connections, etc., made to equipment which resets on vibration isolators, shall be sufficiently flexible to permit the equipment to be properly isolated.

B. Submittal data on vibration isolators shall be included with submittal data on each piece of equipment.

2-02 FLEXIBLE CONNECTIONS

A. Flexible connections shall be installed on each piece of equipment as indicated on Plans.

B. Flexible connections shall be of the metallic type. Metal hose shall be Grade E phosphor bronze, monel or stainless steel corrugated tube covered with comparable bronze or stainless braid restraining and pressure cover. Stainless steel grades shall be 304, 316 or 321 as required for the application. Length of flexible metal hose shall be not less than that recommended by the manufacturer for continuous vibration application.

C. Flexible connections shall be installed in accordance with the manufacturer's recommendations, including placement in the pipe line without damage, misalignment or change in its normal length. Prior to filling the system, the alignment and length shall be checked by loosening the flange bolts to determine the installation conditions. The piping installation shall be corrected if necessary and the flexible hose replaced if damaged. As Vibration Mounting and Controls, Inc., Type MFE.

PART 3 EXECUTION

3-01 INSTALLATION

A. Support equipment as specified herein.

B. Provide isolators for equipment and piping systems as specified herein.

C. Install isolators, materials and equipment as per manufacturer’s directions.

END OF SECTION

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SECTION 22 10 00
PIPE AND FITTINGS

PART 1 GENERAL

1-01 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified and/or shown or scheduled on plans.

B. Piping shall be in accordance with the following standards:

ANSI B16.18	Cast Copper Alloy Solder Joint Pressure Fitting
ANSI B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fitting
ANSI B16.24	Cast Copper Alloy Pipe Flanges and Flanged Fittings
ANSI B31.5	Refrigeration Piping Errata
ASME/ANSI B16.5	Pipe Fitting and Pipe Flanges
ASME/ANSI B16.9	Factory Made Wrought Steel Butt Welding Fittings
ASME/ANSI B16.11	Forged Fittings, Socket Welded and Threaded
ASME/ANSI B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes
ASTM B 32	Solder Metal
ASTM B 42	Seamless Copper Pipe, Standard Sizes
ASTM B 88	Seamless Copper Water Tube
ASTM D1784	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D2412	Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D2665	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) PVC Sewer Pipe and Fittings
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
AWS A5.8	Filler Metals for Brazing
ANSI A13.1	Scheme for the Identification of Piping Systems
IPC	International Plumbing Code

1-02 WORK INCLUDED

A. Pipes, fittings, unions, couplings, flanges, gaskets, and other materials and instructions for the following piping systems.
   1. Sanitary waste, vent piping, and storm drain piping.
   2. Domestic water piping.
   3. Natural gas piping.
   4. Equipment drains.

1-03 SUBMITTALS

A. Provide submittal data showing product is in compliance with these specifications and the referenced industry standards.

1-04 All piping installed on this project shall be new and of full weight and size shown and of proper specification for service intended. Only domestic pipe may be used. When piping is cut, it shall be reamed with pipe reamer and all burrs, scale, trash and foreign matter removed. Where non-ferrous piping connects to ferrous piping, install EPCO dielectric couplings.

1-05 Where piping is threaded, dies shall be clean and sharp and joint compound shall be applied to male end only. All joints shall be made up tight. The caulking of these joints will not be tolerated. Pipe joint compound must be approved by the Engineer. Copper tubing may be cut with a tubing cutter or hacksaw with guide.

PART 2 PRODUCTS

2-01 Provide the specified materials for the following piping systems:

A. Sanitary Waste, Grease Waste, and Storm Drain Piping Below Grade and Outside Building:
   1. Sanitary waste below grade and outside shall be SDR 35 PVC in accordance with ASTM D3034.

B. Sanitary Waste, Vent Piping System, and Storm Drain Piping Inside Building:
   1. PVC pipe shall conform to ASTM D 3034, Schedule 40 PVC. Pipe shall be installed in accordance with ASTM D 2321.
   2. **Piping exposed above ceiling in return air plenum shall be service weight hubles cast iron.**

C. Domestic Water Piping System Outside Building:
   1. Domestic water piping below grade and outside of building shall be Type "K" copper in accordance with ASTM B88. Fittings shall be ANSI B16.18 or ANSI B16.22 soldered joint in accordance with SBCCI 88.

D. Domestic Water Piping System Inside Building:
   1. Domestic water piping within the building shall be Type "L" copper in accordance with ASTM B88 with ANSI B16.18 or ANSI B16.22 soldered joint fittings or with ASME/ANSI B16.26 flared joint fittings. Provide ASTM B42 copper pipe nipples with threaded end connections. Provide ASTM B32, 95-5 tin-antimony solder, or provide Plumbing Code approved lead-free solder.

E. Natural Gas Piping System Inside Building:
   1. Natural gas piping above grade and inside building shall be Schedule 40 black steel in accordance with ASTM A53. **Piping inside return air plenums or above roof shall be welded.** Pipe greater than two inches (2") diameter shall be welded. All other pipe less than two inches (2") diameter may have screwed joints.

F. Equipment Drain Piping:
   1. Equipment condensate drain shall be Schedule 40 PVC.

PART 3 EXECUTION

3-01 INSTALLATION

A. All piping installed on this project shall be new and of full weight and size shown and of proper

specification for service intended. Only domestic pipe may be used. When piping is cut, it shall be reamed with pipe reamer and all burrs, scale, trash and foreign matter removed. Where non-ferrous piping connects to ferrous piping, install EPCO dielectric couplings.

B. Where piping is threaded, dies shall be clean and sharp and joint compound shall be applied to male end only. All joints shall be made up tight. The caulking of these joints will not be tolerated. Pipe joint compound must be approved by the Engineer. Copper tubing may be cut with a tubing cutter or hacksaw with guide.

C. Copper tubing shall be thoroughly reamed, cleaned with steel wool or emery cloth, and a non-corrosive flux used before soldering or brazing. Where soldered joints in domestic water piping are specified, only antimony and lead free solder shall be used. Where brazed joints are specified, only copper-phosphorous alloys shall be used. Where unavoidable soldered joints occur below slab on grade, silver solder with minimum 5% silver content shall be used.

D. Mechanically formed tee connections may be utilized on copper piping systems. Systems shall be in accordance with ASME B31, ANSI B31.5 and International Plumbing Code. System shall utilize brazed connections, rather than soldered. Brazed connections shall be in accordance with Copper Development Association recommendations.

E. Where welding is specified or done, it shall be by electric arc by mechanics skilled in operation and holding a test certificate acceptable to the Engineer. All scale and flux shall be removed from piping after welding.

3-02 STENCILING ON PIPING

A. All piping exposed or concealed shall have the following symbols stenciled on pipe in a visible location. Stencil shall be attached to pipe every twenty feet (20').
Stencil shall be installed after piping has been painted and/or insulated. Stencil legend shall be as follows:

Service:	Symbol:
Sanitary waste and vent	San W.
Domestic cold water	DCW
Domestic hot water	DHW
Natural Gas	Gas
Domestic hot water return	DHWR
Storm Drain	Storm Drain

B. Install "Direction of Flow" arrow at each stencil.

3-03 Painting of Piping and/or Pipe Insulation

A. After insulation and before stenciling, piping in the following locations shall be painted by the General Contractor with appropriate direction from the Mechanical Contractor:
1. All piping in equipment rooms.
2. All other exposed piping indoors.
3. Exposed piping outdoors where aluminum jackets not required.

END OF SECTION

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SECTION 22 34 00
INSTANTANEOUS HOT WATER HEATERS

PART 1 GENERAL

1-01 SCOPE

A. Provide water heaters of the natural gas type described herein.

B. Water heaters shall be in accordance with the following industry standards:

ANSI Z21.22	Relief Values and Automatic Gas Shut Off Devices for Hot Water Supply Systems
ASME BPVC SEC IV	Boiler and Pressure Vessel Code: Section IV Heating Boilers
IPC	International Plumbing Code

PART 2 PRODUCTS

2-01 WATER HEATER (Instantaneous Natural Gas)

A. The water heater(s) shall be Rheem Model RTGH or approved equal.

B. Size and capacity shall be as shown on the drawings.

C. Vent piping shall be 3” PVC.

D. Unit includes a built-in electric blower to force exhaust gas to the outdoors.

E. Unit shall include a controller with digital display showing temperature setting and maintenance codes.

PART 3 EXECUTION

3-01 Water heater shall be installed in accordance with manufacturer's instructions.

3-02 Electrical wiring shall be installed in accordance with these specifications.

END OF SECTION

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SECTION 22 42 00
PLUMBING FIXTURES, TRIM & ACCESSORIES

PART 1 GENERAL

1-01 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Plans.

B. Work Included: Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

C. Plumbing fixtures, trim and accessories shall be in accordance with the following industry standards:

ANSI A112.36.2M	Cleanouts
ASME A112.6.1M	Supports for the Off-the-floor Plumbing Fixtures - Public Use
ASME A112.18.1M	Plumbing Fixture Fittings
ASME/ANSI A112.19.1M	Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	Vitreous China Plumbing Fixtures
ASME A112.19.5	Trim for Water-Closet Bowls, Tanks, Urinals
ASME A112.21.1M	Floor Drains
PDI WH 201	Water Hammer Arrestors
IPC	International Plumbing Code

1-02 GENERAL

A. All fixtures must be securely fastened to the floor or walls by means of inserts or expansion bolts in concrete work, and by means of expansion bolts, toggle bolts in masonry work, and by means of framing and screws in frame construction, to the satisfaction of the Architect/Engineer. Plumber shall install fixtures in accordance with standard industry practice and manufacturer's instructions. Plumber shall seal around counter mounted fixtures to provide positive seepage protection.

B. All plumbing fixtures shall be provided complete with all necessary trim including bolt caps, tail pieces and drains, blank off caps, etc., such that the fixtures are fully functional and aesthetically complete, whether or not all such parts are specifically listed in the specifications below. All porcelain or vitreous china fixtures (and related trim) shall be furnished in white color unless otherwise noted.

1-03 FIXTURE TRIM

A. All plumbing fixture brass trim shall be designed so that all wearing parts are to be in a standardized renewable operating unit which can be removed without detaching the supply fixture or faucet proper. The standardized renewable operating units are to be interchangeable with all supply fixtures and faucets whether quick compression or self-closing. All exposed metal parts of all fixtures, including faucets, waste fittings, waste plugs, strainers, flush valves, traps, supplies, nipples and escutcheons shall be chrome plated brass unless other materials or finish is specified. Angle stops with S.P.S. brass nipples from wall to stops shall be provided on all water supplies to fixtures. Fixture trim must be that of the fixture manufacturer wherever possible and must bear a permanent impression of the manufacturer. No "competitive grade" trim will be permitted. All

tubular waste pipe and fittings under sinks and lavatories shall be 17 gauge chrome plated brass. All p-traps shall have cleanout plugs.

B. SUBMITTALS: Provide submittal data showing product is in compliance with these specifications and the referenced industry standards.

PART 2 PRODUCTS

2-01 Furnish and install all plumbing fixtures as shown on Plans. Kohler fixtures are specified, however, Crane, Eljer, or American Standard may be used if they are equal in all respects to those specified. Contractor shall submit data on trim on well as fixtures. Where Zurn flush valves are specified, equivalent Delaney models will be the only permitted substitute.

A. Cleanouts
General: Furnish all cleanouts and/or test tees as shown on Plans and required by Code. Cleanouts shall be the same size as the pipe they serve, except that 4 inches shall be the largest size required. Cleanouts shall be provided at the foot of each soil stack and of each run, change in direction, and mains, not to exceed 50 feet apart inside of building and 100 feet apart outside of building. Cleanouts shall be as manufactured by Wade, Jay R. Smith, Zurn, or Josam, and shall be as follows:
1. Inside building- Zurn Model ZN 1400 NH.

B. Water Hammer Arresters
1. All water supply piping fittings and fixtures shall be protected against water hammer, shock or surge pressure by water hammer arresters. Arresters shall incorporate metal piston. The following schedule for Zurn or Precision Plumbing Products, arresters shall apply:

P.D.I. Symbol	Fixture Unit Ratings
A	1-11
B	12-32
C	33-60

2. Fixture piping shall be adequately anchored to prevent vibration.

PART 3 EXECUTION

3-01 INSTALLATION

A. Fixtures, trim and accessories shall be installed in accordance with manufacturer's recommendations.

3-02 ROUGH-IN DATA:

A. Where handicapped fixtures are indicated, the following dimensional data shall apply.
Water Closets - Mount rim at 18" A.F.F.
Lavatories - Mount so bottom of bowl is 2'-3" A.F.F.
Drinking Fountain - Mount at 2'-3" to bottom of fountain.
Urinals - Mount rim at 17" A.F.F.

END OF SECTION

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SECTION 23 07 00
MECHANICAL SYSTEMS INSULATION

PART 1 GENERAL

1-01 SCOPE

A. Provide all material, equipment and labor, etc., required to complete installation specified herein and/or shown or scheduled on Plans.

B. Field applied insulation for thermal efficiency and condensation control for HVAC piping, ductwork and equipment.

C. Industry Standards

D. Insulation systems shall be in accordance with the following industry standards:

ASTM C 195	Mineral Fiber Thermal Insulating Cement
ASTM C 916	Adhesives for Duct Thermal Insulation
ASTM C 1136	Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM E 84	Surface Burning Characteristics of Building Materials
ASTM E 96	Water Vapor Transmission of Materials
NFPA 90A	Standard for the Installation of Air Conditioning and Ventilation Systems
NFPA 255	Surface Burning Characteristics of Building Materials
IBC	International Building Code
UL 723	Surface Burning Characteristics of Building Materials

E. Submittals: Provide submittal data showing product is in compliance with these specifications and the referenced industry standards.

1-02 GENERAL

A. Insulation shall include all insulating materials, their application, recanvassing after finish, bands, tie wire, and weather protection for all pipe fittings, valve and equipment as indicated and as specified herein.

B. Insulation and insulation assemblies shall meet the requirements of International Building Code (IBC), unless more stringent requirements are listed herein.

C. Concealed insulation shall have a flame spread of 0-75 and a smoke developed of 0-450.

D. Exposed insulation shall have a flame spread of 0-50 and a smoke developed of 0-450.

E. Scope of Insulation: All new piping as indicated below, or where indicated on plans, details or schematics and all existing piping as noted shall be insulated. All piping system components exposed and subject to freezing shall be insulated. This includes valves, expansion joints, orifices, etc. Where gauge cocks, orifice ports and other similar devices require access, such devices shall have extensions beyond insulation provided by mechanical contractor.

F. If a material specified herein becomes unavailable, or if there is a question regarding the required insulating material on this job, insulator shall advise engineer BEFORE job bids for resolution of the

question.

G. PVC jackets for insulation shall be in accordance with UL 723 and pertinent flame spread and smoke developed ratings.

PART 2 PRODUCTS

2-01 PIPE INSULATION

A. Domestic Water Piping
1. All above grade domestic cold and hot water piping shall be insulated. Piping shall be insulated as follows:
a. One inch (1") thick heavy density UL listed fiberglass insulation with factory supplied vapor barrier jacketing. Jacketing shall have continuous pressure sealing lap adhesive for sealing of the longitudinal joint. Butt strips shall be sized to seal each circumferential joint. Jacket shall have vapor permeance not greater than 0.02 perm/in. Fittings shall be insulated with 1" precut fiberglass and molded snap on type PVC jacket cover having a 25/50 flame/smoke rating. Seal edges of snap-on cover.

B. Storm Drain Piping
1. Interior storm drain piping shall be insulated with one inch (1”) thick heavy density UL listed fiberglass insulation with factory supplied vapor barrier jacketing. Jacketing shall have continuous pressure sealing lap adhesive for sealing of the longitudinal joint. Butt strips shall be sized to seal each circumferential joint. Jacket shall have vapor permeance not greater than 0.02 perm/in. Fittings shall be insulated with 1” precut fiberglass and molded snap on type PVC jacket cover having a 25/50 flame/smoke rating. Seal edges of snap on cover.

C. Condensate Drains
1. One-half inch (1/2”) thick closed cell elastomeric thermal insulation. The insulation shall be pre-slit longitudinally and pressure-sensitive adhesive for closure and vapor sealing of the longitudinal joint. Insulation shall have flame spread and smoke developed rating as established by ASTM E84.

2-02 DUCT INSULATION

A. **ALL** ductwork above finished ceilings shall be insulated on the exterior as follows:
1. All ductwork shall be wrapped with blanket flexible mineral fiber conforming to ASTM 553, Type 1, Class B-3, 1.0 pounds per cubic foot, 2.0 inches thick.
2. The insulation shall be stapled in place and all joints sealed as per manufacturer's directions. A copy of said directions shall be furnished to the Engineer with shop drawings on insulation.
3. Duct dimensions indicated are actual metal sizes prior to installation of exterior insulation.

PART 3 EXECUTION

3.1 INSTALLATION

A. All insulation shall be installed in accordance with manufacturer's written instructions.

B. All above insulation shall be applied by a approved insulating Contractor employing trained insulating personnel.

C. No insulation shall be applied over pipes, fittings or other surfaces which are not clean. Insulation shall be applied after pipes have been thoroughly tested and proven tight by the Mechanical Contractor.

D. Insulation shall fit in snug contact with pipe and be installed in accordance with Manufacturer's recommendations.

E. Stagger joints on layered insulation.

F. Seal joints in insulation.

G. Provide six inch long, 20 gauge galvanized steel sleeve around pipe insulation at each support.

H. Insulate fittings with sheet insulation and as recommended by Manufacturer where no other fitting insulation is indicated above.

END OF SECTION

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SECTION 23 08 00
TESTING AND BALANCING

PART 1 GENERAL

1-01 SCOPE

A. Provide all material, equipment and labor required to test and balance all mechanical systems.

B. Test and Balance Agency Credentials: Test and Balance Agency shall hold current membership in the Associated Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB). Test and Balance Agency shall have completed at least five jobs of comparable size and similarity to this project. Test and Balance Agency job list, credentials and procedures shall be submitted with shop drawings by Mechanical Contractor for approval by Engineer. Test and Balance Agency shall have at least one registered professional engineer on staff and all reports shall bear the stamp of said engineer from the state in which this job is located. Said engineer's license in this state shall be current at the time reports are sealed.

C. Balance procedures required herein shall be accomplished in accordance with ASHRAE HVAC Applications Handbook. Requirements therein shall be as binding as though full reprinted herein. Test and Balance Agency shall be completely familiar with the requirements of the ASHRAE HVAC Applications Handbook. Requirements therein shall as binding as though full reprinted herein. Test and Balance Agency shall be completely familiar with the requirements and shall perform each task listed therein on the required systems. As a minimum, report shall include items required by "Report and Report Information", plus information on hydronic systems necessary to determine proper conformance to design requirements, including motor design and operating amps, and system flows and pressure drops.

D. Procedures required on this job shall be:
Air Side Balancing
Temperature Control Verification
Vibration Testing

E. Instrumentation used by agency shall be in calibration at time of testing. Required instruments shall be as listed in Chapter 34 as a minimum. Accuracy of instruments shall conform to the following list:

Temperature Indicators	± 0.1 degrees F max
Air Flow Indicators	± 10% max
Differential Pressure Gauges	± 5% max
Ampere Meters	± 3% max

PART 2 BALANCING OF SYSTEMS

2-01 JOB INSPECTION

A. Testing and Balancing Agency shall act as an authorized inspection agency, responsible to the Engineer, and shall list all items which require correction or have not been installed in accordance with contract drawings and/or specifications pertaining to heating, ventilating and air conditioning systems.

B. The Testing and Balancing Agency shall be given access to the project site at all times and shall not be required to make prior arrangements with the contractor for site visiting to perform any balancing work or pre-balancing inspection the Agency may require.

2-02 AIR BALANCE

A. Actual air balancing shall not begin until all systems have been completed, placed into operation, final filters installed, and all control systems completed and calibrated.

B. Air balance shall include performance ratings of all supply, return and exhaust fan motors. Fan speeds shall be adjusted to provide design flows, including system diversities, at actual system pressures. Any drive changes necessary to meet this requirement shall be provided by the fan manufacturer and installed by the mechanical contractor under the direct supervision of the Testing and Balancing Agency at no additional cost to the Owner.

C. Pitot Tube traverses of all trunk lines and major branch lines shall be made to determine proper proportioning of air flows within all systems.

D. Pressure drop readings across all major system components and significant drops within duct systems shall be reported to determine any deviation between actual and theoretical value.

E. Accurate flow and pressure measurements shall be made at each terminal device and each supply, return, or exhaust diffuser. Flow at terminal units and outlets shall be adjusted by appropriate means to within 10% of design requirements.

F. Outside air, return air, and supply air quantities for all systems shall be adjusted to within 10% of design requirements.

2-03 CONTROL SYSTEMS

A. The Mechanical Contractor shall have installed and thoroughly checked the action and calibration of all control devices and placed the entire system into operation.

B. Testing and Balancing Agency shall thoroughly re-check all control sequences, and calibration of all control devices. Mechanical Contractor shall cooperate with Testing and Balancing Agency in the re-calibration of set-point readjustment of any control device he may require.

2-04 VIBRATION TESTING

A. Testing and Balancing Agency shall make a visual inspection of all fans and air handling units for defects which cause excessive vibration when unit is operating.

B. Vibration isolation on equipment shall be checked for equal deflection and proper operation.

C. Testing and Balancing Agency shall measure the vibration of each unit with a vibration meter capable of frequency and amplitude analysis, including displacement and velocity readouts. Vibration shall be checked against ASHRAE HVAC Applications Handbook. If vibration exceeds amount listed therein, mechanical contractor shall take corrective action.

D. A complete frequency analysis shall be made in areas where vibration amplitude measurements

exceed those specified, in order to determine the cause of the excessive vibration.

2-05 OWNER INSTRUCTION

A. Testing and Balancing Agency shall provide neatly typed final reports listing results of all air balancing as well as vibration and energy projection measurements and conclusion. Final reports shall be submitted to Architect/Engineer for his approval.

PART 3 EXECUTION

3-03 SCHEDULING

B. Contractor shall notify Testing and Balancing Agency immediately upon receipt of contract, the approximate completion date of project.

C. Contractor shall give two weeks prior notice to Agency for testing and balancing schedule.

D. Contractor shall operate all equipment during each day of testing and balancing as requested by Testing and Balancing Agency.

E. Contractor shall allow sufficient time in completion schedule for testing and balancing.

3-04 COOPERATION

A. Cooperation among all involved parties is essential to expedite completion of final testing and balancing. Contractor shall be responsible for coordinating all jobsite meetings between testing and balancing personnel and various sub-contractors and equipment suppliers. Building will not be turned over to the owner until final testing and balancing reports have been submitted to the engineer and approved.

B. Contractor shall furnish and install through fan manufacturer, any additional drive change recommended by Testing and Balancing Agency, at no additional cost to the Owner.

C. Contractor shall install necessary dampers and gauge connections as recommended by Testing and Balancing Agency to achieve proper balance.

D. Contractor shall install all final filters before final air balancing begins.

E. Contractor shall supply to Testing and Balancing Agency one copy of approved submittal data, including accurate performance data for all submitted equipment and one copy of final mechanical drawings and approved control drawings upon receipt of contract.

F. It is the expressed responsibility of the Testing and Balancing Agency to carry out all procedures described within these specifications in a professional manner.

G. It is the responsibility of the Testing and Balancing Agency to locate and identify all current and potential problem areas within the scope of these specifications and to initiate action by responsible parties to remedy such problems during the testing and balancing period. Test and Balancing Agency shall fully cooperate with the owner and Engineer to alleviate problem areas by system adjustment to the full extent that the system is adjustable.

H. Testing and Balancing Agency shall release no reports until such have been approved by the Engineer.

3-05 COMPLETION OF WORK

A. Testing and Balancing Agency shall inform contractor as to the extent of completion of all testing and balancing requirements listed within these specifications.

3-06 ACCEPTANCE

A. Installation shall not be considered complete until final testing and balancing reports have been submitted to consulting engineer and have been approved by him. One copy of all final reports shall be given to the Owner's representative after final approval by the Consulting Engineer.

3-07 WARRANTY

A. Testing and Balancing Agency shall include an extended warranty of three (3) months, after submission of report during which time the engineer or owner may request a recheck or resetting of any item included in the report. Should it be found that the system has not been properly and completely balanced, the warranty period will be extended until the engineer is completely satisfied.

END OF SECTION

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SECTION 23 30 00
DUCTWORK AND ACCESSORIES

PART 1 GENERAL

1-01 SCOPE

A. Provide all material, equipment and labor required to complete the installation of ductwork systems shown on the drawings and specified herein.

B. Work included: Ductwork systems shall include the following types of systems:
   1. Low velocity supply, return and exhaust air systems.
   2. Flexible supply air systems.

C. Ductwork systems shall be in accordance with the following industry standards:

AMCA 500	Louvers, Dampers and Shutters
AMCA 501	Application Manual for Air Louvers
ASTM A 527/A 527M	Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock-Forming Quality
ASTM C 423	Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 96	Water Vapor Transmission of Materials
NFPA 90A	Installation of Air Conditioning and Ventilating Systems
SMACNA DCS	HVAC Duct Construction Standards - Metal and Flexible
UL 181	Factory-Made Air Ducts and Air Connectors
UL 555	Fire Dampers

D. SUBMITTALS
   1. Manufacturer's Catalog Data
      a. Dampers
      b. Flexible ducts and connectors
      c. Diffusers, registers, and grilles
      d. Metal ducts

PART 2 PRODUCTS

2-01 LOW VELOCITY RECTANGULAR DUCTWORK

A. Steel Ducts: ASTM A 527/A 527M galvanized steel sheet, lock-forming quality; coating designation G90. Construction, metal gage, hangers and supports, and reinforcements shall conform with SMACNA DCS, except that ducts with pressure classifications below 2 inch water gage that are located outside of the conditioned space shall have a seal class C. Ductwork shall be airtight and shall not vibrate or pulsate when system is in operation. Pressure sensitive tape shall not be used as a primary sealant on ductwork with pressure classifications above one inch water.

B. All necessary allowances and provisions shall be made for beams, columns, pipes, conduits, iron work or other obstructions in the construction of the building or the work of other contractors, whether or not the same is shown on these drawings. Where necessary to avoid beams or other structural systems, piping or conduit, the Contractor shall divide or curve ductwork to avoid said systems. Ductwork when divided shall maintain the same cross-sectional areas in accordance with

the latest edition of the ASHRAE Guide.

C. Gauges of galvanized steel shall be as follows:

1. LOW PRESSURE DUCTWORK

Maximum Size Inches	Steel Gauge	Bracing
Up to 12"	26	S slip, drive slip, 1 inch pocket lock on 8 ft. centers
13" - 18"	24	S slip, drive slip, 2 inch pocket lock on 8 ft. centers
19" - 30"	24	S slip, 1" pocket lock on 8' centers with 1x1x1/8" angles 4' from joint.
31" - 42"	22	Longitudinal standing seam, 1" standing S cleat, bar slip, or pocket lock on 4' centers with 1x1x1/8" angles 4' from joint.
43" - 54"	22	Longitudinal standing seam inside 1-1/2" standing S
55" - 60"	20	Cleat, bar slip, pocket lock on 8' centers with 1-1/2 x 1-1/2 x 1/8" angles 4' from joint.

D. Turning vanes shall be installed at each elbow and change in direction of supply duct where shown. Turning vanes shall be a true airfoil design; smoothly rounded entry nose with extending trailing edge. Generated sound power level shall not exceed 54 dB in the third octave band at 2000 fpm duct velocity. Vane spacing shall be 2.4 inches on center across the full diagonal dimension of the elbow. Vanes shall be as manufactured by Aero/Dyne Co., High Efficiency Profile model with factory side rails, or approved equal.

E. Ductwork shall be connected to air handling devices supply return and outdoor air connections by flexible connectors. Connector shall be Dura-Dyne Type DPN or approved equal waterproof and fireproof fabric. Flexible connections shall be at least five inches (5") long and securely fastened with galvanized band iron hoops.

F. Hard Cast DT-Tape with FTA-20 adhesive shall be applied to each duct joint and point of attachment of duct hanger. Samples shall be submitted to the Engineer for approval.

2-02 LOW VELOCITY ROUND DUCTWORK

A. All necessary allowances and provisions shall be made for beams, columns, pipes, conduits, iron work or other obstructions in the construction of the building or the work of other contractors, wehther or not the same is shown on these drawings. Where necessary top avoid beams or other structural systems, piping or conduit, the Contractor shall divide or curve ductwork to avoid said systems. Ductwork when divided shall maintain the same cross-sectional areas in accordance with the latest edition of the ASHRAE Guide.

B. Gauges of galvanized steel shall be as follows:

1. LOW PRESSURE DUCTWORK

Maximum Size Inches	Steel Gauge
Up to 8"	28
9" - 14"	26
15" - 26"	24
27" - 36"	22
37" - 50"	20

2. Ductwork shall be longitudinal seam, snap lock type, with aluminized duct tape applied over

entire length of longitudinal and circumferential seams. Ductwork shall be externally insulated.

C. Furnish and install manually operated volume control dampers in all branches, splits, or at all supply air, return air, exhaust or transfer openings where necessary for proper balancing of air distribution. Dampers shall be of single blade type. Dampers shall have a quadrant type indicating device wtih lock to hold damper in position for proper setting. Damper shall be as Ruskin CDRS-25.

2-03 FLEXIBLE DUCTS

A. Flexible ductwork shall be constructed in accordance with UL 181, Class 1, SMACNA DCS and additional requirements herein specified. Provide to connect between rigid ductwork and air diffusion devices. There shall be no erosion, delamination, loose fibers, or odors from the ducts into the air stream.

B. Flexible ductwork shall be satisfactory for operating pressure up to 6 inches water gauge.

C. Insulated flexible ductwork shall be constructed with alumininized mylar laminated to a corrosion resistant steel wire helix. Duct shall be insulated with one inch (1") thickness of fiberglass insulation having a density of 1 lb./cu. ft. Sheathe insulation with a vapor barrier having a maximum water vapor permeance of 0.20 perm in accordance with ASTM E96, Procedure A. Coat ends of insulation with cement to prevent erosion and delamination.

D. Maximum length of flexible ductwork shall not exceed 6'-0".

E. Flexible ducts shall be suspended on 36 inch centers with a minimum 3/4 inch wide flat banding material. All joints and connections shall be made with 1/2 inch wide positive locking steel straps.

2-04 CASINGS AND PLENUMS

A. Factory fabricated components with field installation. Furnish certified testing data from plenum or casing manufacturer obtainable directly from an independent acoustical laboratory, listing sound absorption and transmission loss characteristics of panel assembly. Sound absorption coefficients and sound transmission loss, determined by an independent laboratory, shall be in accordance with ASTM C 423 and ASTM E 90 respectively.

2-05 DAMPERS

A. Furnish and install manually operated volume control dampers in all branches, splits or at all supply air, return air, exhaust or transfer openings where necessary for proper balancing of air distribution. Dampers shall be of single blade type. Dampers shall have a quadrant type indicating device with lock to hold damper in position for proper setting. Damper shall be as Ruskin CDRS-25.

2-06 DIFFUSERS, REGISTERS, AND GRILLES

A. Material and Finishes: Provide factory-furnished diffusers, registers, and grilles constructed of aluminum. Exterior and exposed edges shall be rolled, or otherwise stiffened and rounded. Colors shall be selected by Owner.

B. Sound Pressure Level: Manufacturer certified sound pressure level ratings of inlets and outlets.

Conform with the following permissible room sound pressure levels:

NC Range, dB	Typical Application
30 - 35	Office or Laboratory Area

C. Throw: The distance from the diffuser, register or grille to the point which the air velocity falls below 50 feet per minute shall not exceed 1.5 times the outlet mounting height.

D. Drop: Maximum drop of air stream shall not be within 5 feet of the floor at the end of the throw.

E. Ceiling Diffusers: Equip with baffles or other devices required to provide proper air distribution pattern as indicated. Provide factory-fabricated, single key, volume dampers. Except for linear diffusers, internal parts shall be removable through the diffuser neck for access to the duct and without the use of special tools.

F. Square Diffusers: Construct each ceiling diffuser of four or more concentric elements designed to deliver air in a generally horizontal direction without excess smudging of the ceiling. Interior elements of square and rectangular ceiling diffusers may be circular, square, or rectangular as manufacturer's standard.

G. Return Air and Exhaust Air Grilles
1. Ceiling Type Grilles
a. Grilles shall be 1/2" by 1/2" grid opening of aluminum construction. Grille shall be surface mounted. Grille shall be white finish. Size and capacity shall be as indicated on Plans.

2-07 DUCT SLEEVES, PREPARED OPENINGS, AND CLOSURE COLLARS

A. Duct Sleeves: Fabricate from minimum 20-gauge galvanized steel. Where sleeves are installed in bearing walls, provide structural steel sleeves as indicated. Size sleeves to provide one-inch clearance between duct and sleeve or between insulation and sleeve for insulated ducts.

B. Prepared Openings: Provide one-inch clearance between the duct and the sleeve, or one-inch clearance between insulation and sleeve for insulated ducts except at grilles, registers, and diffusers.

C. Packing: ASTM C553, Type 1, Class B-2, mineral fiber.

D. Closure Collars: Four inches wide minimum, fabricated from minimum 20 gauge galvanized steel.
1. Sizes and capacities shall be as indicated on drawings.

PART 3 EXECUTION

3-01 INSTALLATION

Conform to NFPA 90A and SMACNA DCS. Provide mounting and supporting of ductwork and accessories including, but not limited to, structural supports, hangers, vibration isolators, stands, clamps and brackets, access doors, and dampers. Provide electrical isolation between dissimilar metals. Electrical isolation may be fluorinated elastomers or sponge-rubber gaskets. Install ductwork accessories as indicated and as recommended by manufacturer's printed instruction. Allow clearance for inspection, repair, replacement, and service. Louvers in accordance with AMCA

501.

A. Ductwork: Air distribution systems shall operate with no chatter or vibration.
   1. Field Changes to Ductwork: Those required to suite the sizes of factory-fabricated equipment actually furnished, shall be designed to minimize expansion and contraction. Use gradual transitions in field changes as well as modifications to connecting ducts. Provide jumper ducts for discharging air into duct junctions as indicated.
   2. Dampers: When installed on ducts to be thermally insulated, equip each damper operator with stand-off mounting brackets, bases, or adapters to provide clearance between the duct and operator not less than the thickness of insulation. Stand-off mounting items shall be integral with the operator or standard accessory of damper manufacturer.
   3. Access Doors: Provide for automatic dampers, volume dampers, fire dampers, coils, thermostats, temperature controllers, valves, filters, humidifiers and other concealed apparatus requiring service and inspection in the duct systems.
   4. Duct Sleeves, Prepared Openings, and Closure Collars: Provide for ductwork penetrations in floors, walls, and partitions through which metallic ductwork passes.
      a. Duct Sleeves: Fill space between duct and sleeve or between insulation and sleeve for insulated ducts with mineral fiber, except at grilles, registers, and diffusers.
      b. Prepared Openings: Fill space between duct and opening or between insulation and opening for insulated ducts with mineral fiber, except at grilles, registers, and diffusers.
      c. Closure Collars: Fit collars snugly around ducts or insulation. Grind edges of collar smooth to preclude tearing or puncturing insulation covering or vapor barrier. Provide nails with maximum 6-inch centers on collars.

B. Ductwork Hangers and Supports: Ductwork hangers and supports shall be in accordance with SMACNA DCS, Section 4. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing member, provide suitable intermediate metal framing.
   1. Flexible Ducts: Support ducts by hangers every 3 feet, unless supported by ceiling construction. Stretch flexible air ducts to smooth out corrugations and long radius elbows. Provide minimum length to make connections.
   2. Flexible Connectors: Provide flexible connectors between fans and ducts or casings and where ducts are of dissimilar metals. For round ducts, securely fasten flexible connectors by zinc-coated steel clinch-type drawbands. For rectangular ducts, lock flexible connectors to metal collars.
   3. Inspection Plates and Test Holes: Provide, where required, in ductwork or casings for all balance measurements. If possible, test holes should be located at least 7.5 times diameters downstream from a disturbance. Extend cap through insulation.
   4. Flashing: Provide waterproof flashing where ducts pass through exterior walls or roofs.
   5. Cleaning of Ducts: Remove all debris and dirt from ducts and wipe clean. Before installing air outlets, force air through entire system at maximum attainable velocity to remove accumulated dust. Provide temporary air filters to protect ductwork which may be harmed by excessive dirt. For large systems, clean duct with high power vacuum machines.

3-02 FIELD QUALITY CONTROL

Administer and direct tests. Furnish instruments, equipment, connecting devices, and personnel for the tests. Notify Contracting Officer 14 days before inspection or testing is scheduled. Correct

defects in work. Repeat tests until work is in compliance.

3-03 TESTING AND BALANCING

Perform testing and balancing on ductwork systems in accordance with Section 23 08 00.

END OF SECTION

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SECTION 23 34 00
EXHAUST FANS

PART 1 GENERAL

1-01 SCOPE

A. Provide all material, equipment and labor required to complete the installation of exhaust fans shown on drawings and specified herein.

B. Exhaust systems shall be in accordance with NFPA 90A.

C. Exhaust fans shall be in accordance with the following industry standards:

AMCA 210	Testing Fans for Rating
AMCA 300	Certified Sound Ratings Program for Air Moving Devices
NEMA MG1	Motors and Generators
NFPA 90A	Installation of Air Conditioning and Ventilation Systems
SMACNA DCS	HVAC Duct Construction Standards - Metal and Flexible
UL 507	Electric Fans

PART 2 PRODUCTS

2-01 ABOVE CEILING EXHAUST FAN

A. Fan shall be mounted above ceiling and vent routed through wall to weatherproof wall louver as shown on plans. Fan shall have forward curved wheel constructed of aluminum. Fan motor shall be of the shaded pole type. Housing shall be of steel construction with baked enamel finish. Fan shall have plug type disconnect. Fan shall have integral backdraft damper.

B. Capacity and characteristics as indicated.

C. As Cook Model specified, or approved equal.

PART 3 EXECUTION

3.1 PREPARATION

Provide storage for equipment and materials at the project site. Parts shall be readily accessible for inspection, repair, and renewal. Protect materials and equipment from weather.

3.2 FANS

Install with resilient mountings, flexible electrical leads, and flexible connections between fan inlet and discharge ductwork. Provide fixed sheaves required for final air balance and safety screen where inlet or outlet is exposed.

3.3 FIELD QUALITY CONTROL

Schedule and administer specified tests. Provide personnel, instruments, and equipment for such tests. Correct defects and repeat the respective inspection and tests. Give the Contracting Officer

ample notice of the dates and times scheduled for tests and trial operations. Conduct inspection and testing in the presence of the Contracting Officer.

A. Inspection: Prior to initial operation, inspect equipment installation for conformance with drawings and specifications.

3.4 TESTING AND BALANCING

Test and balance each exhaust system in accordance with Section 23 08 00, "Testing and Balancing."

END OF SECTION

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SECTION 23 81 13
PACKAGED AIR CONDITIONING AND HEATING EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

A. Provide all material, equipment and labor required to complete the installation of packaged air conditioning and heating equipment.

B. Work Included: Packaged air conditioning and heating equipment shall include:
1. SCOPE
The work covered under this section shall include the following:
   a. Complete variable refrigerant flow system including equipment, piping, and controls. System shall be a VRF (variable refrigerant flow) multi split air conditioning system. The system will utilize an air cooled condensing unit supplying a maximum of forty indoor fan coil units with combinations of outdoor units 3 – 25 ton capacity with a maximum of 2 outdoor units connected at one time for 208-230V/3 Phase service.
   b. The VRF system shall be a simultaneous cooling and heating heat pump system. The VRF system shall consist of an outdoor unit, high efficiency heat recovery units designed for minimum piping and maximum design flexibility, indoor units, and controls by the equipment manufacturer. Each indoor unit shall be independently capable of operating in either heating or cooling mode regardless of the mode of other indoor units.
   c. The variable refrigerant flow system piping system shall be designed by a manufacturer's certified designer. If Basis-of-Design system is not used, contractor shall submit fully revised piping layout to engineer, complete with revised locations and quantities of heat recovery units. Revised piping layout shall be submitted with equipment submittal for review and approval by engineer. Revised piping layout shall not affect performance of indoor or outdoor units. The contractor is responsible for all costs associated with additional review required by engineer.
   d. The VRF system piping system shall be installed by a manufacturer's certified contractor.
   e. The installing contractor shall be trained and certified at the manufacturer's training facility prior to installation, start-up, and commissioning. Submit for review the installation contractor's certification from the manufacturer. This certification shall include the company certification as well as individual certifications for each contractor which will be working on this project.
   f. The refrigeration piping system shall be provided, installed, tested, evacuated, and charged.

C. Packaged air conditioning and heating equipment shall be in accordance with the following industry standards:

ARI DCUAC	Directory of Certified Unitary Air Conditioning Equipment
ARI 210 / 240	Unitary Air-Conditioning and Air-Source Heat Pump Equipment
ARI 410	Forced Circulation Air-Cooling and Air Heating Coils
ASHRAE 15	Safety Code for Mechanical Refrigeration
ASHRAE 52	Equipment Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter

ASME/ANSI B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME/ANSI B31.5	Refrigeration Piping
ASTM B 88	Seamless Copper Water Tube
ASTM B 280	Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM F 872	Filter Units, Air Conditioning: Viscous-Impingement Type
ASTM F 1040	Filter Units, Air Conditioning: Viscous-Impingement and Dry Types, Replaceable
AWS A5.8	Specifications for Filler Metals for Brazing and Braze Welding
FS OO-A-374	Air Conditioners with Remote Condensing Units or Remote Air-Cooled, and Water Cooled Condenser Units, Unitary
MSS SP-58	Pipe Hangers and Supports, Materials, Design and Manufacturer
MSS SP-69	Pipe Hangers and Supports Selection and Application
NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
UL 873	Temperature Indicating and Regulating Equipment
UL 900	Air Filter Units

D. Submittals
1. Manufacturer's Catalog Data.

PART 2 VARIABLE REFRIGERANT FLOW-HEAT PUMP MODELS WITH MULTIPLE INDOOR UNITS

2-01 SYSTEM DESCRIPTION

The variable capacity, heat pump air conditioning system shall be equal to a Mitsubishi or LG Multi-V III (Variable Refrigerant Flow) System. The systems shall be the HP (cool/heat) split system heat pump.

A. Piping
1. Piping to multiple indoor units requires additional piping components. Y-joint fittings must be used to branch the main refrigerant lines.
2. Tee fittings must be used to connect outdoor units when multiple module systems are being installed (systems with more than one outdoor unit).

2.2 QUALITY ASSURANCE

A. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

D. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit. Additional refrigerant is required based on diameters and lengths of system liquid refrigerant lines.

2-03 WARRANTY

A. If within Six (6) years after initial installation of the product, any compressor in the Product shall prove to be defective in material or workmanship, the manufacturer shall replace the

defective compressor at no charge.

B. If within One (1) year after initial installation of the Product, the functional parts of the Product shall prove to be defective in material or workmanship the manufacturer shall repair or replace the defective part at no charge.

2-04 OUTDOOR UNIT

A. General:

The outdoor units shall be equipped with multiple circuit boards that interface to the control system and shall perform all functions necessary for operation. The outdoor unit shall have a powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.

1. The sum of connected capacity of all indoor units shall range from 50% to 130% of outdoor rated capacity.
2. Outdoor unit shall have a sound rating no higher than 64 dB(A).
3. Both refrigerant lines from the outdoor unit to indoor units shall be insulated.
4. The outdoor unit shall have an accumulator with heater and controls.
5. The outdoor unit shall have a high pressure safety switch, fuse, over-current protection and crank case heater.
6. The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet with the outdoor unit installed higher than the indoor units or 131 feet with the condensers installed lower than the indoor units and have total refrigerant tubing length of 3281 feet. The greatest length is not to exceed 656 feet between outdoor unit and the farthest indoor unit without the need for traps.
7. The outdoor unit shall be capable of operating in heating at -4 F ambient temperature without additional low ambient controls.
8. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
9. The outdoor unit shall have a Turbo Intercooler to subcool liquid refrigerant further to increase capacity and performance with long pipe lengths.

B. Unit Cabinet:

1. The chassis shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

C. Fan:

1. The outdoor unit shall be furnished with two direct drives, variable speed propeller type fans.
2. All fan motors shall be BLDC type.
3. The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
4. The fan motor shall be mounted for quiet operation.
5. The fan shall be provided with a raised guard to prevent contact with moving parts.
6. The outdoor unit shall have vertical discharge airflow.

D. Refrigerant

1. R410A refrigerant shall be required for outdoor unit systems.
2. Additional refrigerant is required. Amount is based on installed refrigerant pipe diameters and lengths.

E. Coil:

1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil shall be protected with an integral metal guard.
3. Refrigerant flow from the outdoor unit shall be controlled by means of capacity modulation capable vapor injection scroll compressor.

F. Compressor:

1. The outdoor unit shall be equipped with two capacity modulation capable vapor injection scroll compressors and two vapor injection scroll compressors.
2. Crankcase heaters shall be factory mounted on the compressors.
3. The outdoor unit compressor shall have a variable modulation technology to modulate capacity. The capacity shall be completely variable down to 10% of rated capacity.
4. The outdoor unit compressor shall have a vapor injection technology which can enlarge the mass flow rate of refrigerant, as a result a performance improvement at an extremely low temperature condition.
5. The compressor shall be equipped with an internal thermal overload.
6. The compressor shall be mounted to avoid the transmission of vibration.

G. Electrical:

1. The outdoor unit electrical power shall be 208/230 volts, 3 phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limitations of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units and the outdoor unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, 16 AWG, shielded, two-core cable to provide total integration of the system.

2-05 (WALL-MOUNTED) INDOOR UNIT

A. General:

The unit shall be wall-mounted with a slim silhouette and must be installed with an optional modulating linear expansion valve or two or three rooms EEV (Electronic Expansion Valve) kits. The unit shall be compatible with the (Heat Pump) outdoor unit. The unit shall support individual control using a Control Network Solution.

B. Indoor Unit

The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board and fan motor. An optional electronic modulating linear expansion valves is available for accessories. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air (Nitrogen Gas) before shipment from the factory.

C. Unit Cabinet:

1. The casing shall have a gloss white finish.
2. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and four (4) directions for draining shall be standard.
3. There shall be a separate galvanized steel mounting plate which secures the unit firmly

to the wall.

D. Fan:
1. The indoor fan assembly shall be a cross-flow fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
4. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.
5. The indoor fan shall consist of various speeds.

E. Filter:
1. Return air shall be filtered by means of an easily removable, washable filter (2).
2. Supplemental antibacterial and anti-odor filters shall be included.

F. Coil:
1. The indoor coil shall be of nonferrous construction with slit fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The coil fins are coated with hydrophilic paints.
7. Both refrigerant lines to the indoor units shall be insulated.

G. Electrical:
1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)
3. The control circuit between the indoor units, MCU (Mode Change Unit) and the outdoor unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, two-core, 16 AWG, shielded cable to provide total integration of the system.

H. Controls:
1. This unit shall use factory mounted controls to perform functions necessary to operate the system. Please refer to Part 3.4 of this specification for more details on controls requirements.
2. This unit shall include a wireless controller and holder as standard.

2-06 CONTROLS

A. Overview
1. General:
The control system shall be capable of supporting remote controllers, schedule timers, system controllers and centralized controllers.

B. Electrical Characteristics
1. General:
The control system shall operate at 12VDC. Controller power and communications shall be

via a common communications bus.

2. Wiring:
   a. Main system control wiring shall be installed in a system daisy chain configuration from the indoor units to outdoor unit. Control wiring to wired remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
   b. Control wiring for system controllers shall be installed in a daisy chain configuration from interface module to interface module, to system controllers.
   c. Communication wire connection between outdoor unit modules (systems with multiple outdoor units on a single piped refrigerant system) must be connected from the MAIN unit to SUB1 and SUB2 (where applicable. This wire shall be 2-conductor, 16 AWG, shielded cable.
3. Wiring type:
   COM1 and COM2 control wiring shall be 2-conductor, 16 AWG, shielded cable.

C. Individual Control System
1. Multi-Function Controller
   a. Connection:
      Can control up to 16 indoor units.
   b. Energy saving operation
      - Upper/lower temperature setting
      - Automatic operation stop function
      - Energy saving operation mode
   c. Weekly operating schedule setting
      - Weekly operating schedule (A/C only)
      - Able to set desired A/C operation mode, setting temperature and fan speed to operate based on weekly schedules
      - Able to apply schedule exception day
   d. Other features
      - Different button permission levels
      - Partial button lock option (on/off, selection, temperature setting, fan speed, and schedule setting buttons can be locked individually)
      - Backlight
      - Daylight savings clock advance option
      - Temperature limit setting option
      - Real-time clock function; current time/day display function
      - Built-in room temperature sensor
      - Indoor unit operation state display
   e. Specifications
      - Conductor connection
      - DC 12V (V1/V2) power supplied by indoor unit
      - Can sense temperature via internal sensor, temperature sensor inside the air handler, or use the average temperature between controller and air handler temperature sensors
      - 16AWG shielded cable is necessary for proper operation

PART 3 EXECUTION

3-01 EQUIPMENT INSTALLATION

A. Install equipment and components in a manner to ensure proper and sequential operation of equipment and equipment controls. Install equipment not covered in this section, or in manufacturer's instructions, as recommended by manufacturer's representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including, but not limited to, supports, vibration isolators, stands, guides, anchors, clamps and brackets. Foundations for equipment shall conform to equipment manufacturer's recommendation, unless otherwise indicated. Set anchor bolts and sleeves using templates. Provide anchor bolts of adequate length, and provide with welded-on plates on the head end embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grout-in with a nonshrinking type of grouting mortar. Locate equipment to allow working space for servicing including shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

B. Unitary Air Conditioning System: Install as indicated, In accordance with requirements of ASHRAE 15, end the manufacturer’s installation and operational instructions. System shall be in accordance with NFPA 90A.

C. Room Air Conditioners: Install units in accordance with manufacturer's instructions and provided with structural mountings, panels, and seals for weathertight assembly. Pitch unit as recommended by manufacturer to ensure condensate drain to drain pan without overflow.

3-02 PIPING

Brazing, bending, forming and assembly of refrigerant piping shall conform to ASME/ANSI 831.5.

A. Pipe Hangers and Supports: Design and fabrication of pipe hangers, supports, and welding attachments shall conform to MSS SP-58. Installation of hanger types and supports for bare and covered pipes shall conform to MSS SP69 for the system temperature range. Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58.

B. Refrigerant Piping: Cut pipe to measurements established at the site and work into place without springing or forcing. Install piping with sufficient flexibility to provide for expansion and contraction due to temperature fluctuation. Where pipe passes through building structure pipe joints shall not be concealed, but shall be located where they may be readily inspected. Install piping to be insulated with sufficient clearance to permit application of insulation. install piping as indicated and detailed, to avoid interference with other piping, conduit, or equipment. Except where specifically indicated otherwise, run piping plumb and straight and parallel to walls and ceilings. Trapping of lines will not be permitted except where indicated. Provide sleeves of suitable size for lines passing through building structure. Braze refrigerant piping with silver solder complying with AWS A5.8. Inside of tubing and fittings shall be free of flux. Clean parts to be jointed with energy cloth and keep hot until solder has penetrated full depth of fitting and extra flux has been expelled. Cool joints in air and remove flame marks and traces of flux. During brazing operation, prevent oxide film from forming on inside of tubing by slowly flowing dry nitrogen through tubing to expel air. Make provisions to automatically return oil on halocarbon systems.

Installation of piping shall comply with ASME/ANSI 831.5.

C. Returning Oil from Refrigerant System: Install refrigerant lines so that gas velocity in the evaporator suction line is sufficient to move oil along with gas to the compressor. Where equipment location requires vertical risers, line shall be sized to maintain sufficient velocity to lift oil at minimum system loading. Larger riser shell have a trap, of minimum volume, obtained by use of 90- and 45-degree ails. Arrange small riser with inlet close to bottom of horizontal line, and conned to top of upper horizontal line. Do not install valves in risers.

D. Refrigerant Driers, Sight Glass Indicators, and Strainers: Provide refrigerant driers, sight glass liquid indicators, and strainers in refrigerant piping in accordance with specifications, when not furnished by the manufacturer as part of the equipment. Install driers in liquid line with service valves and valved bypass line the game size as liquid line in which dryer is installed. Size of driers shall be determined by piping and installation of the unit on location. Install dryers of 50 cubic inches and larger vertically with the cover for removing cartridge at the bottom. Install moisture indicators in the liquid line downstream of the drier. Indicator connections shall be the same size as the liquid line in which it is installed.

E. Strainer Locations and Installation: Locate strainers close to equipment they are to protect. Provide a strainer in common refrigerant liquid supply to two or more thermal valves in parallel when each thermal valve has a built-in strainer. Install strainers with screen down and in direction of flow as indicated on drainer's body.

F. Solenoid Installation: Install solenoid valves in horizontal lines with stem vertical and with now in direction indicated on valve. If not incorporated as integral part of the valve, provide a strainer upstream of the solenoid valve. Provide service valves upstream of the solenoid valve, upstream of the strainer, and downstream of the solenoid valve. Remove the internal parts of the solenoid valve when brazing the valve.

3-03 AUXILIARY DRAIN PANS, DRAIN CONNECTIONS, AND DRAIN LINES

A. Provide auxiliary drain pans under units located above finished ceilings or over mechanical or electrical equipment where condensate overflow will cause damage to ceilings, piping, and equipment below. Provide separate drain lines for the unit drain and auxiliary drain pans.

Trap drain pans from the bottom to ensure complete pan drainage. Provide drain lines full site of drain opening.

3-04 CONTROLS ADDITIONAL REQUIREMENTS

A. All HVAC equipment shall communicate directly with the current base Energy Management System.

B. The Contractor shall contact the base facilities office BEFORE BID DATE to confirm connection protocol and connection points.

3-05 FIELD QUALITY CONTROL

A. Leak Testing: Upon completion of installation of air conditioning equipment, test factory- and field-installed refrigerant piping with an electronic-type leak detector. Use same type of refrigerant to be provided in the system for leak testing. When nitrogen is used to boost system pressure for testing, ensure that it is eliminated from the system before charging. Minimum refrigerant leak field test

pressure shall be as specified in ASHRAE 15, except that test pressure shall not exceed 150 psig on hermetic compressors unless otherwise specified as a low side test pressure on the equipment nameplate. If leaks are detected at time of installation or during warranty period, remove the entire refrigerant charge from the system, correct leaks, and retest system.

B. Evacuation, Dehydration, and Charging: After field charged refrigerant system is found to be without leaks or after leaks have been repaired on field-charged and factory-charged systems, evacuate the system using a reliable gauge and a vacuum pump capable of pulling a vacuum of at least one mm Hg absolute.

Evacuate system in accordance with the triple-evacuation and blotter method or in accordance with equipment manufacturer's printed instructions.

END OF SECTION

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SECTION 26 01 01
ELECTRICAL GENERAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS:

A. The "General Conditions" and "Special Conditions" of Contract as written and referred to hereinbefore are adopted and made part of Division 26.

1.2 DESCRIPTION OF WORK:

A. Provide equipment, labor, etc., required to install complete working electrical system as shown and specified.

B. Provide fixed electrical equipment, except where specifically noted otherwise.

C. Provide portable electrical equipment for complete system.

D. Provide equipment and/or wiring normally furnished or required for complete electrical systems but not specifically specified on the drawings or in specifications, as though specified by both.

E. All equipment and wiring shall be new except where specifically noted otherwise.

F. Electrical work includes, but is not limited to:
1. Arrange with local utility companies for services as shown or specified.
2. Removal or relocation of electrical services located on or crossing through project property, above or below grade, obstructing construction of project or conflicting with completed project or any applicable code.
3. Alterations and additions to existing electrical systems.
4. Complete 600-volt Distribution System. Provide meters, switchboards, panelboards, circuit breakers, power outlets, convenience outlets, switches, and/or other equipment forming part of system.
5. Alterations and additions to raceway systems and terminal facilities for telecommunication system.
6. Connection of all appliances and equipment.
7. Complete fire alarm and mass notification system.
8. Complete empty raceway system(s) for auxiliary system(s) as shown.
9. Complete system of outlets and raceways for master television antenna system.
10. Complete raceway and terminal facilities for security system including the following:
    a. Access control system.
11. Complete interior and exterior lighting.
12. Complete lighting control system.
13. Power provisions for UPS system(s) by others.
14. Provide temporary facilities for construction power.
15. Provide Government with training on all systems.

1.3 WORK NOT INCLUDED:

A. Furring for conduit and equipment.

B. Finish painting of conduit and equipment.

C. Installation of motors except where specifically noted.

D. Control wiring for mechanical systems, except where indicated to be provided by Electrical Contractor.

E. Flashing of conduits into roofs and outside walls. Inform General Contractor of number and size of roof penetrations prior to bidding.

1.4 RELATED WORK SPECIFIED ELSEWHERE:

A. Classification of excavation: Architectural Division.

B. Painting: Painting Division.

C. Concrete Work: Concrete Division.

1.5 REQUIREMENTS OF REGULATORY AGENCIES:

A. Obtain and pay for all permits required for the work. Comply with all ordinances pertaining to work described herein.

B. Install work under this Division per drawings, specifications, latest edition of the National Electrical Code, Local Building Codes, and any special codes having jurisdiction over specific portions within complete installation. In event of conflict, install work per most stringent code requirements determined by Contracting Officer.

C. Arrange, pay fees for and complete work to pass required tests by agencies having authority over work. Deliver to Contracting Officer Certificates of Inspection and approval issued by authorities.

1.6 QUALIFICATIONS OF CONTRACTOR:

A. Has completed minimum two projects same size and scope in past five (5) years.

B. This qualification applies to Sub-Contractors.

C. Use workmen experienced in their respective trade. Submit qualifications of Superintendent for review.

D. Government reserves right to reject bid of any Contractor failing to meet these qualifications.

1.7 GENERAL JOB REQUIREMENTS:

A. Drawings and Specifications:

1. Electrical work is shown on "E" series drawings inclusive. Follow any supplementary drawings as though listed above.
2. Drawings and specifications are complementary. Work called for by one is binding as if called for by both.
3. Drawings show general run of circuits and approximate location of equipment. Right is reserved to change location of equipment and devices, and routing of conduits to a reasonable extent, without extra cost to Government.
4. In the event of conflict between drawings and specifications, apply the most stringent ruling and refer conflicts describing electrical work and work under other Divisions to Contracting Officer for remedial action.
5. Use dimensions in figures in preference to scaled dimensions. Do not scale drawings for exact sizes or locations.
6. Execution of Contract is evidence that Contractor has examined all drawings and specifications related to work and is informed to extent and character of work. Later claims for labor and materials required due to difficulties encountered, which could have been foreseen had examination been made, will not be recognized.
7. Charges for extra work not allowed unless work authorized by written order from Contracting Officer approving charge for work.

B. Definitions:

1.	Provide:	Furnish, install and connect complete.
2.	Wire:	Furnish all necessary wiring and connect complete.
3.	Install:	Set in place and wire complete.
4.	Work:	Materials completely installed and connected.
5.	AWG:	American Wire Gage.
6.	NEC:	National Electrical Code (latest edition).
7.	NFPA:	National Fire Protection Association.
8.	OSHA:	Occupation Safety and Health Administration.
9.	UL:	Underwriters Laboratories, Inc.
10.	NEMA:	National Electrical Manufacturers Association.
11.	IEEE:	Institute of Electrical and Electronic Engineers.

C. Workmanship, Guarantee and Approval:
1. Work under this Division shall be first class with emphasis on neatness and workmanship.
2. Install work using competent mechanics, under supervision of foreman, all duly certified by local authorities. Installation subject to Contracting Officer's constant observation, final approval, and acceptance. Contracting Officer may reject unsuitable work.
3. Furnish Contracting Officer written guarantee, stating that if workmanship and/or material executed under this Division is proven defective within one (1) year after final acceptance, such defects and other work damaged will be repaired and/or replaced.
4. In event that project is occupied, or systems placed in operation in several phases at Government's request, guarantee will begin on date each system or item of equipment is accepted by Government.

D. Observations of Work and Demonstration of Operation:
1. At all observations of work, open panel covers, junction box cover, pull box covers, device covers, and other equipment with removable plates for check. Provide sufficient personnel to expedite cover removal and replacement.

2. Contractor to assist Contracting Officer in demonstration of operation of new systems to satisfaction of Government. Contractor to have manufacturer available for demonstration of systems where requested by Government.

E. Testing of Electrical Systems:
   1. Test Completed work as follows:
      a. Perform test required by Contracting Officer to indicate compliance with specifications, drawings and applicable codes. Provide instruments, labor and materials for tests.
      b. Insulation – use 1000 VDC insulation tester (0-500 megohm full-scale), equal to "Megger" as manufactured by Megger Company. Test conductors and busses of all systems, including feeders, main service busway, branches, etc.
      c. Insulations test results shall be submitted and approved prior to connection of devices and equipment.
   2. Switchgear Test:
      a. Prior to acceptance of new construction, all service and distribution equipment, including main switchboard, lighting panelboards, individually enclosed circuit breakers, and safety switches will be tested by the manufacturer. All test results are to be included in submittal data.
      b. Tests will determine whether circuit breaker trip devices are functioning properly; contact surfaces and joints in switches and circuit breakers have minimum electrical resistance; all bolted connections are tight; bus bars properly braced.
      c. Tests shall not affect Contractor's guarantee of materials and workmanship. Contractor to replace defective new equipment and devices without additional cost to Government
   3. Ground Testing:
      a. Testing of Made Ground Electrodes:
         1) Test all Ground Systems.
         2) Using a measuring device which generates minimum of 500 DC, calibrated in ohms (maximum 200-ohm scale) as manufactured by Biddle or Megger/Biddle. (Biddle/Megger models DET20C and DET30C are acceptable).
         3) Provide test electrode in accordance with Measuring Device Manufacturer's instructions. Use ground rods as specified in Section "Grounding".
         4) Follow instructions of measuring device manufacturer for proper results.
         5) Test grounds only when earth is dry.
         6) Record ambient temperature, date, time, appropriate water table level (as obtained from local geologists); type of earth material.
   4. Low voltage:
      a. Test interval – 60 seconds. Test to be discontinued if erratic results are observed. Test records include date, ambient temperature, relative humidity and time of day.
      b. Log readings on loose leaf paper for each circuit, electrode, device, etc.

F. Materials and Substitutions:

1. All material shall be new, with U.L. label where available. If U.L. label is not available, material shall be manufactured in accordance with applicable NEMA, IEEE and Federal Standards.
2. Submitted items or components shall be listed on sheet 1 of submittal brochure complete with identification mark (from drawings), manufacturer, catalog number and any other pertinent information. Submittals will not be reviewed without this summary sheet.
3. Bind each set of submittal data. Submittals will not be reviewed if not bound.

G. Shop and Erection Drawings:
1. Submit complete shop drawings for all material and equipment furnished under Division 26 of specifications, to Contracting Officer for review within (30) days after award of contract. Shop drawings shall be submitted on timely basis to allow adequate lead time for review, re-submission if necessary, manufacture and delivery to allow access of material to project at correct time based on schedule established by Contracting Officer/Contractor. Include complete descriptive data with dimensions, operating data and weight for each item of equipment. Carefully examine shop drawings to assure compliance with drawings and specifications prior to submittal to Contracting Officer. Shop drawings and submittals shall bear the stamp of approval of the Electrical and General Contractor as evidence drawings have been checked by them. Drawing submitted without this stamp of approval will not be considered and will be returned for proper resubmission.
2. Drawings larger than 8-1/2" x 11", submit 3 copies and 1 reproducible of each drawing. Contracting Officer will retain 2 copies and return 1 reproducible and 1 copy to Contractor. Contractor is responsible for copying reproducible for distribution.
3. 8-1/2" x 11" drawing in brochure: Submit 6 original copies for review. Contracting Officer will retain 2 copies and return 4 copies to Contractor.
4. Review of shop drawings does not relieve Contractor of responsibility for errors and omissions in shop drawings. Contractor is responsible for dimensions and sizes of equipment. Inform Contracting Officer in writing of equipment differing from that shown.
5. Prepare erection drawings when required by Contracting Officer. Investigate thoroughly all conditions affecting work and indicate on drawing. Contracting Officer will review erection drawings before work commences.
6. Provide for Government three (3) sets of final shop and erection drawings, except provide 1 set of 1.5 mil mylar sepias of shop drawings larger than 8-1/2" x 11" size.

H. Cooperation:
1. Carefully coordinate work with other contractors. Refer conflicts between trades to Contracting Officer.
2. Work to be installed as progress of project will allow. Schedule of work determined by General Contractor and/or Contracting Officer.

I. Maintenance and Operating instructions for Equipment:
1. Submit to Contracting Officer three (3) sets of data prepared by manufacturer for each item of electrical equipment completely describing equipment. Data to include parts lists, description of operation, shop drawings, wiring diagrams, maintenance procedures

and other literature required for maintenance of equipment. Bind in booklet form for presentation.

J. "Record" Blue Line Prints:

1. Provide "Record" blue line prints at the completion of job. Keep set of prints on job and record day changes to Contract drawings with red pencil. One complete set of blue line prints will be furnished to the Contractor for record drawings. Indicate actual location of conduit systems, outlets, and equipment. Turn over prints to Contracting Officer at final observation.
2. After receipt of "Record" prints, Contracting Officer will forward to consulting engineer for corrections and return to contractor the corrected original tracings. Contractor shall make (and pay for) auto-positive reproductions of all floor plans and riser diagram. Reduce ¼" scale drawings to ½ size; 1/8" scale drawings to be full size; reduce Riser Diagram to ½ size.
3. Frame "Record" auto-positives under glass in extruded aluminum frame and mount with screws an inserts on wall. Mount Riser Diagram near Main Switchboard; Mount Floor Plans near panelboard involved. Where more than one panelboard is involved and are separated, provide framed auto positive near each panelboard.

K. Items for Government:

1. Provide following items for Government at time of substantial completion:
   a. Certificates of inspection and approval from authorities having jurisdiction.
   b. Certification of systems from installing Sub-Contractors (such as Fire Alarm, Security, etc.).
   c. Written guarantees.
   d. "Record" blue line prints.
   e. Final approved shop drawings (3 sets).
   f. Spare fuses (furnish receipt).
   g. Maintenance data (3 sets).
   h. Affidavit of Government Instruction (1 copy).
   i. Test reports

L. Protection and Storage:

1. Provide warning lights, bracing, shoring, rails, guards and covers necessary to prevent damage or injury.
2. Do not leave exposed or unprotected, electrical items carrying current. Protect personnel from exposure to contact with electricity.
3. Protect work and materials from damage by weather, entrance of water or dirt. Cap conduit during installation.
4. Avoid damage to materials and equipment in place. Repair, or remove replace damaged work and materials.
5. Exercise particular care when working around telephone (electronic) equipment to prevent entrance of dust, moisture and debris into the equipment. Provide dust barriers and partitions as required.
6. Deliver equipment and materials to job site in original, unopened, labeled container. Store to prevent damage and injury. Store ferrous materials to prevent rusting. Store finished materials and equipment to prevent staining and discoloring. Store materials affected by condensation in warm dry areas. Provide heaters.

7. Install equipment per manufacturer's recommendations. Conflicts between contract documents and these recommendations, deferred to Contracting Officer.

M. Cutting and Repairing:
1. Cut and repair walls, floors, roof, etc., required to install work. Where work cut is finished, employ original installer of finish to repair finish. Do not cut structural members.

N. Anchors:
1. Provide anchors for all equipment, raceways, hangers, etc. to safely support weight of item involved. Anchors to consist of expansion type devices similar to "Redhead" or lead expansion anchors. Plastic anchors are not acceptable. Protect existing telecommunication equipment from drilling residue.

O. Cleaning and Painting:
1. Clean equipment furnished in this Division after completion of work.
2. Touch-up or re-paint damaged painted finishes.
3. Remove debris, packing cartons, scrap, etc., from site.

P. Starters:
1. Separately mounted starters are furnished under another Division but installed in Division 26 unless specifically noted otherwise.

Q. Control Wiring:
1. Control Wiring including low voltage and line voltage interlock wiring will be furnished and installed under another Division, except where specifically shown otherwise. Carefully coordinate power and control wiring interface.

R. Code Compliance:
1. Entire electrical installation shall comply with all aspects of code including local interpretations. This included but is not limited to:
   a. Installation adjustment to meet all code clearances between electrical such as ductwork, other HVAC, plumbing, fire protection, and structural systems.
   b. Locations for items such as fire alarm appliances, exit lights, egress lighting, disconnect switches, etc.
2. No additional compensation will be allowed for code compliance. Notify Contracting Officer of difficulty encountered for assistance.

END OF SECTION

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SECTION 26 01 02
ELECTRICAL FIRESTOPPING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Firestopping materials and accessories.

1.2 CODES AND STANDARDS:

A. IBC - 2018

B. Underwriters Laboratories – Fire Resistance Directory
1. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials (UL 723).
2. ASTM E119 – Method for Fire Tests of Building Construction and Materials (UL263).
3. ASTM E814 – Test Method of Fire Tests of Through-Penetration Firestops (UL1479).

1.3 QUALITY ASSURANCE:

A. Fireproofing Materials:
1. ASTM E119 and/or ASTM E814 to achieve a fire rating as noted on Drawings or as per applicable Codes.
2. All fireproofing shall be UL classified for the appropriate UL system number.

B. Surface Burning:
1. ASTM E84 with a flame spread smoke developed rating of 0/5.

C. Manufacturer:
1. Company specializing in manufacturing the products specified in this Section with minimum three years experience.

1.4 SUBMITTALS:

A. Submit under provisions of Section 26 01 01 – Electrical General.

B. Product Data: Provide data on product characteristics, performance and limitation criteria.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions. Include the UL System Numbers which apply to each application.

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

E. Provide certificate of compliance from authority having jurisdiction indicating approval.

F. Provide mock-up of applied firestopping material for each type of application.

G. If accepted, mock-up will demonstrate minimum standard for the work.

H. Mock-up may remain as part of the work.

I. Do not apply materials when temperature of substrate material and ambient air is below 40 degrees F.

J. Maintain this minimum temperature before, during, and for 3 days after installation of materials.

K. Provide ventilation in areas to receive solvent cured materials. Use water-based materials in occupied areas.

L. Sequence work to permit firestopping materials to be installed after and surrounding work is complete.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, grade, and UL label where applicable.

B. Coordinate delivery with scheduled installation date to allow minimum storage time at site.

C. Store materials in clean, dry, ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instructions.

1.6 GUARANTEE:

A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

A. 3M brand CP25 Fire Barrier Caulk, CS195 Composite Sheet, FS195 Wrap/Strip, RC-1 Restricting Collars, Interam Fire Dam 150 caulk or moldable putty. Other approved manufacturers are GE "Pensil" Systems and Dow Corning Fire Stop Systems.

B. Primer: Type recommended by firestopping manufacturer for specified substrate surfaces.

2.2 ACCESSORIES:

A. Dam Materials: Mineral fiberboard, mineral fiber matting, sheet metal or alumina silicate fire board.

PART 3 EXECUTION

3.1 GENERAL:

A. Verify site conditions.

B. Verify that openings are ready to receive the Work of this Section.

3.2 PREPARATION:

A. Clean substrate surfaces of dirt, dust, grease, oil, loose materials, or other matter which may affect bond of firestopping material.

B. Remove incompatible materials which affect bond.

3.3 INSTALLATION:

A. Install penetration sealing materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.

B. Seal holes or voids made by penetrations to ensure an effective smoke barrier.

C. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor.

D. Protect materials from damage on surfaces subject to traffic.

E. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.

F. Keep areas of work accessible until inspection by applicable code authorities.

G. Perform, under this section, patching and repairing of fire stopping caused by cutting or penetration by other trades.

H. Install backing materials to arrest liquid material leakage.

3.4 APPLICATION:

A. Apply materials in accordance with manufacturer's instructions.

B. Apply firestopping material in sufficient thickness to achieve rating to uniform density and texture.

C. Install material at floors, walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit, and other items requiring firestopping.

3.5 CLEANING:

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

D. Protect finished work.

E. Protect adjacent surfaces from damage by material installation.

3.6 SYSTEMS AND APPLICATION SCHEDULE:

Construction Condition	UL Designation
Metal Pipe or Conduits Through Round Opening	49, 95, 138, 202, 319, 321
Metal Pipes or Conduits Through Large Opening	49, 63, 93, 94, 137, 233, 234, 319, 321
Busway through Rectangular	97, 99
Blank Opening	61, 62, 92, 102, 104, 136, 318
Non-metallic (Plastic) Pipe or Conduit through Opening	64
Metal Pipe or Conduit Through Gypsum Board Wall	147, 322
Non-Metallic (Plastic) Pipe Or Conduit through Gypsum Board Wall	148
Cables through Gypsum Board Wall	149

A. The following UL sections have applications for fire ratings less than 2-hours: 64, 65, 91, 147, 148, 160, 168, 169 and 320.

B. The following UL sections have applications for fire ratings of 4-hours: 91, 95, 233 and 234.

C. All sections (including those previously listed) listed have applications for fire ratings of 2-hours or less.

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SECTION 26 05 16
CONDUCTORS (MEDIUM VOLTAGE)

PART 1 GENERAL

1.1 DESCRIPTION:

A. All work specified in this Section shall comply with the provisions of Section 26 00 10 – Electrical General Provisions.

B. This Section specifies requirements for wires, cables, splices, terminations and appurtenances for electrical systems of medium voltage: 601 volt to 34,500 volts, inclusive.

1.2 REFERENCES:

A. The following is a listing of the publications referenced in this section:

1. American Society for Testing and Materials. (ASTM)
   a. ASTM B 1 Hard-Drawn Copper Wire.
   b. ASTM B 2 Medium-Hard-Drawn Copper Wire.
   c. ASTM B 3 Soft or Annealed Copper Wire l.
   d. ASTM B 8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   e. ASTM B 33 Tinned Soft or Annealed Copper Wire for Electrical Purposes.
   f. ASTM B 189 Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for
   g. Electrical Purposes.
   h. ASTM D 1373 Medium-Voltage Rubber Insulating Tape.
   i. ASTM D 2802 Ozone-Resistant Ethylene-Propylene-Rubber Insulation for Wire and Cable.
2. Association of Edison Illuminating Companies. (AEIC)
   a. AEIC CS 6 Ethylene-Propylene-Rubber Insulated Shielded Power Cable Rated 5 through 69 KV.
3. Federal Specifications. (FS)
   a. JJ-I-553 Insulation Tape, Electrical (Rubber, Natural and Synthetic)
4. Insulated Cable Engineers Association. (ICEA)
5. ICEA S-68-516 Ethylene-Propylene-Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
6. Institute of Electrical and Electronics Engineers. (IEEE)
   a. IEEE 48 High Voltage AC Cable Terminators, Test Procedure and Requirements.
   b. IEEE 383 Type Test of Class 1E Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations.
   c. IEEE 404 Standard for Type Test of Cable Joints for Use with Extruded Dielectric Cable Rated 5,000 through 46,000 Volts, and Cable Joints for Use with Laminated Dielectric Cable Rated 2,500 through 500,000 Volts.
   d. IEEE 837 Standard for Qualifying Permanent Connections Used in Substation Grounding.
7. National Fire Protection Association. (NFPA)
   a. NFPA 70 National Electrical Code.

b. NFPA 258 Standard Research Method for Determining Smoke Generation of Solid Materials.

8. Underwriters Laboratories, Inc. (UL)
   a. U: 44 Rubber -Insulated Wires and Cables.
   b. UL 467 Grounding and Bonding Equipment.
   c. UL 510 Insulation Tape.
   d. UL 1581 Reference Standard for Electrical Wires, Cables, and Flexible Cords.

1.3 QUALITY ASSURANCE:

A. Wires and cables which have been manufactured more than two (2) years prior to installation shall not be used in the Work of this Section.

B. Tapes for splices or terminations shall be dated by the tape manufacturer to indicate that they have been manufactured no longer than six months prior to use in the Work of this Section.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Where multi-conductors are to be installed as one cable, single conductor cables shall be paralleled by cable manufacturer prior to shipment. Cable assembly overall diameter shall be kept to a minimum.

B. Store material in a clean, dry space and protect from weather.

1.5 SUBMITTALS:

A. Submit the following:

1. Shop drawings:
   a. Submit shop drawings for the installation sequence, pulling tensions and sidewall pressure of all wire and cable pulls, including identification of manhole locations with splices and manholes which will be “pulled-through” without splicing.
2. Catalog Cuts:
   a. Medium voltage cable(s).
   b. Ground wire(s).
   c. Terminators.
   d. Splices.
   e. Pulling devices and end seals.

B. Submit certified shop test reports for wires and cables.

C. Submit field test results for wires and cables, including all test data and methodology.

PART 2 PRODUCTS

2.1 MANUFACTURER:

Subject to compliance with requirements of this Section, provide wires, cables, wire and cable splicing and terminating of one of the following manufacturers, or Engineer approved equal:

A. Wire and Cables:

1. American Insulated Wire Corporation.
2. Pirelli Cable Corporation.
3. The Okonite Company.
4. Rome Cable Corporation.
5. Triangle PWC, Inc.
6. Splicing and Terminating:
7. 3M Company.
8. Southwire
9. The Okonite Company.

2.2 WIRES AND CABLES:

A. General:

1. Locations, types, sizes and numbers of wires and cables are shown on the Contract Drawings.
2. Unless otherwise shown on the Contract Drawings, solid conductors shall be soft or annealed copper, conforming to ASTM B 33 (tinned), ASTM B 189 (lead-coated or lead alloy coated), or ASTM B 3 (uncoated).
3. Pulling Devices and End Seals:
   a. Wires and cables shall be provided with factory fitted pulling devices and end caps unless otherwise shown on the Contract Drawings. Shop drawings showing the pulling devices and end caps to be used shall be submitted to the Engineer for Approval.
   b. For pulling tensions up to 1000 pounds per grip, basket grips may be utilized.
   c. All wires and cables shall be end-sealed, at both end of each length, with either a solder-wiped seal or a heat-shrinkable cap, to prevent the entrance of moisture.
4. Wires and cables shall be identified in accordance with AEIC CS 6. Outer jacket shall be printed with manufacturer's identification, type of insulation, size of conductor, rated voltage, year of manufacture, insulation thickness and UL listing. Each reel shall carry a tag identifying manufacturer, cable type, voltage and length of cable on reel.

B. Grounding Wires and Cables: Unless otherwise shown on the Contract Drawings, grounding conductors shall be as follows:

1. Insulated:
   a. Solid for sizes #8 AWG and smaller, Class B stranded for sized #6 AWG and larger, 600 volt rated, XHHHW or RHW.
   b. Covering shall be a continuous green color and conform to ASTM B 33 and UL 44.
2. Uninsulated:
   a. Solid for sizes #8 SWG and smaller, Class B stranded for sized #6 AWG and larger.

3. In raceways. Soft-drawn and conforming to ASTM B 3.
   a. Direct buried or encased in concrete. Soft-drawn, medium-hard-drawn or hard-drawn and conforming to ASTM B 1, B 2, or B 3, respectively.

C. Medium Voltage Cables:

1. Jacketed, Single Conductor Cable.
   a. Voltage ratings shall be as shown on the Contract drawings.
   b. Insulation - Ethylene-propylene-rubber (EPR) insulated cables shall conform to AEIC CS 6, ASTM D 2802 and ICEA S-68-516, 133 percent insulation level.
   c. General Construction: In cross section from center to circumference, jacketed, single conductor cable shall consist of the following:
      (1) Copper conductor lead or tin coated, Class B stranded or compact strand or sector, as shown on the Contract Drawings.
      (2) Extruded conductor shielding.
      (3) Insulation.
      (4) Extruded EPR, semi-conducting, insulation shielding.
      (5) Jacket of black polyethylene, polyvinyl chloride, or as shown on the Contract Drawings.

D. Maximum outside diameter shall be as shown on the Contract Drawings.

E. Cable Tags: Stainless steel metal tags, No. 28 gauge and ¾ inch wide, embossed with letter and numbers 5/16-inch-high, fastened to the cable at both ends of tags with nominal 1/16-inch diameter monel metal wire or stainless-steel cable ties.

2.3 SPLICING, TERMINATING AND ARCPROOFING MATERIALS:

A. General:

1. All splicing, terminating and arc proofing materials shall be compatible so that no one material will adversely affect the physical or electrical properties of any other, or of the wire cable itself.
2. All materials for making splices and terminations shall be specifically designed for use with the type of wire or cable, insulation and installation and operating conditions of the specific application.

B. Subject to compliance with requirements of this Section, provide connectors of the following types:

1. Split-sleeve, solder, high conductivity, corrosion resistant connectors.
2. Solderless, uninsulated, high conductivity, corrosion resistant, compression connectors conforming to UL 467 and IEEE 837.
3. Welded type connectors.

C. Terminals: Subject to compliance with requirements of this Section, provide terminals of the following types:

1. Solder terminals shall be high conductivity, corrosion resistant type.

2. Solderless, uninsulated, high conductivity, corrosion-resistant compression terminals conforming to UL 467 and IEEE 837.
3. Welded type terminals.

D. Shrinkable Tubing: Subject to compliance with requirements of this Section provide shrinkable tubing of the following types:

1. Either irradiated modified polyvinyl chloride or irradiated modified polyolefin heat shrinkable tubing.
2. Cold shrinkable tubing.

E. Tapes and Sealers:

1. Vinyl Tapes. Flame-retardant, cold and weather-resistant, ¾ inch and 1 ½ inches wide, as required, and conforming to UL 510 and ASTM D 3005.
   a. For interior, dry locations, provide 7 mils conforming to ASTM D 3005 (Type I); Scotch (3M) No. 33, or Engineer approved equal.
   b. For exterior or damp and wet locations, provide 8.5 mils conforming to ASTM D 3005 (Type II); Scotch (3M) No. 88, or Engineer approved equal.
2. Rubber Tapes:
   a. Ethylene-propylene, rubber-based, 30-mil splicing tape, rated for 130 degrees C operation; ¾ inch and wider (1, 1 ½, 2 inches) as shown on the Contract drawings or approved by the Engineer, conforming to ASTM D 1373 and Federal Specification HH-I-553 (Grade A); Scotch (3M) No. 130C, or Engineer approved equal.
3. Insulating Putty:
   a. Rubber based, 125-mil elastic filler putty; 1 ½ inches wide; Scotch (3M) Scotchfil, or Engineer approved equal.
4. Silicone Rubber Tapes:
   a. Inorganic silicone rubber, 12-mil 130 degrees c rated, anti-tracking, self-fusing tape; 1 inch wide; Scotch (3M) No 70, or Engineer approved equal.
5. Sealer:
   a. Liquid applied, fast-drying sealant; Scotch (3M) scotchkote or approve equal.

F. Binding wire shall be uninsulated, tinned copper.

G. Solder:

1. Solder used on the shielding braids of any cable shall be 50 Tin/50 Lead.
2. Flux used when soldering conductor connectors or shielding tapes and shielding braids shall be of a non-corrosive and non-acid type.

H. Insulating compound shall be installed in all splices and all potheads.

I. Arc proofing Material:

1. Fire resistant tape shall be Scotch (3M) No. 77, or Engineer approved equal.
2. Glass cloth binding tape shall be Scotch (3M) No. 69, or Engineer approved equal.

J. Ground Straps:

1. Flexible, tinned copper braid, equivalent to #6 AWG.

K. Special splicing materials and methods shall be as shown on the Contract Drawings.

2.4 SHOP TESTS:

A. For quantities as shown on the Contract drawings, regular dielectric-withstand and insulation-resistance in water tests for wires and cables shall be performed in accordance with UL 44.

B. The following tests for wires and cables shall be performed and certified reports of these tests shall be submitted to the Engineer:

1. Flame tests in accordance with IEEE 383.
2. Jacket tests in accordance with ICEA 5-68-516.
3. Cable tests in accordance with AEIC C 56.

C. The test results shall be certified for each reel/coil/box of wire or cable.

D. Factory inspection and witnessing of tests by the Engineer shall be required for all wires and cables furnished under this Contract. The Engineer reserves the right to require additional testing, or to waive factory inspection or witnessing of tests. The Contractor shall notify the Engineer fourteen (14) days in advance of the scheduling of such factory tests.

2.5 INDEPENDENT LABORATORY TEST:

A. For quantities as shown on the Contract Drawings, the following tests shall be performed in accordance with AEIC and ICEA standards:

1. A.C. Voltage Breakdown Tests.
2. Adhesion of Insulation Shield to Insulation.
3. Volume Resistivity of Conductor Shield to Insulation Shield.
4. Dissection and Dimensional Analysis.
5. Microscopic examination for voids, contaminants, and protrusions.
6. Hot Creep Test to determine state of cure of insulation.
7. Partial Discharge (DC) measurements.
8. Dissipation factor of cable insulation.
9. Impulse breakdown tests.

PART 3 EXECUTION

3.1 PREPARATION:

A. Prior to pulling wires and cables clean raceway systems of all foreign matter and perform all operations necessary so as not to cause damage to wires and cables while pulling.

B. Prior to pulling wires and cables into underground conduit systems, place a feeding tube approved by the Engineer at the entrance end of such systems.

3.2 INSTALLATION:

A. Wire and Cable Installation

1. General:
   a. Keep wires and cables dry at all times.
   b. Seal wire and cable ends with watertight end seals if splicing or terminating does not follow at once.
   c. Before splicing or terminating wires and cables, make a thorough inspection to determine that water has not entered the wires and cables or that the wires and cables have not been damaged.
   d. Use adequate lubrication when installing cables in conduits or raceways. Any pulling compounds shall be compatible with the finish of the wires and cables furnished.

B. Splices and Termination's

1. General:
   a. Medium voltage wires and cables shall not be spliced in each manhole through which they pass, unless otherwise shown on the Contract Drawings, or unless the Contractor submits pulling tension and sidewall pressure calculations and they are approved by the Engineer. Enough slack shall be provided for several re-splicing.
   b. Any splicing or terminating methods other than those required by this Section, for which the components are in accordance with the requirements of this Section, shall be submitted to the Engineer for approval.
2. Insulated Wires and Cables:
   a. Splices and terminations shall be completed by workmen trained and experienced in the type of cable and the voltage class specified in this Section, with not less than three (3) years' experience in this specialty type of work.
   b. Where required by the Engineer, sample splices shall be demonstrated to the Engineer by each splicer performing the Work of this Section. The sample shall be provided to the Engineer after completion of the demonstration.
   c. Termination using stress-relief cones, which conform to class 1, IEEE 48 shall be made in accordance with the cable manufacturer's recommendations.
   d. Splices shall conform to IEEE 404 and shall:
      (1) Meet the full electrical and physical integrity of the wire and cable construction, including voltage rating, ampacity, BIL, and type of waterproofing.
      (2) Conform to the wire and cable manufacturer's requirements and recommendations.
   e. Where splices or terminations are on the Utility side of incoming service equipment, the splices or terminations shall be of the type and style approved by the Utility and shall be submitted to the Utility for approval.
3. Grounding Wires and Cables:
   a. Splices and terminations shall be installed in accordance with the manufacturer's written recommendations.

b. In hazardous or classified locations, splices and terminations shall be solderless, high conductivity, corrosion-resistant, compression type connectors.
c. All underground connections shall be covered with two coats of asphalt base paint. Each splice shall be bonded to ground, using a flexible ground strap, 2 feet long, not less than #6 AWG or equivalent size.

C. Arc proofing

1. Arc proof all wire and cables operating at greater than 600 volts (Line-to-Line).
2. Arc proofing, which has been disturbed for any reason, shall be reinstalled as soon as possible after the disturbance.
3. Arc proofing shall be installed as follows:
   a. Wires and cables shall be grouped by circuit and arc proofing applied over the group of cables comprising one circuit. Splices shall be arc proofed individually and the taping shall join with and be overlapped by the group taping.
   b. Arc proofing shall be applied in two wrappings of half-lapped tape, bound with glass cloth tape applied at the ends of the fire-resistant tape and at intervals not to exceed 24 inches along the entire length of the cables. The two wrappings shall be wrapped with opposing-lays.
   c. Arc proofing shall be extended into the conduit opening or end bell of the raceway entering a hand hole, manhole or box.
   d. Arc proofing tape shall be 1 ½ inches wide where the diameter of the individual cable, or the circumscribed circle for the circuit group, is less that 1 ¾ inches. For larger diameters, the tape shall be 3 inches long.

D. Identification of Wires and Cables

1. Each wire and cable shall be identified by its circuit in all cabinets, boxes, manholes, hand holes, wire ways, and other enclosures, and at all terminal points.
2. The circuit designations shall be as shown on the Contract Drawings. Tags shall be attached to wires and cables in such a manner as to be readily visible.
3. The tag ties shall be wrapped around all conductors comprising the circuit or feeder to be identified.
4. Wires and cables which are arc proofed shall be identified outside the applied arc proofing.

3.3 FIELD TESTS:

A. Perform test after installation of cable, splices, and terminators and before terminating to equipment.

B. Visual and Mechanical Inspection:

1. Inspect exposed cable sections for physical damage.
2. Verify that cable is supplied and connected in accordance with contract plans and specifications.
3. Inspect for proper shield grounding, cable support, and cable termination.
4. Verify that cable bends are not less than ICEA or manufacturer’s minimum allowable bending radius.

5. Inspect for proper fireproofing.
6. Visually inspect jacket and insulation condition.
7. Inspect for proper phase identification and arrangement.

C. Electrical Tests:

1. Perform a shield continuity test on each power cable by ohmmeter method. Record ohmic value, resistance values in excess of 10 ohms per 1000 feet of cable must be investigated and justified.
2. Perform a DC high-potential test on all cables. Adhere to precautions and limits as specified in the applicable NEMA/ICEA Standard for the specific cable. Test procedure shall be as follows, and the results for each cable test shall be recorded as specified herein.
   a. Current-sensing circuits in test equipment shall measure only the leakage current associated with the cable under test and shall not include internal leakage of the test equipment.
   b. Record wet and dry-bulb temperatures or relative humidity and temperature.
   c. Test each section of cable individually.
   d. Individually test each conductor with all other conductors grounded; ground all shields.
   e. Terminations shall be properly corona-suppressed by guard ring, field reduction sphere, or other suitable methods as necessary.
   f. Ensure that the maximum test voltage does not exceed the limits for terminators specified in IEEE standard 48 or manufacturer's specifications.
   g. Apply the DC high-potential test in at least five equal increments until maximum test voltage is reached. No increment shall exceed the voltage rating of the cable. Record DC leakage current at each step after a constant stabilization time consistent with system charging current.
   h. Raise the conductor to the specified maximum test voltage and hold for fifteen (15) minutes. Record readings of leakage current at 30 seconds and one minute and at one-minute intervals thereafter. Provide a graphic plot of readings with leakage thereafter. Provide a graphic plot of readings with leakage current (X-axis) versus voltage (Y-axis) at each increment.
   i. Reduce the conductor test potential to zero and measure residual voltage at discrete intervals.
   j. Apply grounds for a time period adequate to drain all insulation-stored charge.
   k. When new cables are spliced into existing cables, the DC high-potential test shall be performed on the new cable prior to splicing. After test results are approved for new cable and the splice is completed, an insulation-resistance test and a shield-continuity test shall be performed on the length of new and existing cable including the splice. After a satisfactory insulation-resistance test, a DC high-potential test shall be performed on the completed cable system utilizing a test voltage 75 percent of new cable tested value.

D. The tabulated results of all tests shall be submitted to the Engineer and must be approved prior to energizing the cables. Engineer will review test reports and provide approval to contractor.

END OF SECTION

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SECTION 26 05 17
MEDIUM VOLTAGE LOAD-BREAK SEPARABLE CONNECTORS

PART 1 GENERAL

1.1 SCOPE:

A. This specification covers 5 KV and 15 kV separable insulated connectors intended for use in terminating medium voltage underground cables to dead front apparatus such as transformers, switches or switchgear. Connector to be fully shielded and submersible with capacitive test point for testing without disconnection.

1.2 STANDARDS:

A. The following standards shall form a part of this specification – IEEE 386.

PART 2 PRODUCTS

2.1 CONDUCTORS:

A. The full current carrying conductor path shall be copper with a coppertop compression connector, copper stud and copper insulation plug.

2.2 CONDUCTOR SHIELD:

A. The shield shall be extruded semi-conductive material with concentric neutral and jacket.

2.3 INSULATION:

A. The connector shall be designed for use on 'EPR' type insulated cables with 133% insulation. Should additional sealing be required, cold shrinkable adapters shall be provided by available by the manufacturer.

2.4 RATINGS:

A. Voltage Rating and Characteristics

Description	Kilovolts
Standard Voltage Class	15
Maximum Rating Phase-to-Phase	14.4
Maximum Rating Phase-to-Ground	8.3
AC 60Hz 1 Minute Withstand	34
DC 15 Minute Withstand	53
BIL and Full Wave Crest	95
Minimum Corona Voltage Level	11

B. Current Ratings and Characteristics

Description	Amperes
Continuous	200A RMS
Switching	10 operation at 200A at 14.4KV
Fault Closure	10,000A RMS symmetrical at 14.4KV after 10 switching operations for .17s
Short Time	40,000A RMS symmetrical for .17s 3,500A RMS for 3.0s

C. Manufacturers: load break elbows and cold shrink kits shall be manufactured by 3M, Eaton/Cooper or Elastimold.

PART 3 EXECUTION

3.1 Prepare cable for installation of load break elbow.

A. Check to be sure cable size fits within the kit range.
1. Remove cable jacket for 8 ¼".

B. Remove liners from 1 mastic strip and apply 1 wrap around cable jacket ½" from edge, apply with light tension. Cut off excess mastic.
1. Bend neutral wires back over mastic strip and secure to cable jacket 2" from jacket end. Keep wires separated and spaced around cable.

C. Remove white liners from 2nd mastic strip and apply 1 wrap over neutral wires and previously applied mastic strip.
1. Press neutral wires into mastic by applying 2 highly stretched half-lapped layers of vinyl tape over mastic and bent-back neutral wires.

D. Continue cable preparation.
1. Remove semi-con (insulation shield) for 5 7/8", leaving 2 3/8" exposed beyond cable jacket.
2. Remove cable insulation for 2 1/8". Place a 1/8" bevel on end of cable insulation to ease installation.

3.2 Elbow and Load Break Probe Installation

A. Clean the exposed conductor using a wire brush. Place the coppertop (bimetal) connector on the conductor. Make sure threaded hole in connector faces the apparatus bushing. Crimp the connector in place using a tool and die combination. Start crimping just below the knurled line and rotate each successive crimp to prevent bowing. Do not overlap crimps. Place as many crimps on the connector as will fit.
1. Clean excess inhibitor grease from coppertop connector by wiping toward threaded eye.
2. Clean cable insulation with solvent pad(s). Do Not allow solvent to touch cable semi-con.

B. Slide Cold Shrink assembly over cable with loose core end leading (away from cable end). Temporarily position it just beyond prepared cable end.

C. Apply a thin coating of silicone lubricant to the cable insulation.
   1. Clean and lubricate the cable entrance of the elbow.
   2. Place elbow on cable and with a twisting motion, push elbow onto cable until threaded eye of coppertop connector is aligned with the elbow.

D. By hand, thread load break probe into threaded eye of coppertop connector. When tight, use the provided installation tool to properly torque the load break probe. Proper torque is applied when the tool achieves a 180° permanent set.

E. Remove white liners from remaining mastic strip and apply around base of elbow, 1⁄2" from step as shown. Apply 1 layer of vinyl tape over mastic.

F. Align Cold Shrink rubber tube (not core) with step of elbow. Remove core by pulling and unwinding the core counterclockwise.
   1. Attach 14 AWG ground lead from ground braid assembly to the elbow grounding eye. Connect ground braid to system ground. For jacketed concentric neutral cable, attach a neutral strand to grounding eye, and connect remaining neutral bundle to system ground.

3.3 After hi pot testing of cable assemblies, insert elbows into busing at medium voltage equipment.

END OF SECTION

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SECTION 26 05 19
LOW VOLTAGE ELECTRICAL POWER CONDUCTIORS AND CABLES

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Furnishing, installing and testing 600-volt conductors for lighting, power, and auxiliary systems.

PART 2 PRODUCTS

2.1 CONDUCTORS:

A. 98% conductivity copper; #12 AWG minimum; #8 AWG and smaller solid, #6 and larger stranded.

B. Conductors furnished with NEC, 600-volt, insulation as follows:

Dry locations: type THWN or XHHW
Wet locations: type RHH or THWN

C. Wiring for controls and auxiliary systems #14 AWG stranded minimum with NEC type THWN insulation.

D. Luminaire Wire - LED use type SF-2, #16 for luminaires up to 300 watts, and #14 over 300 watts, except for luminaires in concrete pour use #12 of larger or as shown. Conductors in channels of, and flex to luminaires type THHN or XHHW.

E. Color Code as follows and/or per local ordinances. Conductors #10 and smaller with colored insulation. Conductors #8 and larger not available in colors, color coded with colored pressure sensitive tape. Apply minimum 2" of tape to each individual phase conductor in half lapped pattern. The equipment ground conductor and neutral conductors shall be taped green for their entire exposed length. Color-code as follows:

Phase	120/208 Volts	277/480 Volts
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	White
Eq Grnd	Green	Green

F. Manufacturers of copper conductors: Pirelli, Phelps Dodge, Capital Cable, Rome Southwire, Senator, Essex, American, or approved equal.

G. Manufacturers of aluminum conductors: Kaiser “817”, Alcoa “Excelloy”, or approved equal.

PART 3 EXECUTION

A. Install wiring complete with connections to equipment.

B. No wiring installed until after plastering and similar work is complete and dry.

C. Install wiring so conductors are not in tension in completed system.

D. Form wiring neatly and group in circuits. Tie grouped conductors with nylon ties, T&B “Tyrap” or approved equal.

E. Use pulling compound of Ideal “Yellow 77”, Minerallac No. 100, or approved equal.

F. Join and terminate copper conductors individually.
   1. Lugs in damp locations connected to copper bus: 98% conductivity copper or bronze Thomas & Betts “Locktite”, Burndy “QA” or approved equivalent.
   2. Lugs in dry locations and lugs connected to aluminum bus – heavy casting aluminum, CU/AL rated, listed under UL Standard 486B, rated 90 degrees C; plated to prevent electrolysis, Thomas & Betts, Blackburn, Ilsco or approved equivalent.

G. Provide lugs where not furnished as part of equipment – furnish as specified above, to connect all conductors.

H. Furnish lugs for conductors #2/0 and larger with two bolt tongue or approved equivalent.

I. Make conductor taps #8 and larger from a second conductor with 98% conductivity bolted insulated connector, T&B “IDT”, Ilsco “KUP-L-TAP” or approved equivalent. Insulate splices with 600 volt “heat shrink” covers T&B or equal.

J. Splice conductors #8 and larger with solid copper barrel, type fittings applied with an appropriate hydraulic tool. Splices used only where approved. Splice fittings: Burndy “Hydent”. Insulate splices with 600 volt “heat shrink” covers T&B or equal.

K. Joints #10 and smaller: T&B Sta-Kon wire joints EPT66M, with insulating caps, installed with WT161 Tool or C nest of WT11M Tool; Ideal Super/Nuts; Ideal Wing Nuts; 3M “Scotchlock” or Buchanan Electric Products B Cap or Series 2000 Pressure connectors complete with nylon snap on insulators installed with C24 pressure tool. Where joints are made in damp or wet locations insulate splices with 600 volt “heat shrink” covers T&B or equal.

L. Join and terminate aluminum conductors individually:
   1. Lugs – heavy casting aluminum body, CU/AL rated, listed under UL standard 486B, rated 90 degrees C., plated to prevent electrolysis; Thomas & Betts, Blackburn, Ilsco, or approved equal. Provide two bolt tongue for #2/0 and larger conductors.

2. Splices – solid aluminum barrel, compression type; filled with no-oxide compound; Thomas & Betts, color keyed; Burndy "Hydent" or approved equal. Insulate splices with "Heat shrink" 600 volt covers, Thomas & Betts or equal.
3. Taps – heavy casting aluminum body, CU/AL rated listed under UL Standard 486B, rated 90 degrees C., plated to prevent electrolysis; Thomas & Betts, Blackburn, Ilsco or approved equal. Insulate to 600 volts with rubber, electrical tapes or preformed covers.

M. Provide cable supports: As required by NEC. Supports with malleable screwed conduit fitting and non-conductive wedges drilled for the conductors; O.Z. Manufacturing Company or approved equal. Furnish pull box, sized per NEC for each cable support.

N. Bond circuit ground wires where installed to all devices, equipment, outlet and junction boxes, and grounding bushings (where provided) with a full-size conductor and screw type connection.

O. Securely fasten non-ferrous identifying tapes, pressure sensitive labels or engraved nameplates to all cables, feeders and power circuits in vaults, pull boxes, manholes, switchboard rooms, terminations of cables, etc.

P. Mark all branch circuit conductors at panel terminations including neutrals with pressure sensitive numbers to correspond to circuit numbers connected.

Q. Connect circuits and feeders as shown on drawings. Drawings are diagrammatic and do not show every detail required in the wiring system. Detail wiring accomplished per NEC.

R. All conductors making up parallel feeders to be same size, same type, and same insulation, all cut same length. Bond each group of conductors making up a phase or neutral at both ends in an approved manner.

S. DO NOT COMBINE CIRCUITS unless specifically approved by the contracting Officer. No more than 3 phase and 3 neutral conductors in a circuit.

END OF SECTION

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK: Grounding Details

1.2 RELATED SECTIONS:

A. Section 26 35 53 – Surge Protection Devices.

PART 2 PRODUCTS

2.1 SYSTEM GROUNDING:

A. Bond and ground main service neutral, cabinets, equipment, conduits, metallic piping systems, etc., per the latest edition of NEC.

B. Ground conductors – 98% conductivity copper, either bare or with green THW insulation. Other conductor requirements same as described for low voltage, 600 volts, conductors.

C. Ground Connections:
1. Make with mechanical connectors where accessible and with "Cadweld" or approved equivalent where inaccessible.
2. Use high alloy cast copper and/or silicon bronze mechanical connectors with Hex or Allen head bolts where permitted.
3. Size as required for piping connections.
4. Thoroughly clean prior to installation of clamps and/or lugs.
5. Use bolted or screwed on mechanical connectors. Do not use clip-on connections.
6. Bond ground conductor to metal raceway at each end of the run and at each junction box or pull box.
7. Seal connections between dissimilar metals (i.e.: bronze to steel), with approved epoxy resin.
8. Coat connections with "No-OXID-A" compound as manufactured by Dearborn Chemical Company.

D. Provide lighting and power circuits with green covered ground wire sized per NEC, or as shown, except not smaller than #12 AWG. Bond ground wire to all outlet boxes, junction and pull boxes, cabinets, equipment, etc., with self-tapping screw or bolt and appropriate lug. See Section covering "Raceways" for use of grounding bushing.

2.2 DRIVEN GROUND SYSTEM:

A. Provide driven ground rods and buried ground conductor interconnecting ground rods as shown on drawings and required by code.

B. Ground rods ¾" x 10'-0" copperclad steel, Thompson #558 or approved equal. Ground rods installed with tops driven to 1'-6" minimum below grade. Connect ground wire to ground rod with Cadweld or equal installed in ground well endeavor.

C. Bond all masses of metal, i.e.: pipes, conduits, fence posts, etc., within 6'-0" of the buried ground conductor to ground conductor with #6 AWG bare, solid, tinned copper wire, attached to object with appropriate clamp, lug, etc., (Cadweld or equal). Obtain complete set of drawings to determine quantity and location of required connections.

D. All connectors lugs, hardware, etc., for building ground system similar to that for other grounding as described above.

2.3 CENTRAL OFFICE GROUND:

A. Install system of copper bus bars connected together with 500 KCMIL copper conductor at telecomm backboard.

B. Reference system to main water pipe as shown.

C. Purpose of system – to provide reference ground point for telephone equipment.

2.4 COMPUTER GROUND SYSTEM:

A. Provide radial isolated ground system for computer equipment as shown. Grounding systems shall be radial and isolated from each other to prevent formation of electronic loops. The grounding shall originate from the ground bus in central UPS distribution. This ground bus shall be designated the "ground window". The following ground system shall be complete and isolated:
   1. Equipment ground (green wire).
   2. Raceway system.
   3. Raised floor ground.
   4. Computer frame grounds.

B. Each system shall originate at the "ground window" and extend radially to all connections.

C. Test each system with 1000 VDC "megger" to prove isolation of different systems. Tests shall be same as described for feeders in Section 26 01 01. Furnish readings between all ground systems and a reference ground selected by Contracting Officer.

PART 3 EXECUTION

3.1 EQUIPMENT GROUND 'GREEN WIRE CONCEPT':

A. Ground electrical equipment enclosures and conductor enclosures including metal raceways, outlet boxes, cabinets, switch boxes, motor frames, diesel engine frame, transformer cases, metallic piping systems such as water, gas, waste, air and metallic enclosures for all electrical equipment.

B. Provide separate grounding conductor for all circuits to insure adequate ground fault return path.

C. Install separate ground conductors in conduit.

D. Bond green wire to equipment enclosure at source and at apparatus served.

E. Insulate grounding conductor's size to carry ground fault current safely. Minimum size for green wire grounding lead per N.E.C. or as indicated.

F. Do not use grounded current return conductors (neutrals) for equipment grounding. Connect common grounding lead to supply side of service disconnect unit only.

G. Do not ground neutral conductor after it has been grounded at each separately derived system service entrance, transformer or generator.

H. Maintain electrical continuity of conduit systems by threaded fittings with joints made-up wrench tight. Install insulated bushing and locknuts on terminating conduits. Provide conduits containing ground wires with grounding bushings bonded to ground wire with short full-size jumper.

I. Provide receptacles with approved green covered bonding jumper from the grounding terminal screw connected to outlet box.

J. Install ground rods in quantity to provide a maximum of 5 ohms ground resistance. Where multiple rods required, separate a minimum of 10 feet and interconnect with wire of ground size shown.

K. Test ground systems as specified in Section 26 01 01 – Electrical General.

L. Install tags on ground connections to piping or electrode systems for all telephone equipment grounds.

END OF SECTION

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SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Outlet, junction boxes, conduit bodies, wiring gutters and their installation.

PART 2 PRODUCTS

2.1 OUTLET AND JUNCTION BOXES:

A. Provide wiring devices, fixtures and special system outlets with outlet box. Use galvanized steel for concealed boxes and exposed boxes in dry locations. Use cast iron conduit fittings similar to "Condulets" or "Unilets" with threaded hubs for exposed boxes outside and exposed to moisture.

B. Concealed outlets and exposed outlets in unfinished spaces for lights, switches, wall receptacles, etc.; consist of standard galvanized steel outlet boxes and plaster rings.
1. Provide 1/16" thick boxes and covers of form and dimension adapted to its specific use and location, kind of fixture to be used and number, size and arrangement of connecting conduits.
2. Provide 3/8" fixture studs where required.
3. Ceiling Outlet Boxes: 4" octagonal or 4-11/16" square as required, due to number of wires, and 2" deep minimum. Ceiling boxes in slabs concrete type. Plaster rings not required for ceiling outlet unless needed for device.
4. Paint junction boxes provided with blank covers to match surroundings, except use blank device plates in finished areas.
5. Switch and receptacle outlet boxes: 4" square with plaster rings as necessary. Provide multigang boxes where shown or required. Provide metal barriers to separate emergency and normal service wiring per N.E.C.
6. Steel City, Appleton, Raco, Bowers or approved equivalent.

C. Use galvanized cast iron boxes, approved equivalent to Crouse-Hinds type "FS" or Appleton condulets, with appropriate covers for wall outlets in exposed conduit work and exposed to moisture.

D. Use galvanized cast iron boxes equivalent to Crouse-Hinds type GRF for ceiling outlets in exposed conduit work exposed to moisture.

E. Use square cut steel outlet boxes for outlets exposed in finished locations. Use round or square to adapt to device installed. Wiremold, Hoffman or approved equivalent.

2.2 LARGE JUNCTION BOXES:

A. Furnish pull, tap and cable support boxes required by NEC for excessive number of 90-degree conduit bends, conductor taps and cable supports.

1. Box construction per NEC and manufactured with galvanized sheet steel 12 gage minimum, with angle iron frame where required for rigidity; welded or bolted construction. Install bolts to prevent damage to cables in box.
2. Boxes with removable screw type covers and plated screws. Provide split covers where necessary for access. Maximum single piece cover – 36" x 36".
3. Provide separate junction boxes for each feeder. If conduit is installed so separate junction boxes are not practical, one large pull-box may be used with each set of feeder conductors separated by 12 gage steel barriers. Furnish junction box or each compartment in junction box with ground lug for connection of ground wire.

2.3 CONDUIT BODIES:

A. Conduit bodies shall be installed to provide ease of pulling conductors and to provide neat appearance of conduit installation, and as shown on drawings. Conduit bodies constructed of malleable iron or copper free aluminum castings. Bodies shall be finished with standard durable exterior coatings of manufacturer specified. Provide rollers in type "C" and type "LB" bodies, 1-1/4" size and larger. Provide gasketed plated steel or malleable iron covers.

B. Conduit bodies shall be manufactured by Crouse-Hinds, Pyle National, Killark, Appleton or approved equivalent.

2.4 GUTTERS (WIREWAYS):

A. 8" x 8" and smaller – use standard assembly manufactured by Square "D", Walker Electric, B&C Stamping Co., and General Electric. Make special and larger gutters of code grade galvanized sheet steel with hinged covers and approved fastening device.

2.5 SURFACE METAL RACEWAYS:

A. Where indicated on the drawings, wiring shall be run in exposed metal raceways, metal molding or wire mold complete with outlet boxes and fittings. All circuits run in surface metal raceways shall have a ground conductor with green insulation sized per the NEC, but not smaller than No. 12 AWG screw connected to each outlet box. All wiring in surface metal raceways shall be type "THWN" conductors.

2.6 TELEPOWER POLES:

A. Where indicated on the drawings, wiring shall be run in Telepower Poles, complete with entrance end fittings, hanger clamps, trim plates, etc., as required. Poles shall be secured by means of a threaded rod attached to hanger clamp and to the structural ceiling above the grid. All circuits run in Telepower Poles shall have a ground conductor with green insulation sized per the N.E.C., but not smaller than No. 12 AWG connected to the screw terminal in the entrance end fitting and to the ground terminal on the receptacles in the pole. Poles shall only be used with partition furniture and be provided with furniture.

PART 3 EXECUTION

3.1 INSTALLATION OF OUTLET BOXES:

A. Fasten outlet boxes securely to structure.

B. Set all flush outlet boxes so edge of device flange is flush with finished surface.

C. Open no more knockouts in outlet box than required.

D. Seal boxes during construction.

E. Stagger back to back boxes 3" minimum. In rated walls use appropriate U.L. spacing.

F. Coordinate and verify rough-in location and mounting height of all boxes with drawings and other trades prior to installation.

G. Support All Boxes:
1. Outlet boxes – with ¼" diameter galvanized rods or bolts anchored to structure.
2. Outlet boxes for surface mounted luminaires on furred ceilings with ¾" channel iron fastened to ceiling channels. See Section covering "Luminaires".
3. Pull, junction and cable boxes with 3/8" diameter galvanized rods or bolts (4 minimum).
4. Support outlet boxes in steel stud partitions with Caddy "BHA" bar hangers or approved equivalent.

H. Install adjacent outlets at different levels in one vertical line where possible.

I. Provide green covered bonding jumper, screw connected to outlet box in all receptacle boxes.

J. Paint wiring connections in ground mounted outlets or floor outlets in wet locations with "Scotchkote" and fill box with "Duxseal".

K. Mark outlet box covers with permanent ink markers to indicate circuit number(s) and panel of origination. Use black markers for normal service circuits and orange for emergency service.

L. Use 4" octagonal boxes with blank covers for master outlets, installed to permit installation of collars by others.

M. Where outlet boxes installed in unfinished concrete walls or columns, provide 1" deep plaster ring with box and ring set in position before the concrete is poured so concrete will fill around the ring and cover plate can be installed flush with the unfinished surface. In case of brick walls, follow same procedure with mason filling around the plaster ring with mortar.

N. Install all outlets located on columns on centerline of column and bend or shift reinforcing so that the outlet box will be flush with the finished concrete. Provide plaster rings as required so that the plate is flush with the finished plaster or exterior concrete surface.

O. Where outlets installed in waterproofed columns or walls, provide 6" x 6" x 3" deep wood box placed in the forms before concrete is poured. Box will be removed before waterproofing is applied. General Contractor will waterproof wall and opening, after which Electrical Contractor

will install outlet box. General Contractor will grout around box. Set boxes carefully so that cover plates will be flush.

P. Install conduit bodies where shown or where required for sharp bends and/or aesthetics in raceway system. Do not use in lieu of pull boxes except in limited space or as directed by Contracting Officer.

3.2 INSTALLATION OF JUNCTION BOXES:

A. All junction boxes shall be accessible.

B. Securely fastened to structure.

C. Exterior below grade boxes shall be embedded 6” of concrete on sides and bottom. Top shall be level with finished grade unless shown otherwise.

D. There shall be no more knockouts opened in any box than are required.

E. Protect during construction.

F. Identify (See Section 26 05 53).

3.3 INSTALLATION OF GUTTERS:

A. Mount gutters on ¾” thick pressboard backboard, sized for devices to be mounted, 2 coats of fire-retardant paint (install label on board), mount all equipment thereon.

B. Run conductors in gutter without reduction in size, entire length of gutter.

C. Connect individual taps from conductor to tapped device with pre-insulated tap devices sized for conductors used.

D. Gutter Tops: for copper conductors shall be ILSCO type GTA or PTA with GTC or PTC insulating covers or by “TEE” compression lugs as manufactured by Anderson or Burndy, wrapped with Scotch #33 electrical tape to a thickness which equals insulation level of wire.

END OF SECTION

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SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. The accompanying General Conditions shall apply to and form a part of this Section.

PART 2 PRODUCTS

A. Rigid galvanized steel conduit to conform to ASA Standard C80.1 and U.L. Standard No. 6 for rigid metallic conduit, except hot dipped galvanized after threading. Conduits manufactured by Republic, Wheatland, Southwire, Clifton, Triangle or Walker.
   1. Fittings, ells, couplings, etc., galvanized threaded type meeting above standards. Threadless fittings not allowed.
   2. Terminate rigid conduit with two locknuts, one inside, one outside of the cabinet, junction or outlet and a bushing. Bushing – malleable iron with smooth bakelite ring molded into edge of bushing to prevent damage to cable, OZ Manufacturing Company, type "B" or approved equal. Where grounding bushings are required, construction of bushing similar to above except a lug provided for grounding connection, OZ type "BLG" or approved equal.

B. Rigid intermediate grade conduit, IMC, to conform to UL Standard No. 1242; hot dipped galvanized or approved equivalent. Manufactured by Allied, Southwire, or ETP.
   1. All fittings, ells, couplings, etc., constructed to same standards as rigid steel conduit. Fittings – threaded type with all threads engaged. Use "Uni-swivel" couplings in dry locations only.
   2. Conduit terminations same as rigid steel conduit.

C. Flexible steel conduit, "Greenfield", continuous spirally wound and inter-locked, threadless, galvanized conforming to U.L. and CSA Standards for flexible steel conduit; manufactured by National Electrical Products or International Metal Hose Company.
   1. Connectors and fittings galvanized steel, threadless type with insulated throats, U.L. approved for grounding means, Thomas & Betts, Efcor, Midwest, Appleton, Raco, Steel City or ETP.

D. Liquid tight flexible steel conduit constructed similar to flexible steel conduit above, except with polyvinyl chloride jacket, as manufactured by Anaconda "Sealtite" or Robroy – "Flex".
   1. Fitting Assembly – sealing type, with steel gland, nylon ring and ground cone inside locknut. All fittings with insulated throat, U.L. approved for grounding means. Fittings – Thomas & Betts, Efcor, Midwest, Appleton, Raco, Steel City or ETP.

E. Aluminum rigid conduit to conform to UL standard No. 6 for rigid metal conduit, as manufactured by Kaiser or Alcoa.
   1. Use aluminum fittings, except use steel locknuts. Join and terminate similar to rigid steel conduit. Lubricate all joints with compound.

F. Electrical metallic tubing, EMT, threadless, steel type conforming to ASA Standard C80.3 galvanized inside and out, and with additional corrosion resistant finish. EMT manufactured by Republic, Wheatland, Pittsburgh Standard, Southwire, Clifton, Spang-Chalfont, Triangle, Walker, or ETP.
   1. Fittings, connectors, couplings, etc., insulated throat galvanized steel, raintight, compression type; Thomas & Betts, Efcor, ETP, Midwest, Raco, Appleton or Steel City.

G. Plastic conduit, PVC, polyvinyl chloride compound, rated for direct burial, schedule 40, except as noted otherwise, manufactured by Carlon, Sedco, ETP, Can-Tex or approved equivalent.
   1. Fittings same material as conduit and installed with watertight joint compound recommended by manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Install conduit as follows:
   1. Use rigid steel or intermediate grade conduit for:
      a. Circuits run underground.
      b. Circuits run in concrete in contact with earth.
      c. Circuits in hazardous and wet locations.
      d. Circuits exposed to mechanical damage.
   2. Use rigid Aluminum Conduit for:
      a. All 400 cycle feeders and branches.
   3. Use electrical metallic tubing, EMT, for:
      a. Branch circuits (conduit 1” diameter and smaller) in dry locations.
      b. Telecommunication circuits.
      c. Auxiliary systems and controls (low voltage systems such as fire alarm nurse call sound systems, etc.).
      d. Feeders run overhead in dry locations.
   4. Use PVC conduit for:
      a. Circuits run underground where indicated.
      b. Where specifically shown on drawings.
      c. No PVC shall be exposed.

B. Size conduit per NEC. Minimum size 3/4” diameter, but no more than 7 #12 installed in 3/4” conduit.

C. Run conduit concealed where possible. Run concealed conduit above furred ceiling in an orderly manner. Multiple conduits grouped and run parallel.

D. Exposed Conduit: Use only where specifically shown or approved. Run perpendicular to building walls and partitions and tight against structure. Conceal vertical portion of conduits where possible.

E. Paint underground metal conduit with 2 coats of asphaltum or bitumininous. Make underground conduit fittings watertight using Teflon tape. Do not use split couplings and similar fittings

underground and exposed to moisture. Run underground conduits minimum 24" below grade. Do not run conduit in slag fill.

F. Paint conduit fittings and threads exposed to moisture with Rustoleum silver paint after installation.

G. Furnish offsets required to meet field conditions. Make bends in conduit in accordance with the National Electrical Code, except make minimum radius of 6 times conduit diameter or 6" whichever is greater. Bend IMC conduit without deforming.

H. Where conduit crossed expansion joints, install expansion type fittings OZ type EX with bonding jumper or approved equal.

I. Make connections to equipment away from wall with conduit extensions exposed from ceiling to floor, anchored with floor flange and/or angle frame as required. Make connections to equipment with flexible conduit from tee condulet in conduit riser.

J. Vibrating equipment and equipment requiring adjustment, i.e.: motors, transformers, etc. make final connections with flexible conduit.

K. Isolate conduit connections to equipment on roof from roof penetration of conduit with short section of flexible conduit between roof penetration and equipment.

L. Use liquidtight flexible conduit where exposed to moisture, oil, etc.

M. Install conduit to avoid hot water pipes. Maintain 9" clearance of such pipes, unless closer crossings are unavoidable. Maintain minimum 1" clearance from covering of pipe crossed.

N. Support conduit per NEC. Support individual conduits with galvanized hangers and rods as follows:
1" diameter and smaller……..1/4" dia. Rod
1-1/4" to 3" diameter……3/8" dia. Rod
Larger than 3" diameter……1/2" dia. Rod

O. Individual conduit hangers – Minnerallac or approved equal. Support EMT near each joint. Support for multiple conduit runs consist of Unistrut channel as required with ½" diameter galvanized bolts or rods anchored to structure. Provide "U" bolt clamps for each conduit on hangers. Support vertical riser conduits with galvanized bolted clamps at each floor. Do not support conduit to ceiling support system.

P. Terminate conduits entering sheet metal boxes with double locknuts and ground bushings. Terminate conduit exposed to moisture with watertight hubs.

Q. Install appropriate seal-off where conduits exit hazardous areas, areas of temperature differential interior/exterior penetration

R. Where ground conductor installed in conduits 1-1/4" and larger provide grounding bushings, and bond full size ground wire to bushings and from bushing to box or cabinet. Bond with self-

tapping screw and appropriate lug. Where ground wires are run in smaller conduits, bond to outlet and junction boxes with self-tapping screw lug. Provide other conduits with non-grounding bushings as described under another article. Provide all service entrance metallic raceways with grounding bushing and bond to ground bus; bond sized per N.E.C.

S. Install aluminum conduit using "No-OXID-A" compound (Dearborn Chemical Company) on all threads.

T. Conduit work in hazardous areas, or areas with large temperature differential: Use rigid steel or IMC conduit with sealing fittings, poured with hardening compound after conductors are pulled in. Seals installed per NEC. Conduit seals Crouse-Hinds type EYS or approved equal.

U. Sleeves:

1. Provide sleeves for raceways penetrating floor and structural members. Sleeves consist of Electrical Metallic Tubing set in forms. (Exception: Uses Schedule 40 PVC for individual ground conductors).
2. Size sleeves to allow ½" clearance around raceway extending from bottom of floor construction to 2" above floor, minimum sleeve size 2-1/2" diameter. After raceways are installed, seal space between the raceway and sleeve with non-hardening, fireproof, compound, CTC PR-855 sealant, T & B "Flame Safe" for 2-hour fire rating or approved equal.

END OF SECTION

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SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Systems and equipment requiring identification are shown on the drawings, and extent of identification is specified herein and in individual sections of work.

B. Types of electrical identification include:
1. Exposed conduit color marking.
2. Buried cable and conduit warnings.
3. Cable/conductor identification.
4. Operational instructions and warnings.
5. Danger signs.
6. Equipment/system identification signs (nameplates).

1.2 RELATED SECTIONS:

A. Section 26 05 73 – Overcurrent Protective Devices Coordination Study

1.3 SUBMITTALS:

A. Manufacturer's Data:
1. Product specifications and installation instructions for each material and device.

B. Samples:
1. Provide for each color, lettering style and other graphic representation.

PART 2 PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIAL:

A. Color-Coded Conduit Materials:
1. Color code all conduit with ¾ inch wide band of vinyl plastic electrical tape, 3M Company "Scotch 35", applied two (2) full turns around conduit, 6" from all conduit terminations into switchboards, panelboards, motor control centers, starters, cabinets, control panels, pull boxes, outlet boxes, etc., on each side of walls, floors or roof penetrated by conduit and where conduit enters wall to outlets below.

SYSTEM	CONDUIT COLOR CODE COLOR
120/208 Volts, Normal	Black
277/480 Volts, Normal	Yellow
120/208 Volts, Emergency	Black and Red
277/480 Volts, Emergency	Yellow and Red
Fire Alarm/Mass notification	Red

Telecommunication	Blue
Security/Door Monitoring/Card Access	White

B. Where authority does not allow tape, use paint acceptable to authority.

C. Cable/Conductor Identification Bands:
1. Manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers, wrap-around type; pre-numbered plastic coated, or write-on type with clear plastic self-adhesive cover flap, lettered to show circuit identification.

D. Self-Adhesive ARC Flash Labels:
1. Manufacturer's standard, self-adhesive, pre-printed, flexible vinyl signs for operational instructions or warnings. Sizes suitable for application and visibility, with proper wording for application.
2. Color: Orange with black lettering.

E. Engraved Signs (Nameplates):
1. 1/8" thick melamine plastic laminate, complying with FS LP-387, sizes as indicated, engrave with standard letter style of sizes and wording indicated (1/4" letters minimum) white field, black letters for normal service; red field, white letters for emergency service; yellow field, blue letters for D.C. service. Punched for screws.
2. Fasteners: Self-tapping stainless-steel screws, except contact epoxy adhesive where screws cannot or should not penetrate substrate.

F. Lettering and Graphics:
1. Coordinate names, abbreviations and other designations used with those shown or specified. Provide numbers, lettering, and wording as indicated or required for identification and operation/maintenance.

PART 3 EXECUTION

3.1 APPLICATION AND INSTALLATION:

A. General installation requirements:
1. After completion of painting.
2. Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Operational Identification and Warnings:
1. Provide operational signs for main switch.

C. Engraved Plastic Laminated Signs: Install on each major unit of electrical equipment in the building. Provide single line of text, ¼" high lettering on 1" high sign (1-1/2" high where 2 lines required). Matching terminology and numbering of contract documents. Provide signs for each unit of the following categories (signs shall identify item fed, voltage where fed from):
1. Electrical cabinets and enclosures. Indicate voltage.
2. Access panel/doors to electrical facilities.
3. Major electrical switchgear (indicate voltage).

4. Safety switches and circuit breakers.
5. Transformers.
6. Feeders in pull and junction boxes and in all switchgear. Fasten with nylon ties.
7. All equipment furnished in this Division of the specifications.
8. ARC Flash labels refer to Section 26 05 73 – Overcurrent Protective Devices Coordination Study.

G. Install signs where indicated or most visible. Secure with screws or epoxy adhesive. Secure to feeder cables with nylon ties.

END OF SECTION

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SECTION 26 05 73
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Provide a short circuit, protective device coordination, and arc flash hazard determination study for the electrical distribution systems.

B. Verify specified and supplied equipment are properly rated, correctly applied, within industry and manufacturer's tolerances. The short circuit study shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the distribution system down to the lighting panel level (or equivalent). The short circuit study shall consider operation during normal conditions, emergency generator conditions, cogeneration and/or any other operations which could result in maximum fault conditions.

C. The Coordination study will determine correct settings for protective devices which minimize damage caused by an electrical fault and allow for selective coordination between devices. The coordination study shall assume an infinite buss the Utility Company's primary meter, and include primary cable, transformer and protective fusing, at the distribution transformer serving the building network protectors, (if applicable) cable limiters, switchboards, panelboard main, branch, or feeder circuit breakers. Coordination study shall consider operation during normal conditions, emergency conditions and any other adverse alternative operation.

D. Study is subject to review by Contracting Officer/Contracting Officer of record and may require revision/modification as directed by Contracting Officer without any additional cost to the Government.

1.2 QUALIFICATIONS:

A. Contractor shall have this study prepared by a Registered Professional Electrical Contracting Officer (licensed in the state where the project is completed) who has at least ten (10) years of experience and specializes in performing power system studies.

1.3 SUBMITTALS:

A. The contractor shall submit the power system studies within 30 days after the electrical equipment submittals have been received for review by the Contracting Officer. The electrical submittals will be reviewed but will not be approved until the power system studies have been received, reviewed and approved.

B. The power study shall be calculated using SKM, ETAP or ESA.

C. Submit three (3) hard copies of the power systems study and one (1) electronic copy.

PART 2 EXECUTION

2.1 IMPEDANCE ONE-LINE DIAGRAM:

A. Create an impedance one-line diagram. Develop from either riser diagram; one-line diagram or the contract documents. Include additional existing field data not shown on one-line diagram. All electrical equipment wiring to be protected by the overcurrent devices installed under this project and each location where the fault current will be calculated shall be shown. Clearly show, on the one-line, the schematic wiring of the electrical distribution system. One-line diagram shall be submitted on 30x42 size sheet.

B. Show reference nodes on the one-line diagram referring to a formal report, to include the following specific information:
1. Short circuit values (symmetrical & asymmetrical) at the bus of the main service, and all downstream equipment containing overcurrent devices.
2. Transformers kVA and voltage ratings, percent impedance, and wiring connections.
3. Voltage at each bus.
4. Identifications of each bus.
5. Conduit material, feeder sizes, conductor material and length.
6. Overcurrent protection (manufacturer, style and LTPU) rating.
7. Motors and horsepower.

2.2 SHORT CIRCUIT STUDY:

A. Pertinent data, rationale employed, and assumptions in developing the calculations shall be incorporated in the introductory remarks of the study.

B. The study shall be in accordance with applicable ANSI Standards.

C. Attach bus, determine the available short circuit contribution for:
1. 3 phase bolted fault
2. Line to line fault
3. Double line to ground fault
4. Line to ground fault

Incorporate the motor contribution in determining the momentary and interrupting ratings of the protective devices where VFD's are used, assume regeneration type devices.

D. Present the data determined by the short circuit study in a table format. Include:
1. Node & Device identification.
2. Operating voltage.
3. Type of Protective device. (i.e. fuse, molded case circuit breaker, etc.)
4. Device short circuit rating.
5. Calculated maximum short circuit current under conditions or item 2.2.C above under symmetrical & asymmetrical conditions.
6. Comments section indicating if a device is underrated.
7. The Contractor is to be responsible for obtaining all data required for the completion of these studies. This shall include, but not be limited to, conductor material, insulation

type, raceway type, conductor length, fuse, (size/type) breakers (sizes, style, manufacturer, trip plug) and other equipment data from submittals.

2.3 PROTECTIVE DEVICE COORDINATION STUDY:

A. Obtain available fault current from utility company or other manufacturers as required. (e.g. existing 100 KW generator)

B. The study shall adhere to all requirements of the current National Electrical Code and National Electrical Safety Code.

C. The coordination study shall be an extension of the short circuit study described above. Prepare the coordination curves to determine the required settings of protective devices to assure selective coordination.
   1. Show coordination from primary fuse through all breakers, including loads in main distribution panel.
   2. Where main panel feeds a subpanel at the same voltage (i.e. not through a transformer) coordination shall include too largest breaker in subpanel.
   3. Where breakers feed step down transformers, include main breaker or largest breaker on secondary side of transformer.

D. The phase and ground overcurrent protection shall be included, as well as settings for all other adjustable protective devices.

E. Graphically illustrate on log-log paper that adequate time separation exists between devices. Sufficient curves shall be used to clearly indicate the coordination achieved between devices. Reasonable coordination intervals and separation of characteristic curves shall be maintained. Plot the specific time-current characteristics of each protective device in such a manner that the upstream devices will be clearly depicted on the sheet maintain to greatest extent possible minimum of 5 cycle separation between devices.

F. The plots shall include complete titles, representative one-line diagram and legends, associated power company's relays or fuse characteristics, and complete parameters of transformers.

G. The following specific information shall also be shown on the coordination curves:
   1. Device identifications.
      a. Time and current ratio for curves.
      b. Fuse, circuit breaker, and relay curves, showing complete operating bands of low-voltage circuit breaker trip curves.
      c. Motor starting curves.
      d. Low voltage fuses including manufacturer's minimum melt, total clearing tolerance and damage bands.
      e. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands.
      f. Ground fault protective device settings.
      g. Other system load protective devices for largest branch circuit and feeder circuit breaker in each motor control center and panelboard.
      h. Transformer inrush curves.

i. Conductor damage curves.

H. Develop a table to summarize the settings selected for the protective devices. Include in the table the following:
1. Device identification.
2. Current transformer ratio, relay tap, time delay and instantaneous pickup.
3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
4. Recommendations for settings, on all low voltage breakers included in the contract.
5. Fuse rating and type.
6. Ground fault pickup and time delay.
7. Problem areas where protective devices do not coordinate under “real world” scenarios.

2.4 ARC FLASH STUDY:

A. Calculate the arc flash hazard at each switchboard panel, disconnect, transformer etc. using breaker settings developed in the approved coordination study.

B. Develop arc flash labels for installation onto electrical gear.

C. The study shall adhere to all aspects of the National Electrical Safety Code.

D. On Distribution System at 250V or less, served from a transformer 112.5KVA or less, assume an arcing fault duration of 1 second.

PART 3 ANALYSIS

A. Analyze the short circuit calculations and highlight any equipment determined to be underrated or not coordinated.

B. Contractor and his suppliers are responsible to provide a fully coordinated system including cost of equipment system modifications.

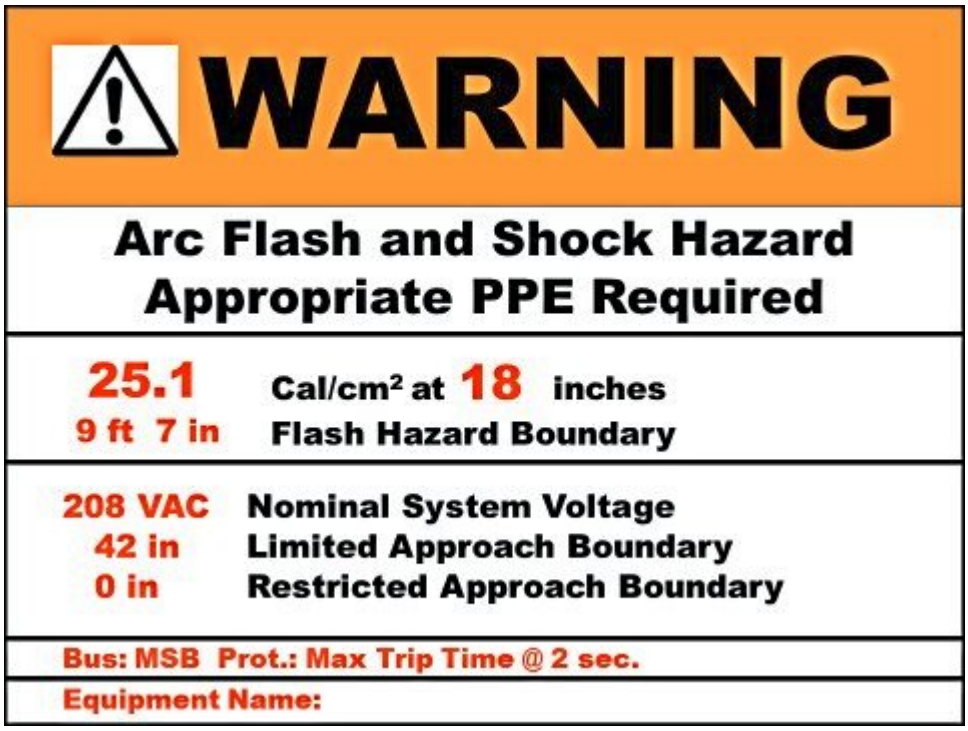
C. Provide labels at each switchboard panel, disconnect, transformer or electrical apparatus listing the arc flash hazard and required personal protective equipment required to service that device using time and let thru values approved by contracting Officer of record after coordination study is approved. (See example at end of this specification.)

PART 4 REPORT

A. The results of the power system study shall be summarized in a final report. The report shall include the following sections:
1. Introduction, executive summary and recommendations, assumptions, impedance one-line drawing, and copies of the project one-line drawings.
2. Tabulations of equipment ratings versus calculated short circuit values and commentary regarding same.
3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

4. Copies of the manufacturer's time current curves for the devices studied and plotted on the time current curves.
5. Arch flash labels for each switchboard, panel, transformer, disconnect, etc.

B. Arc flash labels shall appear similar to the following example:



PART 5 CONTRACTING OFFICERS RESPONSE

A. Contracting Officer of record will review report for compliance and approve, approve with comments or reject.

B. Should contracting Officer disapprove study shall be reworked as required and resubmitted for review.

C. After approval, modifications to equipment shall be made at no cost to Government.

D. Additional days will not be added to the contract for non-compliance of study.

END OF SECTION

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SECTION 26 09 23
LIGHTING CONTROL DEVICES

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 lighting control devices:
1. Outdoor and indoor photoelectric switches.
2. Multipole contactors.

B. Related Sections include the following:
1. Section 26 09 43 – Network Lighting Controls
2. Section 26 27 26 – Wiring Devices

1.3 DEFINITIONS:

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS:

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

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

PART 2 PRODUCTS

2.1 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS:

A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES:

A. Description: Solid State, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, microprocessor input, and complying with UL 773A.
1. Light-Level Monitoring Range: 1.5 to 10 fc 16 to 108 lx, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.

2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.

B. Approved Product: ET2000 series by Intermatic, or equal by Tork or Paragon.

2.3 MULTIPOLE LIGHTING CONTACTORS:

A. Approved Manufacturers:
1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Cutler-Hammer; Eaton Corporation.
4. GE Industrial Systems.
5. Square-D.

B. Description: Electrically operated and mechanically or electrically held as shown, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast or LED device (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Control-Coil Voltage: Match control power source.

2.4 CONDUCTORS AND CABLES:

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG.

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG.

C. Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 16 AWG.

D. Provide unshielded, twisted-pair cable for control and signal transmission conductors.

PART 3 EXECUTION

3.1 WIRING INSTALLATION:

A. Wiring Method: Comply with Division 16 Section “Conductors”. Minimum conduit size shall be ½ inch (13 mm).

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer’s written instructions.

C. Provide field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment.

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.2 IDENTIFICATION:

A. Identify components and power and control wiring.

B. Label time switches and contactors with a unique designation.

3.3 FIELD QUALITY CONTROL:

A. Perform the following field tests and inspections and prepare test reports:
1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify actuation of each sensor and adjust time delays.

B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

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

3.4 ADJUSTING:

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

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SECTION 26 12 19
PAD-MOUNTED, LIQUID FILLED, MEDIUM VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Liquid-filled pad-mounted transformers.

1.2 REFERENCES:

A. IEEE C37.47™ - Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses.

B. IEEE C57.12.00™ - Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.

C. IEEE C57.12.34™ – Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers, 2,500 KVA and Smaller: High Voltage, 34,500 GrdY/19,900 Volts and Below; Low Voltage, 480 Volts and Below.

D. ANSI C57.12.28 - Switchgear and Transformers, Pad-Mounted Equipment - Enclosure Integrity.

E. IEEE C57.12.90™ - Standard Test Code for Liquid-Immersed Distribution Power and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers.

F. IEEE C57.13™ - Requirements for Instrument Transformers.

G. ANSI/IEEE 386 - Separable Insulated Connector Systems for Power Distribution Systems above 600 V.

H. ASTM D877 - Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.

I. NEMA AB1 - Molded Case Circuit Breakers.

J. CAN/CSA-C88-M90 - Electrical Power Systems and Equipment.

1.3 SUBMITTALS:

A. Submit shop drawings indicating outline dimensions, connection and support points, weight, specified ratings and materials.

B. Submit product data indicating standard model design tests and options.

C. Submit manufacturer's installation instructions.

1.4 OPERATION AND MAINTENANCE DATA:

A. Include procedures for sampling and maintaining fluid, maintaining unit, and replacing components.

1.5 QUALITY ASSURANCE:

A. Manufacturer: Company specializing in distribution transformers with three years documented experience.

PART 2 PRODUCT

2.1 SUPPLIER:

A. Howard Industries, Kuhlman or Engineer approved equal.

2.2 PAD-MOUNTED FLUID-FILLED TRANSFORMERS:

A. The transformer(s) shall be compartment type, self-cooled, loop feed, for mounting on a pad and shall comply with the latest applicable standards.

B. The average temperature rise of the windings, measured by the resistance method, shall be 65° C when the transformer is operated at rated KVA output. The transformer shall be capable of being operated at rated load in a 30° C average, 40° C maximum ambient, as defined by IEEE C57.12.00™ without loss of service life expectancy.

C. Coolant and insulating fluid shall be inhibited mineral oil.

D. The high and low voltage compartments shall be located side by side, separated by a steel barrier. When facing the transformer, the low voltage compartments shall be on the right. Terminal compartments shall be full height, air-filled, with individual doors. The high voltage door fastenings shall not be accessible until the low voltage door has been opened.

E. The following accessories shall be provided as standard on all transformers:

1. Nameplate in low voltage compartment.
2. 1” upper filter press and filling plug
3. 1” Drain valve with sampling device.
4. Tap changer with silver-plated stationary and movable contacts, for de-energized operation only, which is externally operable and pad lockable.
5. Load break switch & operating handle for each incoming primary feeder.
6. The front of both compartments shall be removable to allow the transformer to be rolled or skidded into position over conduit stubs. ANSI tank grounding provisions shall be furnished in both compartments.
7. Dial type thermometer.
8. Magnetic liquid-level gauge to communicate with PMCS via dry contact closure

9. Pressure vacuum gauge
10. Pressure relief valve to communicate with PMCS via dry contact closure
11. Penta head bolts for primary compartment doors.

F. The transformer(s) shall be rated as follows:
1. Main Fire Station
   a. 150 KVA self-cooled (ONAN).
   b. Primary voltage 8/13.86kV wye.
   c. Secondary voltage 120/208, 4-wire 60 Hz with two 2-1/2% full capacity above normal and two 2-1/2% below normal taps.
   d. Impedance shall be 5.75, ±7-1/2%.
   e. Basic impulse level of the primary winding shall be KV as specified in IEEE C57.12.00 for comparable KV class
2. Remote Fire Station
   a. 150 KVA self-cooled (ONAN).
   b. Primary voltage 4160V delta
   c. Secondary voltage 120/208V, 4-wire 60 Hz with two 2-1/2% full capacity above normal and two 2-1/2% below normal taps.
   d. Impedance shall be 5.75, ±7-1/2%.
   e. Basic impulse level of the primary winding shall be KV as specified in IEEE C57.12.00 for comparable KV class

G. The transformer shall be of sealed-tank construction of enough strength to withstand a pressure of 7 psi without permanent distortion. The cover shall be welded and the handhole fastenings tamper resistant. The transformer shall remain effectively sealed for a top oil temperature range of –5° C to 105° C. When required, cooling panels will be provided on the back and sides of the tank. Lifting eyes and jacking provisions will be provided.

H. Coils shall be wound with aluminum conductors.

I. All cores to be constructed of high grade, grain-oriented, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux is to be kept well below the saturation point.

J. The HV terminations and equipment shall be dead front.

K. HV dead front bushings shall 200A Amp, one-piece integrated, with removable stud, for use with separable connectors. Bushings shall be externally clamped and front removable.

L. The low voltage bushings (≤600V) shall be molded polymer and provided with blade-type spade terminals with NEMA standard hole spacing arranged for vertical take-off. The low voltage neutral shall be an insulated bushing, grounded to the tank by a removable ground strap.

M. Provide bayonet type oil immersed fuses that are externally replaceable with a hot stick without opening the transformer tank.

N. Surge Protection - Provide three distribution class lightning arresters for surge protection. Arresters are to be mounted in the high voltage compartment.

O. Additional Accessories

1. Automatic pressure relief device (self-sealing with indicator).
2. Sudden pressure relay.
3. Bushing well inserts.

P. Transformer shall be UL listed.

Q. Transformer shall be FM labeled.

R. Testing - Tests shall be conducted in accordance with the provisions of IEEE C57.12.90™ and shall include, as a minimum, the following tests:

1. Ratio
2. Polarity
3. Phase Rotation
4. No-Load Loss
5. Excitation Current
6. Impedance Voltage
7. Load Loss
8. Applied Potential
9. Induced Potential
10. QC Impulse Test

PART 3 EXECUTION

3.1 EXAMINATION:

A. Provide pad and install transformer as detailed on the plans.

B. Verify field measurements are as instructed by manufacturer.

C. Install in accordance with manufacturer's instructions.

D. Install safety labels to NEMA 260.

3.2 ADJUSTING:

A. Adjust primary taps so that secondary voltage is within 2 % of rated voltage.

END OF SECTION

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SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Lighting and power panelboards and their installation.

1.2 SUBMITTALS:

A. Provide shop drawings. Include individual diagram of each panelboard showing all specified requirements.

1.3 RELATED SECTIONS:

A. Section 26 05 73 – Overcurrent Protective Devices Coordination Study

B. Section 26 35 53 – Surge Protection Devices

PART 2 PRODUCTS

A. Construct panelboards in accordance with latest NEMA and UL standards.

B. Panelboards to be same manufacturer as other distribution equipment.

C. Panelboard assembly UL labeled, and UL labeled as Service Entrance Equipment where used for that purpose.

D. Panelboards to have integrated equipment fault rating equal to interrupting rating of lowest rated overcurrent device.

E. Panelboards shall be factory assembled.

F. Bussing:
1. 98% conductivity copper, tinplated at joints.
2. Bus assembly designed for a maximum temperature rise of 55 degree C above 40 degree C ambient temperature when carrying rated current.
3. Minimum thickness of bus bars – 3/32”.
4. Bussing braced to withstand a fault current equal to the highest device interrupting capacity in the panel.
5. Neutral bus full size copper on same basis as phase busses and insulated from the cabinet.
6. Arrange bus bar connections so that adjacent vertical circuit protective devices are consecutively connected to phases A, B and C throughout panel. Provide 50% capacity ground bus in each panel cabinet, bolted to cabinet.

G. Cable terminations:

1. Include neutral and ground connections as shown.
2. Make with separate, individual heavy casting aluminum, AL/CU rated lugs, Thomas & Betts, Ilsco, Blackburn or approved equivalent.
3. Use 2 bolt tongue or equivalent connection to bus for #1/0 or larger cables.
4. Securely bolt lugs to bus with bolts, nuts and lock washers.
5. Provide double lugs on main bus where shown. Use offset compression lugs as required.

H. Circuit breakers:
1. Molded case, thermal-magnetic, quick-make, quick-break, trip free on faults, thermal-inverse time delay element and magnetic instantaneous trip coil in each ungrounded phase conductor, main breaker in main panel shall have a solid state trip unit (LSI).
2. Engrave breaker ampere rating on handle or trip unit.
3. Furnish multipole breakers with internal common trip.
4. Ground fault breakers class “A” type to trip on fault currents of 4-6 ma.
5. Main circuit breakers UL rated for service entrance use.
6. Switch “SWD” rated where required by NEC.

I. Fusible Switches:
1. UL approved for Service Entrance use.
2. Dual horsepower rated for AC and DC current.
3. Accepts standard One Time, Current Limiting, or Dual Element fuses.
4. Copper Fuse Clips, reinforced for good contact, mounted on insulated base.
5. Interlocked hinged cover. (Interlock defeatable with screwdriver).
6. Padlockable in “on” or “off” position.
7. Quick-make, quick-break mechanism with simultaneous operating poles.
8. Switch contact to be blade type, blow-off butt contacts acceptable only if manufacturer certifies contacts will remain closed under any fault conditions within limits of applied fuse.

J. Panelboards classified by type over-current protection as follows:
1. BQL Bolted quick-lag circuit breaker distribution, 0-100 ampere branches, with minimum interrupting rating as indicated on the drawings.
2. CCB Heavy duty convertible circuit breaker distribution, 0-800 ampere branches with minimum interrupting rating as indicated on the drawings.

K. All spaces in panelboards usable. Panelboard space provided with necessary connections for future installation of overcurrent devices.

L. Identification:
1. Permanently attach nameplates and circuit numbers to panel.
2. Use horizontal consecutive circuit numbers for lighting and appliance panels unless shown otherwise on panelboard schedules.
3. Provide typewritten circuit directories describing service of each circuit in Types BQL panels.
4. Provide laminated plastic nameplate circuit identification for each circuit in Types CCB panels.
5. Provide each panelboard with nameplate showing name and voltage.

M. Manufacturers:
1. Panelboards manufactured by Siemens, Square “D”, General Electric or Cutler-Hammer.

2.2 CABINETS: (Same manufacturer as interiors)

A. Code thickness, hot dip galvanized steel or painted with trim and door. Hardware: combination latch and cylinder lock, all keyed the same. Provide celluloid or plastic covered directory card holder on the inside of door. Trim, door and exposed interior shall be finished with factory prime and smooth finish coat of the color selected by Contracting Officer. Reinforce cabinets as necessary for service and short circuit rating intended.

B. Flush or surface as indicated of sufficient size to allow minimum 3” gutter space each side of panel and eight inches (8”) at top and bottom, minimum 20” wide. Provide adjustable trim clamp, semi-flush hinges and inside rabbet.

C. Provide panels with door in door trim construction.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Mount panelboards securely to building structure with 3/8” minimum diameter galvanized bolts and inserts number as required for size of panel, but not less than 4. Mount panelboards with centerline 4’-6” approximately above finished floor. Where panels of different heights are mounted adjacent, install top of panel trim at same height above floor. Close all unused openings.

B. Where two sets of feeder cables are required in panel gutter space, run one set in each side of panel.

END OF SECTION

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SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Wiring devices and plates and installation.

1.2 RELATED SECTIONS:

A. Section 26 09 23 – Lighting Control Devices

PART 2 PRODUCTS

2.1 DEVICES:

A. Furnish devices shown on drawings. Catalog numbers establish a standard of quality. Equivalent devices manufactured by Hubbell, Sierra, Arrow Hart, Bryant, Leviton, General Electric or Daniel Woodhead may be used. Submit list of devices with catalog number proposed for review prior to ordering.

B. Use Ivory color, except in special areas designated by the Contracting Officer, furnish color chart to Contracting Officer for selection.

C. Special colors selected from standard available of either white, brown, black, grey or beige. Furnish color chart.

D. Use red color for devices on emergency power circuits.

2.2 DEVICE PLATES:

A. Furnish devices with cover plates, .04” thick, type 302, stainless steel with brushed finish.

B. Device plates manufactured by Sierra or Hubbell.

C. Furnish configuration of device plates required for multi-gang installations.

D. Furnish in use weatherproof devices with individual gasketed aluminum or stainless-steel covers manufactured by Sierra or Hubbell.

E. Use red color for devices connected to emergency electrical system.

F. Engrave all device plates for devices with ¼” high indicate panel of origination and catalog number.

PART 3 EXECUTION

A. Install receptacles with ground wire from ground screw connected to outlet box.

B. Install devices vertical unless shown otherwise.

C. Install receptacles with ground slot up.

D. Furnish devices as follows:

APPROVED DEVICES	NEMA CONF.	MANUF. NO.	CATALOG
Single Receptacle	5-20R	Hubbell	5361
Single Receptacle	6-20R	Hubbell	5462 with 5464
Single Receptacle	14-20R	Hubbell	8410 with 8411C
Single Receptacle	15-20R	Hubbell	8420 with 8421
Single Receptacle	5-30R	Hubbell	9308 with 9309
Single Receptacle	6-30R	Hubbell	9330 with 9331
Single Receptacle	14-30R	Hubbell	9430A with 6 ft. rubber cord set
Single Receptacle	6-50R	Hubbell	9367 with 9368 plug
Single Receptacle	14-50R	Hubbell	9450 with rubber cord set
Single Receptacle	L5-20R	Hubbell	*23000-HG with 23004-HG
Single Receptacle	(X-Ray)	Hubbell	25605 with 25615
Duplex Receptacle	5-15R	Hubbell	5252 * 8200
Duplex Receptacle	5-20R	Hubbell	5362 * 8310
Electric Water Cooler Receptacle	5-20R	Hubbell	6F5262 * 6F8200
GFI Duplex	5-20R	Hubbell	6F5262 * 6F8200
Wall Switch 1-Pole	20A	Hubbell	CSB120
Wall Switch 3-Way	20A	Hubbell	CSB320

Wall Switch 4-Way	20A	Hubbell	CSB420
Wall Switch Momentary Contact	15A	Hubbell	HBL1381
Wall Switch Narrow Type	20A	Arrow-Hart	QST-91 W/T-1600

END OF SECTION

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SECTION 26 28 23
DISCONNECTS (MOTOR & CIRCUIT & SEPARATE CIRCUIT BREAKERS)

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Safety switches and disconnects and separately mounted circuit breakers.

B. Provide shop drawing.

PART 2 PRODUCTS

2.1 DISCONNECT SWITCHES:

A. Heavy duty rated 250 or 600 volts as required; quick-make, quick-break operation; horsepower rated. If switch is not available with proper horsepower rating, classify switch as isolating switch only and provide nameplate reading, "DO NOT OPEN UNDER LOAD". Operating handle interlocked with switch door to prevent opening door with switch closed. Provide mechanical over-ride for authorized personnel to open switch door without operating switch handle.

B. Fusible or non-fusible as shown. Furnish Bussman "Fuse-Tron" fuses for each fusible position, size as shown. Furnish 3 spare fuses for each size.

C. Furnish with provisions for locking with padlock. Enclosures for switches NEMA 1, general purpose, NEMA 3R, raintight, or special enclosure, as shown.

D. Standard product of Siemens, Square "D", General Electric, or Cutler-Hammer.

2.2 SEPARATELY MOUNTED CIRCUIT BREAKERS:

A. Furnish and install separately mounted circuit breakers for overcurrent protection of feeders and branch circuits where shown on drawings.

B. Circuit breakers: Thermal-magnetic, molded case type, rated 600 volts, with interrupting rating as indicated on the drawings.

C. Individual circuit breakers shall be mounted in NEMA 1, general purpose surface or flush enclosures as shown.

D. Circuit breakers shall be the standard product of G.E., Siemens, Square "D" or Cutler-Hammer.

E. Lock-able switch.

PART 3 EXECUTION

A. Secure disconnect switches to building or equipment surface as shown. If location shown is not suitable for installing, provide Unistrut P-1000 rack mounted as directed to secure switch.

B. Disconnects shall be located to be accessible and within 5 feet or closer to equipment served.

C. Provide engraved nameplates identifying equipment served, fuse or breaker size. Refer to Section 26 05 53 - Identification for Electrical Systems.

END OF SECTION

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SECTION 26 32 14
DIESEL GENERATOR SETS

PART 1 GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. This Section includes packaged engine-generator sets suitable for use in applications with the features as specified and indicated where the engine generators will be used as the Standby power source for the system.

1.3 DEFINITIONS:

A. Emergency Standby Power (ESP): Per ISO 8528: The maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set can deliver in the event of a utility power outage or under test conditions for up to 200 hours of operation per year with the maintenance intervals and procedures being carried out as prescribed by the manufacturers. The permissible average power output (Ppp) over 24 hours of operation shall not exceed 70 percent of the ESP unless otherwise agreed by the RIC engine manufacturer.

B. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 ACTION SUBMITTALS:

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.
2. Time-current characteristic curves for generator protective device.
3. Sound test data based on a free field requirement.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set, and other components specified.
2. Wiring Diagrams: Control interconnection, Customer connections.

C. Certifications:

1. Submit statement of compliance which states the proposed product(s) is certified to the emissions standards required by the location for EPA, stationary emergency application.
2. Submit statement of compliance which states the proposed product(s) are seismically certified in compliance with local requirements signed and sealed by a qualified professional engineer.

1.5 INFORMATIONAL SUBMITTALS:

A. Manufacturer Seismic Qualification Certification: Submit certification that the engine-generator set, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control test reports.

1. Certified summary of prototype-unit test report. See requirements in Part 2 "Source Quality Control" Article Part A. Include statement indicating torsional compatibility of components.
2. Certified Test Report: Provide certified test report documenting factory test per the requirements of this specification, as well as certified factory test of generator set sensors per NFPA110 level 1.
3. Report of exhaust emissions and compliance statement certifying compliance with applicable regulations.

1.6 QUALITY ASSURANCE:

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

D. Comply with NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).

E. Comply with NFPA 70 (National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702).

F. Comply with NFPA 110 (Emergency and Standby Power Systems) requirements for Level 1 emergency power supply system.

G. Shall be listed UL 2200.

H. The Standby Emergency Generator manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

I. Comply with all applicable codes and regulations including applicable sections of the Unified Facilities Criteria.

1.7 WARRANTY:

A. Base Warranty: Manufacturer shall provide base warranty coverage on the material and workmanship of the generator set for a minimum of twenty-four (24) months from registered commissioning and start-up.

1.8 PROJECT CONDITIONS:

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 0.0 deg C (32.0 deg F) to 48.89 deg C (120.0 deg F).
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 300.0 feet (91.44 m).

PART 2 PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: The basis for this specification is Cummins Power Generation Equipment 150kW generator. Approved equals may be considered if equipment performance is shown to meet the requirements herein.

2.2 ENGINE-GENERATOR SET:

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.

C. Capacities and Characteristics:

1. Minimum Power Output Ratings: Electrical output power rating for Standby operation of not less than 150.0kW/187.5kVA, at 80 percent lagging power factor, 120/208V, Three

phase, 4 -wire, 60 hertz. Package should include a 400A, 100% rated output circuit breaker.

2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component. The engine-generator nameplate shall include information of the power output rating of the equipment.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 1.0 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 5 seconds. On application of a 100% load step the generator set shall recover to stable voltage within 10 seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Not more than 15 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds. On application of a 100% load step the generator set shall recover to stable frequency within 10 seconds.
6. Output Waveform: At full load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for any single harmonic. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
7. Sustained Short-Circuit Current: (For engine-generator sets using a PMG-excited alternator) For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 8 seconds without damage to generator system components. For a 1-phase, bolted short circuit at system output terminals, system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.
8. Start Time: Comply with NFPA 110, Level 1, Type 10, system requirements.
9. Ambient Condition Performance: Engine generator shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition. Ambient temperature shall be as measured at the air inlet to the engine generator for enclosed units, and at the control of the engine generator for machines installed in equipment rooms.

2.3 ENGINE:

A. Fuel: #2 Diesel and JP8

B. Rated Engine Speed: 1800RPM.

C. Lubrication System: The following items are mounted on engine or skid:

1. Lube oil pump: shall be positive displacement, mechanical, full pressure pump.

2. Filter and Strainer: Provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions.

1. Provisions must be made for engine to operate on JP8 Fuel.

E. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and performance.

1. Designed for operation on a single 208/240/480 VAC, Single phase, 60Hz power connection. Heater voltage shall be shown on the project drawings.
2. Installed with isolation valves to isolate the heater for replacement of the element without draining the engine cooling system or significant coolant loss.
3. Provided with a 12VDC thermostat, installed at the engine thermostat housing.

F. Governor: Adjustable isochronous, with speed sensing. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate as appropriate to the state of the engine generator. Fuel rate shall be regulated as a function of starting, accelerating to start disconnecting speed, accelerating to rated speed, and operating in various isochronous states.

G. Cooling System: Closed loop, liquid cooled.

1. The generator set manufacturer shall provide prototype test data for the specific hardware proposed demonstrating that the machine will operate at rated standby load in an indoor ambient condition of 40deg C.
2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
3. Size of Radiator overflow tank: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
6. Duct Flange: Generator sets installed indoors shall be provided with a flexible radiator duct adapter flange.

H. Muffler/Silencer: Selected with Critical sound level performance as required to meet sound requirements of the application, sized as recommended by engine manufacturer and selected

with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

I. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element and restriction indicator.

J. Starting System: 12V, as recommended by the engine manufacturer; electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Cycle: As required by NFPA 110 for level 1 systems.
3. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Include required interconnecting conductors and connection accessories.
4. Battery Compartment: Factory fabricated of metal with acid-resistant finish.
5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation. The battery charging alternator shall have sufficient capacity to recharge the batteries with all parasitic loads connected within 4 hours after a normal engine starting sequence.
6. Battery Chargers: Unit shall comply with UL 1236, provide fully regulated, constant voltage, current limited, 12A battery charger for each battery bank. It will include the following features:
   a. Operation: Equalizing-charging rate based on generator set manufacturer’s recommendations shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
   b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 20 deg C to plus 40 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
   c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
   d. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
   e. Provide LED indication of general charger condition, including charging, faults, and modes. Provide an LCD display to indicate charge rate and battery voltage. Charger shall provide relay contacts for fault conditions as required by NFPA110.
   f. Enclosure and Mounting: NEMA, Type 1, wall-mounted cabinet.
7. Sub-Base Fuel Tank: Provide double walled sub-base fuel tank with a minimum of 36hr capacity at 75% load. Tank shall conform to standards for indoor installation.
   a. Provide supply and return pickup tubes that extend to the bottom of the tank.
   b. Provide required emergency and normal vents.
   c. Provide lockable fuel cap.

d. Provide Rupture basin alarm contact.
e. Provide low level fuel contact.
f. Contractor shall fill tank with 100% pure diesel fuel, Blended BIO Diesel is not allowed.

2.4 CONTROL AND MONITORING:

A. Engine generator control shall be microprocessor based and provide automatic starting, monitoring, protection and control functions for the unit.

B. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. (Switches with different configurations but equal functions are acceptable.) When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

C. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

D. Configuration: Operating and safety indications, protective devices, system controls, engine gages and associated equipment shall be grouped in a common control and monitoring panel. Mounting method shall isolate the control panel from generator-set vibration. AC output power circuit breakers and other output power equipment shall not be mounted in the control enclosure.

E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:

1. AC voltmeter (3-phase, line to line and line to neutral values). Provide both Digital and Analog meters.
2. AC ammeter (3-phases). Provide both Digital and Analog meters.
3. AC frequency meter. Provide both Digital and Analog meters.
4. AC kVA output (total and for each phase). Display shall indicate power flow direction.
5. Digital Ammeter-voltmeter displays shall simultaneously display conditions for all three phases.
6. Emergency Stop Switch: Switch shall be a red “mushroom head” pushbutton device complete with lock-out/tag-out provisions. Depressing switch shall cause the generator set to immediately stop the generator set and prevent it from operating.
7. Fault Reset Switch: Supply a dedicated control switch to reset/clear fault conditions.
8. DC voltmeter (alternator battery charging).

9. Engine-coolant temperature gage.
10. Engine lubricating-oil pressure gage.
11. Running-time meter.
12. Generator-voltage and frequency digital raise/lower switches. Rheostats for these functions are not acceptable. The control shall adjustment of these parameters in a range of plus or minus 5% of the voltage and frequency operating set point (not nominal voltage and frequency values.)
13. AC Protective Equipment: The control system shall include over/under voltage, over current, short circuit, loss of voltage reference, and over excitation shut down protection. There shall be an overload warning, and overcurrent warning alarm.
14. Status LED indicating lamps to indicate remote start signal present at the control, existing alarm condition, not in auto, and generator set running.
15. A graphical display panel with appropriate navigation devices shall be provided to view all information noted above, as well as all engine status and alarm/shutdown conditions (including those from an integrated engine emission control system). The display shall also include integrated provisions for adjustment of the gain and stability settings for the governing and voltage regulation systems.
16. Panel lighting system to allow viewing and operation of the control when the generator room or enclosure is not lighted.
17. DC control Power Monitoring: The control system shall continuously monitor DC power supply to the control and annunciate low or high voltage conditions. It shall also provide an alarm indicating imminent failure of the battery bank based on degraded voltage recover on loading (engine cranking).

F. Remote Alarm Annunciator: Comply with NFPA 110. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition.

G. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION:

A. Generator Overcurrent Protection: The generator set shall be provided with a UL Listed/CSA Certified protective device that is coordinated with the alternator provided to prevent damage to the generator set on any possible overload or overcurrent condition external to the machine. The protective device shall be listed as a utility grade protective device under UL category NRGU. The control system shall be subject to UL follow-up service at the manufacturing location to verify that the protective system is fully operational as manufactured. Protector shall perform the following functions:

1. Initiates a generator kW overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
2. Under single phase or multiple phase fault conditions, or on overload conditions, indicates an alarm conditions when the current flow is more than 110% of rated current for more than 10 seconds.

3. Under single phase or multiple phase fault conditions, operates to switch off alternator excitation at the appropriate time to prevent damage to the alternator.
4. The operator panel shall indicate the nature of the fault condition as either a short circuit or an overload.
5. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot greater than 120% of nominal voltage.
6. The protective system provided shall not include an instantaneous trip function.

2.6 GENERATOR, EXCITER, AND VOLTAGE REGULATOR:

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H

D. Temperature Rise: 105 environments.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.

G. Enclosure: Drip-proof.

H. Voltage Regulator: SCR type, separate from exciter, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, full wave rectified, and provide a pulse-width modulated signal to the exciter.

I. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

J. Sub-transient Reactance: 15 percent maximum, based on the rating of the engine generator set.

K. Alternator shall be capable of providing a Maximum SkVA of 1766 for motor starting.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE:

A. Description: Weather Protective Steel housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.

B. Construction:

1. Louvers: Equipped to permit air circulation when engine is not running while providing adequate air flow at full load conditions,

2. Hinged Doors: With padlocking provisions. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.
3. Exhaust System:
   a. Muffler Location: Within enclosure.
4. Hardware: All hardware and hinges shall be stainless steel.
5. Wind Rating: Wind rating shall be 150 mph.
6. Mounting Base: Suitable for mounting on sub-base fuel tank or housekeeping pad.
7. A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.
8. Inlet ducts shall include rain hoods.

C. Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 40 deg C.

D. Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 89 dBA measured at any location 7 m from the engine generator in a free field environment.

E. Electrical Provisions

1. External Electrical Connections: All power and control interconnections shall be made within the perimeter of the enclosure.

F. Site Provisions:

1. Lifting: Complete assembly of engine generator, enclosure, and subbase fuel tank (when used) shall be designed to be lifted into place as a single unit, using spreader bars.

2.8 VIBRATION ISOLATION DEVICES:

A. Vibration Isolation: Generators installed on grade shall be provided with elastomeric isolator pads integral to the generator unless the engine manufacturer requires use of spring isolation.

2.9 FINISHES:

A. Indoor and Outdoor Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Color shall be coordinated with the Contracting Officer.

2.10 SOURCE QUALITY CONTROL:

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters. In addition, the equipment engine, skid, cooling system, and alternator shall have been subjected to actual prototype tests to validate the capability of the design under the abnormal conditions

noted in NFPA110. Calculations and testing on similar equipment which are allowed under NFPA110 are not sufficient to meet this requirement.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test engine generator set manufactured for this Project to demonstrate compatibility and functionality.
2. Full load run.
3. Maximum power.
4. Voltage regulation.
5. Steady-state governing.
6. Single-step load pickup.
7. Simulated safety shutdowns.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Comply with packaged engine-generator manufacturers' written installation, application, and alignment instructions and with NFPA 110.

B. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

C. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

D. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and seismic requirements of the site.

E. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the Engineer of Record or Commissioning Agent.

F. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

G. On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer’s recommended practice.

3.2 ON-SITE ACCEPTANCE TEST:

A. The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer and Commissioning Agent shall be notified in advance and shall have the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system. Tests shall include:

B. Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.

C. Installation acceptance tests to be conducted on site shall include a "cold start" test, a four-hour full load (resistive) test, and a one-step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

D. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

3.3 TRAINING:

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

3.4 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

3.5 SERVICE AND SUPPORT:

A. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including engines, alternators, control systems, paralleling electronics, and power transfer equipment.

B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be on call 24 hours per day, 365 days per year. The service organization shall be physically located within 100 miles of the site.

C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

END OF SECTION

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SECTION 26 35 53
SURGE PROTECTION DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Surge Suppression Devices for main distribution panel, distribution and branch panel protection.

1.2 SUBMITTALS:

A. Submit under provisions of Section 26 01 01 – Electrical General.

B. Submit shop drawings of catalog data with complete description of materials and performance data.

C. Submit a single impulse surge current test report issued by a nationally recognized testing facility & an ANSI/IEEE Category C3 (20KV, 10KA) life cycle test report. The test reports should demonstrate that each CAPS unit can withstand, in its installed configuration, the specified values (up to 200K transient amps per mode) without failure of any internal component (MOVs, wiring, printed circuit board, fusing and disconnect).

D. Contracting Officer will not grant “prior approval” on equipment not specified within. Substitutions are permitted as long as they meet the specification requirements.

1.3 REFERENCES:

A. TVSS must meet the recommendations of, and comply with, the most recent edition of:
1. ANSI/IEEE C62.41, C62.41.1, C62.45, C62.48, C62.72.
2. National Electric code, Article 285.
3. Underwriters Laboratories: UL 1449 & UL 1283.

B. Listed to UL 1149, Second Edition, 2005 Revision (effective Feb. 9, 2007).

C. Secondary Surge Arrestor listed (service entrance unit only).

D. Listed to UL 1283 for EMI/RFI filters.

1.4 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 26 01 01 – Electrical General

B. Section 26 05 26 – Grounding and Bonding for Electrical Systems

C. Section 26 05 33 – Raceways and Boxes for Electrical Systems

D. Section 26 24 16 – Panelboards

E. Section 26 27 26 – Wiring Devices

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT:

A. Raceway and Fittings: Refer to Section 26 05 33 – Raceways and Boxes for Electrical Systems.

B. Wire and Cable: Manufacturer shall provide 15' shielded cable type THHN, standard copper, for remote mounting of devices where space limitation prevent adjacent mounting to protected equipment.

C. Surge Suppressor for Main Switchboard/MCC shall protect in all seven modes for a wye configuration (L-N, L-G, all phases & N-G). Tested surge current capacity of 200,000 amps per protection mode, minimum. Current Technology Model SL2-200 or approved equal. Provide a 100-amp breaker in the protected gear.

D. Surge Suppressor for Distribution Panels shall protect in all seven modes for a wye configuration (L-N, L-G, all phases & N-G). Test surge current rating of 100,000 amps per protection mode, minimum. Current Technology Model TG100 or approved equal. Provide a 60-amp breaker in the panel for connection to the bus.

E. Surge Suppressor for Branch Circuit Panels shall protect in all seven modes for a wye configuration (L-N, L-G, all phases & N-G). Test surge current rating of 60,000 amps per protection mode, minimum. Current Technology Model TG60 or approved equal. Provide a 60-amp breaker in the panel for connection to the bus.

F. Each unit shall be capable of surviving at least the following Category C3 (20KV, 10KA) impulses without failing or degrading the UL 1449 surge suppression rating more than 10%:

Type 1	Main Distribution Panel	12,000 impulses
Type 2	Distribution Board	4,500 impulses
Type 3	Branch Circuit Panels	3,500 impulses

G. Main Service Surge Suppressor shall be capable of protection the loads from the damaging effects of temporary over-voltages and voltage swells as defined by ANSI/IEEE Standard 1100=2005 (the Emerald Book) at 180% rated nominal voltage to a .7-ohm impedance load for 3,600 cycles.

H. Main Service Surge Suppressor shall be dual listed under UL 1449, Second Edition, and 2005 Revision as a TVSS device and under UL 96, meeting the Secondary Surge Arrestor Requirements in the UL Master Label Certification Program.

I. Diagnostic Monitoring System: The Surge Suppressor on the Main Service shall include the Master MIND Diagnostic Monitoring System. This system includes a microprocessor based digital monitor that displays RMS Phase Voltage, N-G voltage and current, # of Surges, # of sags, # of swells, #of power dropouts and outages, has an audible alarm, Form C Contacts and monitors each fuse in the Surge Suppressor system.

2.2 POWERLINE CORD/DIRECT-WIRED (120 VAC) SUPPRESSORS:

A. Suppressors shall consist of a three-stage hybrid design. First stage M.O.V., second stage air-core 300 uh inductor, and third stage silicon avalanche diode.

B. The suppressor shall provide certified test data confirming a fail short failure mode.

C. Suppressor shall provide three suppression modes. Line to neutral, line to ground, and neutral to ground.

D. Suppressor shall provide a maximum single impulse current rating of 10,000 amperes (8 x 20 us – waveform) per mode.

E. Suppressor shall provide a pulse life rating of 3,000 amperes (8 x 20 us – waveform) every thirty (30) seconds for 2,000 occurrences.

F. Suppressors maximum clamping voltage when subjected to the ANSI/IEEE C62.41 – 1980, Cat. B (6 kV – 1.2 x 50 us, 3kA impulse) shall not exceed 450 volts peak.

2.3 WARRANTY:

A. The Surge Suppressor system shall have a fifteen (15) year limited product warranty from date of shipment against transient failure, when installed in compliance with applicable national/local electrical codes and manufacturer's installation manual.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Install in strict accordance with the manufacturer's printed instructions.

B. Have a factory authorized representative inspect installation and verify that the complete system is working to factory specifications before final inspection. Provide affidavit of inspection in close out documents.

C. The contractor shall fire seal all raceway openings between each SPD and the electrical gear it is protecting to prevent any air born particles from migrating to the electrical gear.

3.2 SERVICE ENTRANCE (480/277v 30, 4w) TYPE 1:

A. Provide a service-entrance suppressor at each utility service entrance to the facility.

B. Suppressor shall be installed on the load side of the first disconnecting point of the service.

C. Conductors between suppressor and point of attachment to the service-entrance equipment shall be kept as short and straight as possible, preferably close-nippled to the device being protected. The mounting position of the suppressor shall permit a straight and short lead length connection between the suppressor and the point of connection to the device.

D. Suppressor's ground shall be bonded to the service entrance grounding conductor and grounded conductor.

3.3 DISTRIBUTION PANELS TYPE 2:

A. Install a secondary suppressor at each panelboard location as indicated on the drawings.

B. Conductors between suppressor and point of attachment to the panelboard shall be kept as short and straight as possible.

C. Separately mounted Suppressors shall be installed with separate grounding and grounded conductors. The grounding and grounded conductor shall have no contact at this point unless the service panel is a “separately derived system” according to NEC 250-5(d).

3.4 BRANCH PANEL TYPE 3:

A. Install a secondary suppressor at each panelboard location as indicated on the drawings.

B. Conductors between suppressor and point of attachment to the panelboard shall be kept as short and straight as possible.

C. Separately mounted Suppressors shall be installed with separate grounding and grounded conductors. The grounding and grounded conductor shall have no contact at this point unless the service panel is a “separately derived system” according to NEC 250-5(d).

3.5 ELECTRONIC POWER SUPPLY:

A. Install one each power line cord or direct-wired branch circuit suppressor between each equipment item and its power supply conductors as follows:
1. Fire Alarm master panel.
2. Building Management System head end.
3. Security System head end.
4. Telephone switch.

B. Install suppressor according to manufacturer’s recommendations.

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SECTION 26 36 00
AUTOMATIC TRANSFER SWITCHES

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 transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches, sizes and configuration to match drawings and Generator specifications.
2. Provide (1) 400A, 3P, 4W, 480V, Nema 3R, Automatic Transfer Switch as shown on the drawings.

B. Related Sections include the following:

1. All Division 26 Sections

1.3 SUBMITTALS:

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

1. Technical data on all major components of all transfer switches and other products described in this section. Data is required for the transfer switch mechanism, control system, cabinet, and protective devices specifically listed for use with each transfer switch. Include steady state and fault current ratings, weights, operating characteristics, and furnished specialties and accessories.
2. Single-Line Diagram: Show connections between transfer switch, power sources, and load.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Dimensioned outline drawings of assembly, including elevations, sections, and details including minimal clearances, conductor entry provisions, gutter space, installed features and devices and material lists for each switch specified.
2. Internal electrical wiring and control drawings.
3. Interconnection wiring diagrams, showing recommended conduit runs and point-to-point terminal connections to generator set.
4. Installation and mounting instructions, including information for proper installation of equipment to meet seismic requirements.

C. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Seismic certification, as required for site conditions. Seismic certifications shall be third-party certified and based on testing. Certification based on calculations does not meet this requirement.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational *both during and after* the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Manufacturer and Supplier Qualification Data

1. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
2. The manufacturer of this equipment shall have produced similar equipment for a minimum period of 10 years. When requested, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
3. The generator set manufacturer shall supply, warrant, and service the transfer switches. The supplier shall maintain a service location within 100 miles of the project site.

E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays, timers and protective devices; provide setting and calibration instructions where applicable.

F. Warranty documents demonstrating compliance with the project's contract requirements.

1.4 QUALITY ASSURANCE:

A. Only approved bidders shall supply equipment provided under this contract.

B. Comply with all applicable codes and regulations including applicable sections of the Unified Facilities Criteria.

C. Manufacturer Qualifications: The equipment supplier shall maintain a service center capable of providing training, parts, maintenance and emergency repairs to equipment, including transfer switch generator sets and remote monitoring equipment (if applicable) at the site within a response period of less than (eight hours) from time of notification.

1. The transfer switch shall be serviced by technicians employed by, and specially trained and certified by, the generator set supplier and the supplier shall have a service organization that is factory-certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
2. Submit names, experience level, training certifications, and locations for technicians that will be responsible for servicing equipment at this site.
3. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

D. Source Limitations: All transfer switches are to be obtained through one source from a single manufacturer. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for products provided.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked as suitable for use in emergency, legally required or optional standby use as appropriate for the connected load.

F. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:

1. Transfer switches and enclosures shall be UL 1008 listed and labeled as suitable for use in emergency, legally required, and optional standby applications.
2. NFPA 70, National Electrical Code. Equipment shall be suitable for use in systems in compliance with Articles 700, 701 and 702.
3. Comply with NEMA ICS 10-1993 AC Automatic Transfer Switches
4. IBC 2006 – The transfer switch(es) shall be prototype-tested and third-party certified to comply with the requirements of IBC group III or IV, Category D/F. The equipment shall be shipped with the installation instructions necessary to attain installation compliance.
5. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
6. EN55011, Class B Radiated Emissions and Class B Conducted Emissions
7. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity
8. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity
9. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity
10. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity
11. IEC 1000-4-6 Conducted Field Immunity
12. IEC 1000-4-11 Voltage Dip Immunity
13. IEEE 62.41, AC Voltage Surge Immunity
14. IEEE 62.45, AC Voltage Surge Testing

G. Comply with NFPA 110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems, regardless of the actual circuit level.

H. The manufacturer shall warrant the material and workmanship of the transfer switch equipment for a minimum of 2 years from registered commissioning and start-up.

I. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, and repair parts cost, etc. during the minimum noted warranty period described above.

1.5 COORDINATION:

A. Size and location of concrete bases and anchor bolt inserts shall be coordinated and as required.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

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

1. Cummins Power Generation
2. Caterpillar
3. Kohler

B. Equipment specifications for this Project are based on automatic transfer switches manufactured by Cummins Power Generation Model OTPC level 1 Controls.

C. Transfer switches utilizing molded case circuit breakers do not meet the requirements of this specification and will not be accepted.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS:

A. Provide transfer switches in the number and ratings that are shown on the drawings. Indicated Current Ratings: Apply as defined in UL 1008 and CSA for continuous loading and total system transfer.

B. Fault-Current Closing and Withstand Ratings (WCR): UL 1008 and CSA WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.

C. Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60 degrees C (- 40 to + 140 degrees F).

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically interlocked in both directions (except that mechanical interlock is not required for closed transition switches).

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Switches using molded-case switches or circuit breakers, or insulated case circuit breaker components are not acceptable.
2. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
4. Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.
5. The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical but must be coordinated with control function.
6. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
7. The transfer switch shall include the mechanical and control provisions necessary to allow the device to be field configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.
   a. Phase angle monitoring/timing equipment is not an acceptable substitute for this functionality.
8. Transfer switches designated on the drawings as “2-Pole or 3-pole” shall have a full current-rated neutral bar with lugs.

G. Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.

H. Terminals: Terminals shall be pressure type and appropriate for all field wiring. Terminal arrangement and cabinet space must be such that feeder conductors can enter from the top, side or bottom of the switch, at the installer’s discretion. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.

I. Enclosures: All enclosures shall be third-party certified for compliance to NEMA ICS 6 and UL 508 or CSA, unless otherwise indicated:

1. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70 regardless of the direction from which the conduit enters the enclosure.
2. Exterior cabinet doors shall provide complete protection for the system’s internal components. Doors must have permanently mounted key-type latches. Bolted covers or doors are not acceptable.
3. Transfer switches shall be provided in enclosures that are third party certified for their intended environment per NEMA requirements.

a. Transfer switches mounted in a controlled indoor environment shall be provided in NEMA Type 1 enclosures (IEC type IP30). Switches installed outside or exposed to the weather shall be NEMA 3R, as noted on the drawings.

2.3 AUTOMATIC TRANSFER SWITCHES:

A. Comply with requirements for Level 1 equipment according to NFPA 110.

B. Indicated current ratings:

1. Refer to the Project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
2. Main contacts shall be rated for 600 VAC minimum.
3. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C (-40 to +140 degrees F), relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 meters).

C. Manual Switch Operation: The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical but must be coordinated with control function.

D. Relay Signal: Control shall include provisions for addition of a pre-transfer relay signal, adjustable from 0 to 60 seconds, to be provided if necessary, for elevator operation, based on equipment provided for the project.

E. Control: Transfer switch control shall be provided with necessary equipment and software to communicate with the genset control, other transfer switches, remote annunciation equipment, and other devices over a high-speed control network.

F. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

G. Automatic Transfer Switch Control Features

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
2. All transfer switch sensing shall be configurable from an operator panel or from a Windows XP or later PC-based service tool. Designs utilizing DIP switches or other electromechanical devices are not acceptable.
3. The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.

4. The control system shall be designed, and prototype tested for operation in ambient temperatures from - 40 degrees C to + 60 degrees C (- 40 to +140 degrees F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
5. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

H. Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. The panel shall also include an alphanumeric display for detailed system information. Panel display and indicating lamps shall include permanent labels.

1. The indicator panel LEDs shall display:
   a. Which source the load is connected to (Source 1 or Source 2)
   b. Which source or sources are available?
   c. When switch is not set for automatic operation, because the control is disabled, or the bypass switch is in use.
   d. When the switch is in test/exercise mode
2. The indicator shall have pushbuttons that allow the operator to activate the following functions:
   a. Activate pre-programmed test sequence.
   b. Override programmed delays, and immediately go to the next operation.
   c. Reset the control by clearing any faults.
   d. Test all the LEDs by lighting them simultaneously.
3. The alphanumeric digital display shall be vacuum fluorescent-type, clearly visible in both bright sunlight and no-light conditions over an angle of 120 degrees, and shall display the following:
   a. AC voltage for all phases, normal and emergency
   b. Source status: connected or not connected.
4. The display panel shall be password-protected, and allow the operator to view and adjust:
   a. Set nominal voltage and frequency for the transfer switch.
   b. Adjust voltage and frequency sensor operation set points.
   c. Set up time clock functions.
   d. Set up load sequence functions.
   e. Enable or disable control functions including program transition.
   f. View real-time clock data, operation log (hours connected, times transferred, failures) and service history.

I. Control Functions: Functions managed by the control shall include:

1. Software adjustable time delays:
   a. Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (default 3 sec)
   b. Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 sec)

c. Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (default 3 sec)
d. Engine cooldown: 0 to 30 minutes (default 10 min)
e. Programmed transition: 0 to 60 seconds (default 3 sec)

2. Undervoltage sensing: three-phase normal, three-phase emergency source.
   a. Pickup: 85 to 98% of nominal voltage (default 90%)
   b. Dropout: 75 to 98% of nominal voltage (default 90%)
   c. Dropout time delay: 0.1 to 1.0 seconds (default 0.5 sec)
   d. Accurate to within +/- 1% of nominal voltage
3. Over-voltage sensing: three-phase normal, three-phase emergency source.
   a. Pickup: 95 to 99% of dropout setting (default 95%)
   b. Dropout: 105 to 135% of nominal voltage (default 110%)
   c. Dropout time delay: 0.5 to 120 seconds (default 3 sec)
   d. Accurate to within +/- 1% of nominal voltage
4. Over/under frequency sensing:
   a. Pickup: +/- 5 to +/-20% of nominal frequency (default 10%)
   b. Dropout: +/-1% beyond pickup (default 1%)
   c. Dropout time delay: 0.1 to 15.0 seconds (default 5 sec)
   d. Accurate to within +/- 0.2%
5. Voltage imbalance sensing:
   a. Dropout: 2 to 10% (default 4%)
   b. Pickup: 90% of dropout
   c. Time delay: 2.0 to 20 seconds (default 5 sec)

J. Control features shall include:

1. Programmable genset exerciser: A field-programmable control shall periodically start the generator, transfer the load to generator for a preset time, then re-transfer and shut down the generator after a preset cool-down period.
   a. Push-button programming control shall have a selection of eight different schedules for exercising generator, with or without load.
2. In event of a loss of power to the control, all control settings, real-time clock setting, and the engine start-time delay setting will be retained.
3. The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.
4. Transfer Override Switch: Overrides automatic re-transfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light to indicate override status.

K. Control Interface

1. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
2. Unassigned Auxiliary Contacts: Two normally open, 1-pole, double-throw contacts for each switch position, rated 10A at 240 VAC.

L. Engine Starting Contacts

1. One isolated and normally closed, and one isolated and normally open; rated 10A at 32 VDC minimum.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Identify components according to Division 26 Section "Identification for Electrical Systems."

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS:

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary, to accommodate required wiring.

B. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

C. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.

D. Ground equipment according to the NEC

3.3 SOURCE QUALITY CONTROL:

A. Prior to shipping, factory shall test and inspect components, assembled switches, and associated equipment to ensure proper operation.

B. Factory shall check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements.

C. Factory shall perform dielectric strength test complying with NEMA ICS 1.

3.4 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: The supplier of the transfer switch(es) and associated equipment shall inspect, test, and adjust components, assemblies, and equipment installations, including connections, and report results in writing.

B. Manufacturer's representative shall perform tests and inspections and prepare test reports.

C. After installing equipment and after electrical circuitry has been energized, installer shall test for compliance with requirements.

1. Perform recommended installation tests as recommended in manufacturer's installation and service manuals.
2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch.
    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Verify time-delay settings.
    c. Verify that the transfer switch is accurately metering AC voltage and current (when provided).
    d. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

END OF SECTION

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SECTION 26 41 00
LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.1 SCOPE:

A. Furnish and install all materials and labor required to provide a complete functional lightning protection and common ground system for the building as shown and detailed on the plans, in strict accordance with this section of the specifications and the applicable contract drawings.

B. Completed system shall bear UL master label "C".

1.2 STANDARDS AND QUALITY ASSURANCE:

A. The following specifications and standards of the latest current issue form a part of this specification.

1. N.F.P.A. – Code No. 780

B. All materials for this system shall be new and the standard product of a manufacturer regularly engaged in the production of lightning protection systems and shall be of the latest approved designs. Equipment shall be approved for UL listing. All materials shall be as manufactured by Thompson Lightning Protection, Robbins, Harger, AC Lightning Security, National Lightning Protection (NLP), Preferred Lightning Protection or approved equal. For approval of manufacturer other than specified, complete proposed material data and installation drawings must be submitted to Architect for review not less than 10 days prior to bid date.

C. In order to ensure integrity of installation, the system shall be installed under the direct job site supervision of Certified Master Installer.

1.3 SHOP DRAWINGS:

A. Complete shop drawings of the entire lightning protection system showing the type, size, mounting details, and location of all equipment, grounds and cable routings, etc., shall be submitted to the Architect for approval prior to start of work. If any departures of consequence from the Approved Shop Drawings are deemed necessary by the Contractor, details thereof shall be submitted and approval obtained, before work is resumed and completed.

1.4 SYSTEM:

A. System materials in general shall be copper and high copper-content bronze castings, and shall comply in weight, size, and composition for the class of structure to be protected, as specified in above mentioned Codes. The system shall consist of all necessary cables, air terminals, mounting bases, fittings, couplings, connectors,

fasteners, etc., as required to give a complete and coordinated system. All cable and all air terminals shall bear proper UL labels.

B. Supplier of system shall review all drawings to obtain all items required to be connected to system. Drawings show only main aspects of system. No extra compensation will be allowed for coverage and connectors required to meet NFPA 780.

C. System conductors shall be completely concealed wherever practical. All main downleads and roof risers shall be concealed within the building walls or columns, on new work or extensions to existing structures. Downleads and risers to be run in 1" PVC conduit in locations shown on Shop Drawings. Down leads in steel frame buildings shall be bonded at the top and bottom. Install suitable junction boxes in conduit system for bonding taps which shall be made with full-size conductor. Rebar steel in these columns shall be lapped a minimum of 24 diameters and ties shall be installed per A.S.T.M. standards.

D. All system fittings except cable holders, regardless of Structure classification shall be heavy-duty type made from bronze castings and secured with bolted-pressure clamps. Pressure plates made from stamped or pressed metal parts, or fittings utilizing crimp-type pressure devices will not be allowed. All bolts, screws and related type hardware shall be stainless steel.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT:

A. All materials shall be copper or copper alloys as described above, UL approved and labeled as required, and of the size, weight, and construction to suit the application where used in accordance with Code requirements for the Class of structure involved, and as per manufacturer recommendations.

B. Air terminals shall be solid, ½" diameter round copper bar, full nickel plated, and of sufficient length to project 10" minimum above the object to be protected, and UL labeled. Locate and space points in accordance with L.P.I. requirements.

C. Point bases shall be cast bronze with bolt-pressure cable connectors. Parapet type units shall provide for 1-1/2" coping overhand. Adhesive type bases for flat roofs shall be a minimum surface contact area of 18.5 square inches and be secure with a proper adhesive.

D. Conductors shall be braided smooth twist or rope-lay stranding commercially pure copper cable, sized per Code and UL labeled.

E. Ground rods shall be ¾" diameter and 10'-0" long copper-clad steel, connected to system downlead cable with two-bolt bronze clamp with stainless steel cap screws. Driven depth to be minimum of 12 feet.

F. Cable fasteners shall be substantial in construction, compatible with the conductor and mounting surfaces, and spaced according to Code requirements.

G. Bonding devices, cable splicers, and miscellaneous connectors shall be cast bronze with bolt pressure cable connections with stainless steel hardware. Any connections between dissimilar metals shall be made with approved bi-metallic connectors or spacers.

PART 3 EXECUTION

3.1 SYSTEM DESIGN: (WHEN NO DRAWINGS ARE TO BE MADE)

A. Contractor shall have supplier of system design system in accordance with these specifications furnishing shop drawing for approval.

B. Building is steel framed and steel frame may be used as a part of the lightning protection system as allowed by code.

3.2 INSTALLATION:

A. All equipment and materials shall be installed in a neat workmanlike manner by skilled installers, under the direct field supervision of a Certified Master Installer who has qualified under the LPI's Certification Program or similar installation training.

B. System installation shall be complete; including necessary cable networks on the roof for air terminals and devices, bonding networks and taps for grounding equipment and roof metals, and downlead conductors routed concealed in building structure to ground level. Where downleads and risers penetrate roofs and walls, suitable ½" copper rod type thru-roof connectors shall be used, equipped with necessary lead or neoprene washers and nuts for watertight seal. Copper pitch pockets shall be used at locations with built-up roofs. Adhesive-type point bases and cable holders shall be installed on build-up roof areas before application of roof gravels.

C. System installers shall thoroughly coordinate their work with other trades to insure a correct, neat, and unobtrusive complete installation.

3.3 BONDING AND SYSTEM GROUNDS:

A. A common ground shall be provided between the lightning protection system and the building electric and telephone service grounds. In addition, all underground metallic piping systems shall be bonded with full size conductor; including water, gas, sewer, fuel oil, and any other piping system, at points where these piping's enter the building.

B. The building electrical service shall be provided with a set of lightning surge arresters, secondary as required. Only valve type arresters will be acceptable, either single or three-phase as required.

C. Bonding of all metallic objects and systems at roof levels and elsewhere on the structure shall be complete. Primary bonds for metal bodies of conductance shall be bonded with appropriate fittings and full-time conductor; and shall consist of but not be limited to the following: Roof exhaust fans, HVAC units with related piping ductwork, exhaust vents and any other roof piping systems, cooling towers, elevator hoist machinery supports and rails systems, window washing tracks, antenna mast for TV, radio or microwave, flag poles, roof handrails and/or decorative screens, roof ladders, skylights, metal stacks, etc. Exterior architectural metal fascia and/or curtain walls or mullions, which extend the full height of the structure shall also be bonded, if not inherently bonded thru the building frame.

D. Metal bodies of inductance located within six feet of a conductor or object with primary bonds, shall be bonded with secondary cable and fittings. Typical of these are: plumbing vent stacks, roof flashings, parapet coping caps, gravel guards, isolated metal building panels or siding, roof drains, down spouts, roof ventilators, exterior balcony handrails, lower level sizeable miscellaneous metals, etc.

3.4 SUPERVISION AND CERTIFICATION:

A. The manufacturer's local representative shall be a Certified Master Installer and shall provide direct jobsite technical supervision to Contractor's personnel during installation to ensure compliance with all Code requirements.

B. Upon job completion, Contractors shall furnish Owners with written certification plus UL Master Label "C", that system is installed in compliance with above Codes.

3.5 SHOP DRAWINGS:

A. Shop drawings as built with certifications by master installer shall be turned over at close out.

END OF SECTION

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SECTION 26 51 00
LIGHTING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

A. Furnish and install all lighting luminaires, with all necessary accessories and lamps as shown, specified and/or scheduled.

1.2 RELATED SECTIONS:

A. Section 26 09 23 – Lighting Control Devices.

B. Section 26 01 01 – Electrical General for requirements for submittals.

C. Division 1 for allowances and Government-furnished items to be installed under this Section.

1.3 ABBREVIATIONS:

A. LED – Light Emitting Diode.

1.4 SUBMITTALS:

A. Shop drawing submittals for luminaires shall include the following for each luminaire: Complete construction details including all dimensions, complete description of materials used, complete electrical data (including operating voltage), photometric test report from an independent testing lab, complete description of finish, and manufacturer catalog cutsheet of lamp to be used.

B. Luminaire Manufacturer to have recognized safety labels on all fixtures: UL, ETL or CSA.

C. Luminaire Manufacturer must be able to supply IESNA LM-80 test report for all LED fixtures.

D. Luminaire Manufacturer must be able to supply IESNA LM-79 report as well as ies data files produced by a NVLAP – accredited laboratory, per DOE CALIPER specifications.

E. Delivered lumens and LPW of the luminaire must be listed on specification sheet.

F. Chromaticity must be in the ANSI C78.377A color space and reported on the LM-80 report.

PART 2 PRODUCTS

2.1 LUMINAIRES:

A. Furnish and install luminaires as shown in luminaire schedule, or otherwise indicated on the drawings. Manufacturer catalog numbers shown are for general descriptive purposes only and are intended only to establish the standard of quality.

B. Locations of luminaires on electrical drawings are diagrammatic. Verify location of luminaires with architectural drawings prior to installation. Conflicts between electrical and architectural drawings shall be referred to the Contracting Officer for resolution.

C. Provide luminaires complete with all options, accessories and other appurtenances required for a complete installation. Contractor shall verify type of ceiling and wall construction being installed, and provide luminaires properly configured for the type of construction.

D. All luminaires shall be UL listed for the application being installed.

E. Exit signs shall be furnished with 6" high letters with ¾" stroke. Verify color of signage required by local code authorities. Signs shall meet all NFPA, UL and local building code requirements.

F. Pendant stem mounted luminaires shall be furnished with ball aligner swivel, 30 degrees from vertical minimum, with swivel below canopy, with ½" diameter metal tube (stem).

G. Plastic lenses and shielding shall meet NFPA and local building code requirements for light transmitting plastics.

H. Metal luminaire housings shall be free of tool marks, dents, burrs and sharp edges. All metal parts shall be painted, galvanized or otherwise corrosion resistant.

I. Reflector surfaces shall be finished specular, semi-specular, diffuse or painted as indicated. Specular finish materials shall have a minimum reflectance value of 83%. Semi-specular or diffuse finish shall have reflectance of 75% and white painted finish materials shall have reflectance of 88%.

J. Luminaire support wires shall be zinc-coated, soft temper ASTM A641/A641M steel, 12 gage.

K. Luminaires with aircraft cable suspension system shall use 1/16" diameter (minimum) stainless steel aircraft cable and adjustable cable gripper with swaged cable stop at ceiling canopy. Cable size shall be selected by luminaire manufacturer to provide adequate support.

L. All luminaires shall be furnished with 10 year limited warranty on fixtures and drivers.

2.2 LED LAMP AND DRIVERS:

A. All LED fixtures pretested prior to shipment.

B. Luminaire Manufacturer to use one of the top five LED suppliers to ensure quality standards are met at all times.

C. Luminaire Manufacturer must perform a Thermal Management test to ensure that fixtures dissipate heat away from LEDs.

D. Luminaire Manufacturer must employ tight binning specifications to limit color temperature variations.

E. LED Drivers shall have a PF of >=0.9 and THD of <20%.

F. All electronic components within the fixtures shall be lead free, mercury free and RoHS compliant.

G. LED boards are to be individually replaced or repaired without replacement of whole luminaire.

H. Driver and LED boards easily accessible from below luminaire without removing fixture.

I. Luminaire Manufacturer must offer a ten (10) year limited warranty backed by that manufacturer on the LEDs and Driver.

J. Dimming LED drivers must dim to 1% or less.

K. LED boards to include plug-in connectors for ease of upgradeability.

L. LEDs minimally rated for 70% lumen maintenance at 50,000 hours (L70/50,000)

2.3 LAMPS:

A. Furnish luminaires as specified in Luminaire Schedule.

B. Correlated color temperature (CCT) of no greater than 4100K will be accepted.

C. Color rendering index (CRI) of no less than 80 for interior applications will be accepted.

2.4 EMERGENCY LIGHTING:

A. Provide luminaires and exit signs with self-contained battery power supplies as indicated. All equipment shall conform to UL924-Emergency Lighting and Power Equipment.

B. Battery shall be sealed, maintenance-free lead-acid type (indoors) or nickel-cadmium (outdoors or unconditioned spaces) with 10-year nominal life. Unit shall incorporate a fully automatic solid-state charger and automatic transformer relay to transformer to backup battery power supply upon failure of normal power.

PART 3 EXECUTION

A. Support luminaires from structure of the building, independent from the ceiling membrane or finish material. Luminaire shall be set level, plumb, and square with ceilings and walls.

B. Recessed lay-in luminaires in suspended grid ceilings shall not be supported solely from the ceiling grid. Provide devices for securing the luminaire to the ceiling grid to comply with the National Electrical Code (“earthquake clips”). Luminaires heavier than 20 pounds shall have supplemental support wires anchored to the structure above the ceiling.

C. Recessed luminaires in fire-rated ceiling assemblies shall be installed in accordance with the UL listing of the assembly.

D. Recessed luminaires (non lay-in or hard ceiling types) shall be supported by ¾" steel ceiling channel, or factory-supplied hanger bars one on each side of the luminaire, anchored to ceiling structure. Recessed luminaires heavier than 20 pounds shall have supplemental support anchored to the structure above the ceiling. Do not use conduit to support luminaire.

E. Provide recessed luminaires with appropriate frames, hardware and trim for the ceiling installed.

F. Install luminaires free and clear of structural and mechanical interferences above the ceiling. If location indicated on the drawing conflicts with other elements, notify the Contracting Officer for directions for remedial action.

G. Attach surface and pendant mounted luminaires to 3/16" fixture stud in outlet box. Luminaires in excess of 20 pounds shall have supplemental support anchored to the structure above the ceiling.

H. Luminaires surface mounted to grid-type ceilings shall be mounted with Caddy IDS type clips anchored to structure above.

I. Wall mounted luminaires shall be anchored to wall structure. Luminaire shall fully conceal the outlet box.

J. Wiring to luminaires shall be with flexible metallic conduit to junction box. Do not wire luminaire to luminaire unless noted otherwise, or if using manufactured wiring systems.

K. Individual flexible connections under 6 feet in length shall consist of 2 #14 and 1 #14 (ground) in 3/8" flexible metallic conduit (for circuits 20A or less). Bond ground wire and conduit at each end.

L. Recessed luminaires in insulated ceilings shall be installed so that insulation is no less than 3 inches away from the fixture enclosure unless the luminaire is listed for direct contact with insulation (IC rated).

M. Reflectors, trim cones, and other visible trim of luminaires shall not be installed until completion of ceiling work, and shall be clean and free of dust, fingerprints, scratches, dents, etc. upon substantial completion.

END OF SECTION

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SECTION 27 10 05
STRUCTURED CABLING FOR VOICE AND DATA

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Cabling and pathways inside buildings.

B. Cross-connection equipment, enclosures, and outlets.

C. Grounding and Bonding the telecommunications distribution system.

1.2 RELATED REQUIREMENTS:

A. Section 07 84 10 – Firestopping - Electrical

B. Section 26 05 26 – Grounding and Bonding for Electrical Systems

PART 2 PRODUCTS

2.1 MANUFACTURERS:

A. Cabling and Equipment
1. Panduit
2. AMP Netconnect/Tyco Electronic Corporation
3. Siemen Company

2.2 SYSTEM DESIGN:

A. Replace existing telecom and entertainment TV outlets with new outlets and cabling to existing equipment rack in Communications 103. Replace existing patch panels formerly serving demolished telecom outlets with Category 6 patch panels. Existing cable tray above ceilings to remain. Replace existing grounding system with ground bar and associated equipment shown on Electrical detail drawing E0.5. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, and outlets.
1. Comply with TIA/EIA-568 and TIA/EIA-569, latest editions.
2. Comply with TIA-570, latest editions.
3. Provide fixed cables and pathways that comply with NFPA 70 and ANSI/J-STD-670 and are UL listed or third-party independent testing laboratory certified.
4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
5. Extend existing telecom equipment to new location as shown.

B. Capacity:
1. Offices and Work Areas: Provide minimum two voice outlet and two data outlet in each work area.
2. Provide additional outlets where indicated on drawings.

C. Main Distribution Frame (MDF):
   1. Existing data equipment to remain in place, protect during construction.

D. Cabling to Outlets: Specified horizontal cabling, wired from each outlet to patch panel in Communications Room 103.

2.3 PATHWAYS:

A. Conduit: Provide pull cords in all conduit.

B. Underground Service Entrance: PVC, Type EPC-40 conduit.

2.4 COPPER CABLE AND TERMINATIONS:

A. Copper Horizontal Cable: TIA/EIA-568 Category 6 solid conductor unshielded twisted pair (UTP), 22 AWG, 100 ohm; 4 individually twisted pairs; covered with blue jacket and complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444.
   1. In locations other than in plenums, provide NFPA 70 type CMG general purpose, CMR riser-rated, or type CMP plenum-rated cable.
   2. In plenums, provide NFPA 70 type CMP plenum-rated cable.
   3. Testing: Furnish factory reel tests.

B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

C. Entertainment TV cable: RG-6 Coaxial cable with type “F” female connector at faceplate.

D. Jacks and Connectors: RJ-45, non-keyed, terminated with 110-style insulation displacement connectors; high impact thermoplastic housing; complying with same standard as specified horizontal cable and UL 1863.
   1. Performance: 500 mating cycles.
   2. Voice and Data Jacks: 4-pair, per-wired to T568A configuration, with color indications for T568B configuration.

2.5 ENCLOSURES:

A. Backboards: Existing plywood backboard to remain.
   1. Size: 48 inches wide by 96 inches high.
   2. Do not paint over UL label.

B. Building Entrance Protector: Existing to remain. Protect during construction.

C. Outlet Boxes: For flush mounting in walls; depth as required to accommodate cable manufacturer’s recommended minimum conductor bend radius.
   1. Size, Unless Otherwise Indicated: 4 inches square by 2-1/8 inches deep.
   2. Wall-Mounted Telephones: 4 inches high by 2 inches wide by 2-1/8 inches deep.
   3. Faceplates: Plastic, complying with system design standards and UL 514C.

4. Labels: Comply with TIA/EIA-606 using encoded identifiers; label each jack on the face plate as to its function with a unique numerical identifier. Labeling to be approved by Owner.

D. Communications and TV outlets: shall be as specified on Electrical drawing E0.5.

E. Patch panels: Category 6 in 24 or 48 patch configuration, as specified on Electrical drawing E0.5.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL:

A. Comply with latest editions and addenda of TIA/EIA-568, TIA/EIA-569, ANSI/J-STD-607, NFPA 70, and System Design as specified in Part 2.

B. Comply with latest editions and addenda of TIA-570, ANSI/J-STD-607, NFPA 70, and System Design as specified in Part 2.

3.2 PATHWAYS:

A. Install with the following minimum clearances:
1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
2. 12 inches from power conduits, cables and panelboards.
3. 5 inches from lighting fixtures.
4. 6 inches from flues, hot water pipes, and steam pipes.

B. Conduit:
1. Do not install more than two (2) 90-degree bends in a single horizontal cable run.
2. Leave pull cords in place where cables are not initially installed.
3. Conceal conduit under floor slabs and within finished walls, ceilings, and floors except where specifically indicated to be exposed.
   a. Conduit may remain exposed to view in mechanical rooms, electrical rooms, and telecommunications rooms.
   b. Treat conduit in crawl spaces and under floor slabs as if exposed to view.
   c. Where exposed to view, install parallel with or at right angles to ceilings, walls, and structural members.
   d. Under floor slabs, locate conduit at 12 inches, minimum, below vapor retarder; seal penetrations of vapor retarder around conduit.

C. Ground and Bonding: Perform in accordance with ANSI/J-STD-607 and NFPA 70. See electrical detail sheet E0.5 for grounding work and specification at existing backboard.

D. Firestopping: Seal openings around pathway penetrations through fire-rated walls, partitions, floors, and ceilings in accordance with Section 078400.

3.3 INSTALLATION OF EQUIPMENT AND CABLING:

A. Cabling:
   1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
   2. Do not over-cinch or crush cables.
   3. Do not exceed manufacturer's recommended cable pull tension.
   4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Stack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
   1. At Distribution Frames: 120 inches.
   2. At Outlets – Copper: 12 inches.
   3. At junction boxes above ceiling serving modular furniture or demountable walls: 120 inches. Verify length with furniture layout.

C. Copper Cabling:
   1. Category 5e/6: Maintain cable geometry; do not untwist more than 1/2" from point of termination.
   2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.

D. Wall-Mounted Rack and Enclosures:
   1. Existing to remain. Protect during construction. Remove/relocate rack as required for new construction per Owner's direction.

E. Field-Installed Labels: Comply with TIA/EIA-606 using encoded identifiers.
   1. Cables: Install color coded labels on both ends.
   2. Outlets: Label each jack on its face plate as to its type and function, with a unique numerical identifier.

3.4 FIELD QUALITY CONTROL:

A. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:
   1. Inspect cable jackets for certification markings.
   2. Inspect cable terminations for color coded labels of proper type.
   3. Inspect outlet plates and patch panels for complete labels.

C. Testing – Copper Cabling and Associated Equipment.
   1. Test operation of shorting bars in connection blocks.
   2. Category 5e/6 Backbone: Perform near end cross talk (NEXT) and attenuation tests.
   3. Category 5e/6 Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

D. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone and document.

END OF SECTION

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SECTION 28 31 05
MILITARY FIRE ALARM AND MASS NOTIFICATION SYSTEM

PART 1 GENERAL

1.1 SUMMARY:

A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.

B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.

C. The Fire Alarm/Mass Notification System shall consist of all necessary hardware equipment and software programming to perform the following functions:
1. Fire alarm system detection and notification operations.
2. Control and monitoring of elevators, door hold-open devices, fire suppression systems, emergency power systems, and other equipment as indicated in the drawings and specifications.
3. Two-way supervised firefighter's phone operations when applicable.
4. One-way supervised automatic voice alarm operations.
5. Monitor the Knox box for opening tamper.

D. The Fire Alarm and Mass Notification drawings presented in the contract documents are only to be considered “schematic” in nature. UFC 3-600-01 and UFC-4-021-01 require that the Fire Alarm and Mass Notification systems be designed by a registered Professional Fire Protection Engineer who has been certified by the NCEES, or an individual that has obtained NICET, Fire Alarm Systems, Level III/IV certification. Final designs, calculations, submittals, and installation for this project are the responsibility of a Fire Alarm manufacturer and vendor whose staff includes a registered Professional Fire Protection Engineer, or a NICET, Level III/IV technician to certify all parameters of the design. This individual’s name, signature, and professional engineer number or NICET certification number shall be included on all final design documents. All Fire Alarm and Mass Notification equipment and wiring drawings, calculations, and submittals shall be approved in writing by the Contracting Officer, or his assignee, before any Alarm work in the project facility may begin.

1.2 SCOPE OF WORK:

A. Provide complete a Mass Notification/Fire Alarm System capable of network connectivity. The system shall report fire alarm and trouble conditions to the fire command center as well as receive mass notification messaging from the fire command center that will be broadcasted on the system.

1.3 ACCEPTABLE EQUIPMENT AND SERVICE PROVIDERS:

A. Manufacturers: The equipment and service described in this specification are those supplied and supported by SimplexGrinnell and represent quality and intent of the equipment.
1. Subject to compliance with the requirements of this specification, provide a Simplex 4100ES fire alarm/mass notification system or approved equal.

2. Subject to compliance with the requirements of this specification, provide an American Signal Interior System Interface (ISI) unit or approved equal for network integration.
3. Approved manufacturers of Fire Alarm Equipment for this project include Simplex, Siemens, and Notifier. Any fire alarm system submitted must meet or exceed the full specifications, and any system that fails to meet any single aspect of the specifications will rejected in its entirety.

1.4 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this section.

B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
1. Division 26: "Basic Electrical Materials and Methods."
2. Division 26: "Wiring Methods."
3. Division 21: "Fire Suppression".
4. Division 21: "Fire Protection".
5. Division 23: "HVAC Systems".

C. The system and all associated operations shall be in accordance with the following:
1. Requirements of the following Model Building Code: BOCA IBC, 2009 Edition
2. Requirements of the following Model Fire Code: BOCA NFPA 1, 2009 Edition
3. NFPA 72, National Fire Alarm Code, 2002 Edition
4. NFPA 70, National Electrical Code, 2002 Edition
5. NFPA 101, Life Safety Code, 2009 Edition
6. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems, 2009 Edition
7. Local Jurisdictional Adopted Codes and Standards
8. ADA Accessibility Guidelines
9. UFC 4-021-01. Latest Edition
10. UFC 3-600-01 Fire Protection Engineering for Facilities.

1.5 SYSTEM DESCRIPTION:

A. Fire Alarm: Provide a complete, non-coded addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.

B. Mass Notification: Provide a complete mass notification system with combination clear/amber strobe devices (addressable style), internal and external speakers as indicated on drawings. The staff shall have the ability to activate from the Local Operator Controller (LOC) audible and visual alarm devices and provide real time pre-recorded messages or live voice information and instructions to all building occupants in the vicinity of the building(s).

C. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm

control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing multiple site-specific configuration programs with one active and one in reserve. Panel shall be capable of full system operation during new site-specific configuration downloads, master exec downloads, and slave exec downloads.

D. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

E. Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout differentiates alarm signals from all other printed indications.

F. Wiring/Signal Transmission:
   1. Transmission shall be hard-wired, using separate individual circuits for each zone of alarm operation as required or addressable signal transmission, dedicated to fire alarm service only.
   2. System connections for initiating device circuits shall be Class B, Style D, signaling line circuits shall be Class B, Style 4 and notification appliance circuits shall be Class B, Style Y.
   3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.

G. Remote Access:
   1. FACP shall have the capability to provide Remote Access through a TCP/IP Ethernet connection.
   2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.
   3. FACP shall have the capability to provide third party access through a serial interface connection and be agency listed for specific interfaces and for the purpose.

H. Required Functions: The following are required system functions and operating features:
   1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
   2. Noninterfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.
   3. Transmission to an approved Supervising Station: Automatically route alarm,

supervisory, and trouble signals to a supervising station service.

4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the type of device, the operational state of the device (i.e alarm, trouble or supervisory) and shall display the custom label associated with the device.
5. General Alarm: A system general alarm shall include:
   a) Indication of alarm condition at the FACP and the annunciator(s).
   b) Identification of the device /zone that is the source of the alarm at the FACP and the annunciator(s).
   c) Operation of audible and visible notification appliances until silenced at FACP.
   d) Closing doors normally held open by magnetic door holders.
   e) Unlocking designated doors.
   f) Shutting down supply and return fans serving zone where alarm is initiated.
   g) Closing smoke dampers on system serving zone where alarm is initiated.
   h) Initiation of smoke control sequence.
   i) Transmission of signal to the supervising station.
   j) Initiation of elevator Phase I functions (recall, shunt trip, illumination of indicator in cab, etc.) in accordance with ASME/ANSI A17.1, when specified detectors or sensors are activated, as appropriate.
6. Supervisory Operations: Upon activation of a supervisory device such as a fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:
   a) Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
   b) Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
   c) Record the event in the FACP historical log.
   d) Transmission of supervisory signal to the supervising station.
   e) Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.
7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.
8. System Reset
   a) The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
   b) Should an alarm condition continue, the system will remain in an alarmed state.
9. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.
10. WALKTEST: The system shall have the capacity of 8 programmable passcode

protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one-person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:

a) The “city circuit” connection and any suppression release circuits shall be bypassed for the testing group.
b) Control relay functions associated with one of the 8 testing groups shall be bypassed.
c) The control unit shall indicate a trouble condition.
d) The alarm activation of any initiating device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.
e) The unit shall automatically reset itself after signaling is complete.
f) Any opening of an initiating device or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.

I. Analog Smoke Sensors:

1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a CRT Display or printed for annual recording and logging of the calibration maintenance schedule.
5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported to the Supervising Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
6. The FACP shall continuously perform an automatic self-test on each sensor that

will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.

7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.
10. UFC 3-600-01 will determine the number of smoke detectors required for this project.

J. Audible Alarm Notification: By voice evacuation and tone signals on loudspeakers in areas as indicated on drawings.

1. Automatic Voice Evacuation Sequence:
   a) The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall resume. This sequence shall sound continuously until the "Alarm Silence" switch is activated.
   b) All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.

K. Speaker: Speaker notification appliances shall be listed to UL 1480.

1. The speaker shall operate on a standard 70.7VRMS NAC using twisted/shielded wire.
2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet. Outdoor speakers should be capable of 15-watt taps.
3. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.

L. Manual Voice Paging

1. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.
2. The control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers.
3. Total building paging shall be accomplished by the means of an "All Call" switch.

M. Constant Supervision of Non-Alarm Audio Functions:

1. When required, the system shall be configured to allow Non-Alarm Audio (NAA) functions such as background music or general/public address paging.
2. During NAA operation, the speaker circuit shall be electrically supervised to provide continuous monitoring of the speaker circuit.
3. During an alarm condition, supervision shall be disabled, and alarm signals delivered to speakers.

N. Fire Suppression Monitoring:
1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
3. WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.
4. Kitchen suppression system under hood shall be separately mounted and activation of hood system shall shut trip branch feeder electrical device under hood.

O. Fire Alarm and Mass Notification system shall communicate via Monaco radio transceiver to base fire department. Communicate with base fire department for exact model number to match existing base standards.

P. Power Requirements
1. The control unit shall receive AC power via a dedicated fused disconnect circuit.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.
4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously at the user interface while incoming power is present.
5. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.
7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
8. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.6 SUBMITTALS:

A. General: Submit the following according to Conditions of Contract.
1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
2. Wiring diagrams from manufacturer.

3. Shop drawings showing system details including location of FACP, all devices, circuiting and details of graphic annunciator.
4. System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate in accordance with the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, SLC, NAC, relay, sensor, and auxiliary control circuits.
6. Operating instructions for FACP.
7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
8. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
9. Record of field tests of system.

B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions, if required, to make clarifications or revisions to obtain approval.

C. Submittals and complete system design shall be prepared by designer with NICET Level II Certification.

1.7 QUALITY ASSURANCE:

A. Installer Qualifications: A factory authorized installer is to perform the work of this section.

B. Each and every item of the Fire Alarm System shall be listed under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

1.8 MAINTENANCE SERVICE:

A. Maintenance Service Contract: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives.

B. Basic Services: Within the warranty period, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.

C. Renewal of Maintenance Service Contract: No later than 60 days prior to the expiration of the maintenance services contract, deliver to the Government a proposal to provide contract maintenance and repair services for an additional one-year term. Government will be under no obligation to accept maintenance service contract renewal proposal.

1.9 EXTRA MATERIALS:

A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:

1. Break Rods for Manual Stations: Furnish quantity equal to 15 percent of the number of manual stations installed; minimum of 6 rods.
2. Notification Appliances: Furnish quantity equal to 10 percent of each type and number of units installed, but not less than one of each type.
3. Smoke Detectors or Sensors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10 percent of each type and number of units installed but not less than one of each type.
4. Detector or Sensor Bases: Furnish quantity equal to 2 percent of each type and number of units installed but not less than one of each type.
5. Provide spare parts kit for the ISI units per manufacturers recommendations.

PART 2 PRODUCTS

2.1 FIRE ALARM CONTROL PANEL (FACP):

A. General: Comply with UL 864, "Control Units and Accessories for Fire Alarm Systems".

B. The following FACP hardware shall be provided:

1. Power Limited base panel with beige cabinet and door, 120 VAC input power.
2. 2,000-point capacity where (1) point equals (1) monitor (input) or (1) control (output).
3. 2,000 points of Network Annunciation at FACP Display when applied as a Network Node.
4. 2000 points of annunciation where one (1) point of annunciation equals:
   1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
   1 LED on panel or 1 switch on panel.
5. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FACP LCD Display.
6. Municipal City Circuit Connection with Disconnect switch, 24VDC Remote Station (reverse polarity), local energy, shunt master box, or a form "C" contact output. Provide signal shall be via MONACO radio transceiver and match existing base standards.
7. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.
8. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
9. Three (3) Class B or A (Style Y/Z) Notification Appliance Circuits (NAC; rated 3A@24VDC, resistive).
10. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries.
11. Power Supplies with integral intelligent Notification Appliance Circuit Class B for system expansion.
12. Four (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory of other

fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.

13. The FACP shall support up to (5) RS-232-C ports and one service port. All (5) RS-232 Ports shall be capable of two-way communications.
14. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
15. Programmable DACT for either Common Event Reporting or per Point Reporting.
16. Service Port Modem for dial in passcode access to all fire control panel information.
17. Connect to ISI unit for reporting of alarm and trouble conditions to the True Site Workstation via radio transmission.

C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

D. Alphanumeric Display and System Controls: Panel shall include an 80-character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

1. The system shall have the capability to provide expanded content, multi-line, operator interface displays as indicated on the drawings and specifications. The expanded content multi-line displays shall be Quarter-VGA (QVGA) or larger and be capable of supporting a minimum of 854 standard ASCII characters to minimize or eliminate the levels of navigation required for access to information when responding to critical emergencies and abnormal system conditions. The QVGA operator interface shall provide operator prompts and six context sensitive soft keys for intuitive operation.
    a) Expanded content, multi-line operator interfaces shall be capable of providing the following functions:
        (a) Equal or hierarchal priority assignment. In systems with two or more operator interfaces, each operator interface shall be programmable to allow multiple operator interfaces to have equal operation priority or to allow hierarchal priority control to be assigned to individual operator interfaces (locations).
        (b) Up to 50 custom point detail messages for providing additional point specific information in detailed point status screens.

E. Voice Alarm: Provide an emergency communication system, integral with the FACP, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:

1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface. Each amplifier shall be capable of performing constant supervision for non-alarm audio functions such as

background music and general paging.

2. All announcements are made over dedicated, supervised communication lines. All risers shall support Class B wiring for each audio channel.
3. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone and up to 5 remote microphones.
4. Status annunciator indicating the status of the various voice alarm speaker zones and the status of fire fighter telephone two-way communication zones.

F. Distributed Module Operation: FACP shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 4 (Class B) supervised serial communications channel (SLC):
1. Amplifiers, voice and telephone control circuits
2. Addressable Signaling Line Circuits
3. Initiating Device Circuits
4. Addressable Notification Appliance Circuits
5. Auxiliary Control Circuits

2.2 REMOTE LCD ANNUNCIATOR:

A. Provide a remote LCD Annunciator, where required, with the same "look and feel" as the FACP operator interface. The Remote LCD Annunciator shall use the same Primary Acknowledge, Silence, and Reset Keys; Status LEDs and LCD Display as the FACP.

B. Annunciator shall have super-twist LCD display with two lines of 40 characters each. Annunciator shall be provided with four (4) programmable control switches and associated LEDs.

C. Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.

D. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

E. The LCD shall display the following information relative to the abnormal condition of a point in the system:
1. 40-character custom location label.
2. Type of device (e.g., smoke, pull station, waterflow).
3. Point status (e.g., alarm, trouble).

F. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge, Silence and Reset operation shall be the same as the FACP.

G. The Remote Annunciator shall be installed in the enclosure with LOC.

2.3 LOCAL OPERATOR CONTROLLER (LOC):

A. LOC'S shall be located as indicated on the drawings and shall be verified with the Professional prior to rough in.

B. The LOC shall be housed in a flush or surface mounted steel enclosure as indicated on

the drawings. It shall have a continuous hinged lockable door with magnetic door latch.

C. The LOC shall consist of a microphone, 8 alarm initiating buttons and HVAC shutdown.

2.4 EMERGENCY POWER SUPPLY:

A. General: Components include battery, charger, and an automatic transfer switch. System shall be powered from the existing emergency generator.

B. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm notification devices in alarm mode for a period of 15 minutes.

2.5 ADDRESSABLE MANUAL PULL STATIONS:

A. Description: Addressable single-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

2.6 SMOKE SENSORS:

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:

1. Factory Nameplate: Serial number and type identification.
2. Operating Voltage: 24 VDC, nominal.
3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
4. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.
5. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
6. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
7. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
8. The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI.
9. Sensors include a communication transmitter and receiver in the mounting base

having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.

10. Removal of the sensor head for cleaning shall not require the setting of addresses.

B. Type: Smoke sensors shall be of the photoelectric.

C. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions for the project. Sensor includes relay as required for fan shutdown.

1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.
2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
4. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
8. Each duct smoke sensor shall have a Remote Test Station with an alarm LED and test switch.
9. Where indicated provide a NEMA 4X weatherproof duct housing enclosure that shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

2.7 HEAT SENSORS:

A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.

2.8 ADDRESSABLE CIRCUIT INTERFACE MODULES:

A. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems.

B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.

C. There shall be the following types of modules:
   1. Type 1: Monitor Circuit Interface Module:
      a) For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
      b) For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
   2. Type 2: Line Powered Monitor Circuit Interface Module
      a) This type of module is an individually addressable module that has both its power and its communications supplied by the two-wire signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
      b) This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.
   3. Type 5: 4-20 mA Analog Monitor Circuit Interface Module
      a) This module shall communicate the status of a compatible 4-20 mA sensor to the FACP. The FACP shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.

D. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.9 MAGNETIC DOOR HOLDERS:

A. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develop a minimum of 25 lbs. holding force.

B. Material and Finish: Match door hardware.

2.10 ADDRESSABLE ALARM NOTIFICATION APPLIANCES:

A. The Contractor shall furnish and install Addressable Notification Appliances and accessories to operate on compatible signaling line circuits (SLC).
   1. Addressable Notification appliance operation shall provide power, supervision

and separate control of horns and strobes over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft and a minimum 3 twists (turns) per foot.

2. Class B (Style 4) notification appliances shall be wired without requiring traditional in/out wiring methods; addressable "T" Tapping shall be permitted. Up to 63 appliances can be supported on a single channel.
3. Each Addressable notification appliance shall contain an electronic module and a selectable address setting to allow it to occupy a unique location on the channel. This on-board module shall also allow the channel to perform appliance diagnostics that assist with installation and subsequent test operations. A visible LED on each appliance shall provide verification of communications and shall flash with the appliances address setting when locally requested using a magnetic test tool.
4. Addressable Controller: Addressable Controller shall supervise Channel (SLC) wiring, communicate with and control addressable notification appliances.
5. Visible/Only Devices (V/O): Provide combination Clear and Amber addressable strobe devices. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.

B. ADDRESSABLE APPLIANCES NAC POWER EXTENDER

1. The Addressable Controller shall be a stand-alone panel capable of powering a minimum of 3 Signaling line circuits. Each channel shall be rated for 2.5 amps and support up to 63 addressable notification appliances. Power and communication for the notification appliances shall be provided on the same pair of wires. Addressable SLC notification appliance circuits shall be Class B, Style 4.
2. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.
3. The NAC extender panel may be mounted close to the host control panel or can be remotely located.

C. Speaker: Speaker notification appliances shall be listed to UL 1480.

1. The speaker shall operate on a standard 70.7VRMS NAC using twisted / shielded wire.
2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet. Outdoor speakers shall be capable of being tapped up to 15W.
3. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.
4. The Speaker installs directly to a 4" square, 1 ½" deep electrical box with 1 ½" extension.

D. Accessories: The contractor shall furnish any necessary accessories.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL:

A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
1. Factory trained and certified personnel.
2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
3. Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION:

A. Furnish and install a complete Fire Alarm System and Mass Notification as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

B. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.

C. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

D. Install manual station with operating handle 48 inches (1.22 m) above floor. Install wall mounted audible and visual notification appliances not less than 80 inches (2.03 m) above floor to bottom of lens and not greater than 96 inches (2.44 m) above floor to bottom of lens.

E. Mount outlet box for electric door holder to withstand 80 pounds pulling force.

F. Make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors.

G. Automatic Detector Installation: Conform to NFPA 72.

3.3 WIRING INSTALLATION:

A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority having Jurisdiction and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).

B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written

approval of the Fire Alarm System Manufacturer.

C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

D. Mount end-of-line device in box with last device or separate box adjacent to last device for Class "B" supervision.

3.4 FIELD QUALITY CONTROL:

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
1. Factory trained and certified.
2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
3. Certified by a state or local authority.
4. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.

C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning

D. Inspection:
1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.

E. Acceptance Operational Tests:
1. Perform operational system tests to verify conformance with specifications:
a) Each alarm initiating device installed shall be operationally tested. Each device shall be tested for alarm and trouble conditions. Contractor shall submit a written certification that the Fire Alarm System installation is complete including all punch-list items. Test battery operated emergency power supply. Test emergency power supply to minimum durations specified. Test Supervising Station Signal Transmitter. Coordinate testing with Supervising Station monitoring firm/entity.
b) Test each Notification Appliance installed for proper operation. Submit written report indicating sound pressure levels at specified distances.
c) Test Fire Alarm Control Panel and Remote Annunciator.

3.5 TRAINING:

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Government's maintenance personnel as specified below.
   1. Train Government's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.
   2. Schedule training with the Government at least seven days in advance.

END OF SECTION

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SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 - GENERAL

1-01 DESCRIPTION

A. This item shall consist of the removal and satisfactory disposal of trees, **except those that may be designated to remain in place**, stumps, logs, snags, brush, weeds, grass, and other perishable or objectionable material within the limits of project site or along the length of the project as designated.

B. This work shall include the stripping and stockpiling of topsoil, stump removal, felling of trees, clearing of brush and other operations as may be detailed herein or indicated on the Plans.

PART 2 - MATERIALS

2-01 GENERAL

A. Materials cleared from the site, including merchantable timber, if any, shall become the property of the CONTRACTOR for his disposal unless otherwise noted elsewhere in the Specifications.

B. The Contractor shall provide equipment of whatever nature is needed to complete the work to the satisfaction of the Contracting Officer. Equipment deemed by the Contracting Officer to be inadequate for the work must be removed from the site.

PART 3 - EXECUTION

3-01 GENERAL

A. Clearing and grubbing shall be completed a satisfactory distance in advance of earthwork for site preparation, roadways, pipe laying operations etc. and such operations shall not be started until the cleared and grubbed area has been reviewed by the Contracting Officer.

B. The Contractor shall be responsible for obtaining permits for hauling, dumping, burning, disposal and other operations, as may be required by Local, State and Federal requirements.

3-02 CLEARING AND GRUBBING

A. The area within the construction limits of the project site shall be cleared of trees, stumps, roots, logs, vegetation and other objectionable matter. Roots over 1-1/2 inches in diameter shall be grubbed out to a minimum depth of 18 inches below original ground or 12 inches below the proposed finished grade in excavated areas. **Where indicated on the Plans or directed by the Contracting Officer, trees that are to remain in place within the project limits, shall be protected from damage by other clearing or construction operations.**

B. Stump holes shall be backfilled and compacted to the density required for subgrades in Section 31 23 23 "Earthwork" where applicable.

C. When necessary to completely remove grass and small roots from the areas to be covered by earth fill, such as roadways, levees, or other site construction, such areas shall be stripped to sufficient depth to remove same, to the extent directed by the Contracting Officer.

D. Felling of trees and other clearing operations shall be conducted in a manner that prevents damage to trees that are to remain and to protect existing improvements, structures, utility lines or other items.

3-03 DISPOSAL OF MATERIALS

A. All merchantable timber shall become the property of the CONTRACTOR for his disposal unless otherwise noted.

B. Burying of stumps, trees, logs, snags or other vegetative materials will not be permissible within the project site limits unless otherwise provided for in these Specifications.

C. All perishable material shall be completely removed from Government property to disposal areas provided by the Contractor and approved by the Contracting Officer. On-site burning of materials is not allowed.

E. Materials which are stripped from the project site which are not suitable for reuse shall be disposed of by the Contractor at a location provided by him and approved by the Contracting Officer.

F. All cost of hauling, stockpiling and disposal of material shall be included in the Contract Price bid price.

END OF SECTION
31 11 00

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SECTION 31 23 23
EARTHWORK

PART 1 GENERAL

1-01 DESCRIPTION

A. This work shall consist of general grading, excavating, site preparation, hauling, placing, processing, filling, spreading, compacting, and protecting areas to be filled in accordance with these Contract Documents and the MISSISSIPPI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2004 EDITION and in conformity with the lines, grades, slopes, and typical cross sections depicted by the Contract Documents.

B. This item shall also consist of satisfactorily stockpiling materials or disposing of all unsatisfactory materials encountered within the construction limits of the project site. The work includes grading and subgrade construction on streets, roadways, and parking areas, drainage ditch and channel construction, water and sewer main construction and site work for wells, tanks, pumping stations, etc.

1-02 EXAMINATION OF SITE

A. The Contractor shall visit the site and inform himself fully of the amount of excavation, filling and grading required under the Contract.

B. The Contractor shall fully familiarize himself with the surrounding area and the conditions of access under which the project is to be completed.

1-03 CLASSIFICATION OF EXCAVATION

A. Required excavation shall be identified as Unclassified Excavation, Undercut Subgrade, Channel Excavation, Borrow Excavation (Owner furnished or Contractor furnished), Structure Excavation, as required for construction of the project, and as described in the Geotechnical Report. All work shall conform to the recommendations of the Geotechnical Report.

B. Unclassified Excavation: Unclassified excavation will consist of all excavation materials of whatever character encountered in the work except for those classes described herein.

C. Undercut Excavation: Undercut excavation shall consist of the removal and disposal of deposits of soils and organic matter not suitable for foundation or subgrade material as determined by the Contracting Officer and satisfactorily disposing of materials on or off-site.

Undercut excavation shall include materials which will decay or produce unsatisfactory subsidence in the embankment, pipe or structural bedding. Undercut excavation may be made up of decaying stumps, roots, logs, humus, highly plastic clay (CH), or other unsatisfactory material.

D. Channel and Ditch Excavation: Excavation of drainage ways shall consist of excavating all earthen materials and shaping the channel to the neat lines, grades and typical sections required for the various type sections of channel improvements proposed. Channel and ditch excavation shall include the hauling, spreading, placing, processing, compacting, or disposal of all excavated material.

Channel excavation shall be that required to improve or relocate existing channels.

Ditch excavation shall be that required to construct upstream and downstream channels for pipe culverts or for the excavation of drainage swales.

E. Borrow Excavation: Borrow excavation shall consist of the removal, hauling, placing, processing, shaping, and compacting of approved select on-site material at the location directed by the Contracting Officer.

F. Structure Excavation: Structure excavation shall consist of the removal of all material to the dimensions and depths, shown in the Contract Documents or as directed by the Contracting Officer, necessary for the construction of structures and the installation of other items. It shall also include, as necessary, all dewatering, pumping, bailing, drainage, cribbing, sheeting and other foundation work; and should include backfilling and the proper disposal of all excavated material as directed.

PART 2 MATERIALS

2-01 EQUIPMENT

A. Contractor may use the type of earth moving, compaction, processing, and watering equipment that he desires or has at his disposal, provided the equipment is in satisfactory condition, of adequate design to perform the work efficiently, and is of such capacity and quantity that the construction schedule can be maintained as planned by the Contractor and approved by the Contracting Officer in accordance with the Contract Time contained in the Contract. The Contractor shall furnish, operate and maintain such equipment as is necessary to control uniform density, layers of fill and cross sections.

2-02 MATERIALS

A. Foundation Construction, Roadway Construction and Backfill Behind Curb: Material for fills shall consist of material obtained from the excavation of onsite banks, borrow pits or approved off-site sources. The material used shall be free from vegetable matter and other deleterious substances and shall not contain large rocks or lumps. Borrow materials shall consist of a select nonorganic and debris-free silty clays (CL) or sandy clays (CL) having a liquid limit less than 45 and a plasticity index (PI) within the range of 10 to 24, or clayey sands (SC) with a PI in the range of 7 to 15 and a liquid limit less than 35, or slightly clayey silty sands (SM) with a minimum PI of 3. The fill materials should be spread in loose lifts having a maximum thickness of 9 in. and compacted to not less than 95% of standard proctor maximum dry density (ASTM D698 at moisture contents within the 3 points of the optimum moisture content.

PART 3 EXECUTION

3-01 GENERAL REQUIREMENTS

A. Suitable materials excavated in project site construction shall be used insofar as practicable in the formation of fills, subgrades and shoulders as shown in the Contract Documents. When suitable material is not needed for fills on the site, it shall be placed on other areas designated by the Contracting Officer and in accordance with subparagraph "I" hereof.

B. Sequence of Operations: No site construction shall be started until sufficient clearing, grubbing, stripping and adequate pipe and drainage work to allow proper drainage within construction limits has been satisfactorily completed to allow earthwork to proceed without interruption.

C. Site and pavement Subgrade Preparation

1. Prior to placing material on areas to receive fill, the existing ground shall be thoroughly proofrolled with a roller to prove that the area is of a satisfactory density with stability to begin placement of fill material. Stability shall be determined by proof-rolling with loaded dump trucks or other suitable equipment by the Contractor. At least two (2) full coverage passes over the site should be performed. Any areas that are soft or yielding during proof-rolling should be processed (spread, scarify, water, or dry) to compact with stability or undercut, filled, and compacted with suitable material as directed by the Contracting Officer.

2. Prior to any pavement construction, any debris, organics and humus matter encountered during excavation should be removed from areas supporting structures or receiving fill placement prior to construction. After all debris, organics or humus matter are removed, the existing soil subgrade should be excavated to a depth of 12 inches, mixed and re-compacted.

3. A 6 inch thick, densely graded crushed limestone base course shall be placed beneath any concrete pavements. Base course shall be compacted to a minimum of 95% of maximum dry density per Standard Proctor. Crushed concrete with the same gradation may be used in lieu of crushed limestone.

D. Foundation Preparation:

1. Prior to foundation construction, any debris, organics and humus matter encountered during excavation should be removed from areas supporting structures or receiving fill placement prior to construction. After all debris, organics or humus matter are removed, the existing soil subgrade should be excavated to a depth of 3 feet, mixed and re-compacted. Additionally, a geotextile reinforcement, MDOT Type 6 or equal should be placed in the excavation prior to any backfill operations. Any soft or unstable areas encountered during re-compaction may require remediation. Remediation of soft or

unstable areas may consist of re-mixing, moisture conditioning, over-excavation, and/or geotextile reinforcement, but should be determined on a case-by-case basis by the engineer.

2. In areas which will support structures, the soil subgrade and any necessary fill placement should be compacted to a minimum of 95% of maximum dry density per Standard Proctor (ASTMD698). Compaction should be achieved in maximum loose lifts of 12 inches at a moisture content comparable (± 2.0%) to the optimum moisture content established in the laboratory and compaction verified with each lift. A minimum of two density tests should be performed every lift per building. Fill placement adjacent to existing slopes should be stepped or benched into all slopes exceeding two vertical feet of fill placement in a manner to facilitate adequate compaction.

E. Excavation:

Excavation shall be performed at locations indicated in the Contract Document, to lines, grades and cross sections shown, and shall be made in such manner that fills can be formed in accordance with the requirements herein. Suitable material encountered within the limits indicated shall be used in the formation of fills. Material not approved for use in fills shall be disposed of on site if so directed by the Contracting Officer. During the process of excavation, the grade shall be maintained to assure that it will be well drained at all times.

1. The non-organic, non-high plasticity clay debris-free soils removed from the excavated areas should be suitable for use in the embankment. All suitable materials removed from the
required excavations shall be utilized in construction of embankments, fills, and backfill for undercut areas as designated in the Contract Documents. The Contractor shall organize the excavation and fill such that on-site materials from excavated areas can be used for fill. Excess materials (suitable or unsuitable) shall be wasted or disposed of on-site as directed by the Contracting Officer. No separate payment will be considered for the disposal of excess materials (suitable or unsuitable). Grading of excess materials shall be such to prevent ponding of water and to slopes that will prevent erosion. Vegatative cover shall be established on all spoil areas at no additional cost to the Owner.

The Contractor shall control the excavation work so that the ground surface is properly pitched to prevent water from running into the excavated areas. Water that has accumulated in the excavated areas shall be promptly removed by the Contractor at his expense.

2. Undercutting: When objectionable material not suitable for foundation or subgrade material as determined by the Contracting Officer remains after clearing, grubbing, stripping, and earthwork operations, in areas for subgrade or foundation construction, the Contractor will undercut such material to such depth and extent as directed and backfill with suitable material. This shall not relieve the Contractor of his obligation to process suitable but wet soils for use in embankment as directed by the Contracting Officer. Fill material shall be placed in uniform layers and compacted as specified for fills.

Undercut materials shall be disposed of and fill material obtained as directed by the Contracting Officer.

3. Tolerances: Excavation and grading shall be completed to conform to the lines and grades shown in the Contract Documents. The surface shall conform to the specified grades within 0.5 inches, unless a different tolerance is indicated by the Contract Documents. Deviations shall be corrected by further grading, filling, reshaping and compacting until conformance is obtained.

F. Formation of Fills:

1. Fills for project site shall be constructed to lines, grades, cross sections and dimensions shown in the Contract Documents.

2. Earthfills shall be formed by distributing the materials in successive uniform horizontal layers not to exceed nine inches (9") in thickness, loose depth, for the full width of the cross sections. Each layer of fill shall be compacted to a density of at least ninety-five percent (95%) of standard Proctor maximum dry density at moisture contents within 3 percentage points of the optimum water content. The Contractor shall spread, scarify, water, or dry the material to achieve the required moisture content. Stability shall be determined by proof-rolling performed by the Contractor.

3. The upper surface of the fill shall be shaped to provide complete drainage of surface water at all times. The forming of ruts will not be permitted. The Contractor shall protect the work from erosion and adverse weather conditions.

4. Each layer of earthfill shall be compacted as required, with appropriate equipment. Fill material shall be compacted within three percent (3%) of optimum moisture content by processing to dry or watered and properly mixed as needed before being rolled. The furnishing and application of water for construction of fills or processing to dry soils will not be paid for separately; such operations shall be considered as incidental to the formation of fills.

5. Construction operations shall be performed in such manner that the simultaneous rolling and placing of material in the same lane or section will not occur. To avoid uneven compaction, the hauling equipment shall traverse, as much as possible, the full width of the cross section. Each layer shall be compacted as required before material for the next layer is deposited.

6. Fills and embankments will not be paid for as a separate item. The cost of making fills shall be made at the Contract Unit Price specified on the Bid Form for unclassified excavation unless otherwise noted.

G. Subgrade Preparation: Subgrade preparation as specified in this section shall ordinarily apply to the graded section prior to the placing of a course of selected material such as base material.

Materials shall not be deposited on the prepared subgrade until it has been checked and approved by the Contracting Officer. When practicable, such prepared subgrade shall be maintained free from ruts and depressions, adequately drained and in a smooth and compacted condition. Damaged subgrade shall be reshaped, recompacted and approved by the Contracting Officer prior to use.

1. As required by the Contract Documents and established in the Proposal, all silty and clayey soils in the finished subgrade shall be treated with lime in accordance with the Specifications. These soils are defined as silty or sandy clays (CL and CL-ML) and silts (ML). Delineation of the areas requiring lime will require close inspection by the Contractor and Contracting Officer. Exposed silty and clayey soils shall be treated to a minimum depth of six inches (6") in the final subgrade level. The Contractor shall treat to the depth required to provide a 6" treated subgrade.

2. When the subgrade material is thoroughly and completely mixed and at the proper moisture content for compaction (as specified by the Contracting Officer), the roadbed or foundation shall be machined and the subgrade material shaped in such a manner that after full compaction, the finished subgrade course shall be the width indicated and closely conform to the lines, grades, and typical section shown in the Contract Documents or as specified.

The Contractor shall guard against all irregularities in shape or section and loss of crown or segregation of materials. Proper drainage shall be maintained at all times.

3. After shaping has been completed and the material is at plus or minus three percent (3%) of the optimum moisture content, the subgrade shall be compacted in accordance with the provisions and requirements specified hereinafter.

Compaction shall be accomplished by rolling with the sheepsfoot rollers and pneumatic-tired traffic rollers of the type heretofore specified. Compaction shall begin at the bottom and continue until the entire area is thoroughly compacted to at least 95 percent (95%) of Standard Proctor maximum dry density with stability present (ASTM D 698). Stability shall be determined by proof-rolling performed by the Contractor. During the compacting, the subgrade shall be maintained at the proper section by light machining or dragging and at the proper moisture content. Final rolling shall be accomplished with pneumatic tired rollers.

4. Lack of uniformity in the mixture, inequalities in the surface or other irregularities shall be corrected by adding or replacing materials and remixing, reshaping, and recompacting as necessary and required.

The Contractor shall be responsible for producing a subgrade, the surface of which shall present a uniform appearance and a smooth riding surface, without sharp breaks or depressions which will collect or hold water. The finished grade and typical section shall be as close to that shown in the Contract Documents as can be constructed with proper and expert manipulation of a motor grader. In no case shall be maximum variation (when tested with

a ten foot (10') straight-edge parallel to the centerline) be more than one-fourth inch (1/4").

5. The compacted subgrade will be tested for specified compaction and thickness before acceptance. No minus tolerance in base thickness will be allowed. No density below that specified above will be accepted.

Any areas which do not meet the above requirements shall be corrected by means satisfactory to the Contracting Officer, including rebuilding where necessary.

H. Channel and Ditch Excavation and Grading: Channel and Ditch excavation shall be performed in proper sequence with other construction. Satisfactory materials shall be placed in fills as needed. Unsatisfactory material shall be wasted in disposal areas. Ditches shall be graded to drain and shall not contain low spots which would hold water. Ditches and slopes shall be dressed to a tolerance of plus or minus 0.1 foot from indicated grade.

I. Foundations: Excavation for structural foundations shall be made at slopes which will provide safe working conditions, or adequate sheet piling shall be installed. Where the recommendations of a geotechnical evaluation are included in the Contract Documents, Contractor shall follow said recommendations. Backfill material shall not contain any expansive materials and shall be compacted in lifts to ninety-five percent (95%) of standard Proctor maximum dry density with stability present (ASTM D 698).

I. Disposal of Excess Material: All excess material and material unsuitable for use in fills shall be disposed of as directed by the Contracting Officer, in designated on-site or off-site areas. Material disposed of on-site shall be placed and graded to field established contours and elevations. After placement of excess material, such fills shall be consolidated by complete coverages with construction equipment. Fills shall be dressed to present a neat appearance before project acceptance. Slopes shall be such that water does not pond but erosion control shall be maintained. Vegetative cover shall be established on all spoil areas at no additional cost to the Owner.

3-02 SEASONAL AND WEATHER LIMITS

A. No fill material shall be placed, spread or rolled while the ground or fill is frozen or thawing or during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until the moisture content and density of the fill are as previously specified.

3-03 TESTING

A. Contractor shall be responsible for determining that material utilized in fills meet project requirements and shall provide Atterburg Units, Gradation, Standard Proctor density tests, field density tests, etc. for on-site and off-site materials utilized in fills, foundations or bases. Proctors shall be run as frequently as necessary to assure consistency of material and wherever changes in material are encountered.

B. Density tests shall be performed at not less than the following interval:

1. Foundation Backfill - at least in every second lift of vertical fill, or every 100 CY, whichever is more frequent.

2. Subgrade Fills - at least in every second lift of vertical fill in a maximum of 500 linear feet, or every 2000 cubic yards, whichever is more frequent.

3. Road and Street Bases - in every lift of each day's production, with spacing in each lift not to exceed 300 feet, and with total yardage per test not to exceed 2000 cubic yards.

C. Testing shall be performed by an independent testing laboratory, which shall submit test results to the Contracting Officer for review. Contractor shall pay testing costs.

D. Density tests shall be performed at not less than the following interval:

1. Foundation Backfill - at least in every second lift of vertical fill, or every 100 CY, whichever is more frequent.

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31 23 23

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SECTION 31 25 14.16
REINFORCED EROSION CONTROL MAT

PART 1 - GENERAL

1-01 DESCRIPTION

A. This work consists of furnishing materials and performing all work necessary to install a reinforced erosion control mat on drainage ditches or slopes, or as directed by the Contracting Officer.

PART 2 - PRODUCTS

2-01 DEGRADABLE BLANKET

A. Type A

1. The erosion control blanket shall be a machine-produced mat of 100% agricultural straw, North American Green S-150 Erosion Control Systems standard straw (2010-0) or approved equal.

2. The blanket shall be of consistent thickness with the straw evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with a lightweight photodegradable polypropylene netting having an approximate 0.50 x 0.50 inch (1.27 x 1.27 cm) mesh and be sewn together on 1.50 inch (3.81 cm) centers (50 stitches per roll width) with degradable thread.

3. The blanket shall be manufactured with a colored line or thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) to ensure proper material overlapping.

4. The erosion control blanket shall have the following properties.

a. Material Content

Matrix 100% Straw Fiber (0.50 lbs/yd^2) (0.27 kg/m^2)
Netting One side only, lightweight photodegradable (2.10 lbs/1,000 ft^2 [1.02 kg/100m^2] approximate weight) Thread Degradable

b. Physical Specifications (per roll)

	English	Metric
Width	6.67 ft	2.03 m
Length	108.00 ft	32.92 m
Weight	40.00 lbs ± 10%	18.14 kg
Area	80.00 yd^2	66.89 m^2
Stitch Spacing	1.50 inches	3.81 cm

B. Type B

1. The erosion control blanket shall be a machine-produced mat consisting of 70% agricultural straw and 30% coconut fiber, North American Green SC-150 Erosion Control Systems high velocity straw (2020-01) or approved equal.

2. The blanket shall be of consistent thickness with the straw and coconut fiber evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with heavyweight photodegradable polypropylene netting having ultraviolet additives to delay breakdown and an approximate 5/8 inch (1.6 cm) x 5/8 inch (1.6 cm) mesh, and on the bottom side with a lightweight photodegradable polypropylene netting with an approximate 1/2 inch (1.3 cm) x 1/2 inch (1.3 cm) mesh. The blanket shall be sewn together on 1.5-inch (3.8 cm) centers with degradable thread.

3. The erosion control blanket shall have the following properties:

a. Material Content

Straw	70% (.35 lb/yd^2) (.19 kg/m^2)
Coconut Fiber	30% (.15 lb/yd^2) (.08 kg/m^2)
Netting	Topside heavyweight photodegradable with UV additives (3 lb/1,000 ft^2 approx. wt.) Bottom side lightweight photodegradable 1.64 lb/1,000 ft^2 (8.0 kg/100 m^2) approx. wt.
Thread	Degradable

b. Physical Specifications (Roll)

Width	6.5 feet (2 m)
Length	83.5 feet (25.4 m)
Weight	30 lbs (13.6kg) +/- 10%
Area	60 yd^2 (50 m^2)
Stitch Spacing	1.5 inches (3.8 cm), 50 per 6.5 feet (2 m) roll width

2-02 PERMANENT BLANKET

A. The permanent erosion control/turf reinforcement mat is constructed of 100% coconut fiber North American Green C-350 or approved equal. The coconut fiber shall be stitch bonded between a heavy duty UV stabilized bottom net, and a heavy duty UV stabilized crimped middle netting overlaid with a heavy duty UV stabilized top net. The three nettings are stitched together on 1.5 in (3.8 cm) centers with UV stabilized polypropylene thread to form a

permanent three-dimensional structure. The following list contains further physical properties of the Erosion Control/Turf Reinforcement Mat.

Property	Test Method	Value	Units
Ground Cover	Image Analysis	93	%
Thickness	ASTM D1777	.63 (1.6)	in (cm)
Mass Per Unit Area	ASTM D3776	.92 (.50)	lb/sy (kg/m^2)
Tensile Strength	ASTM D5035	480 (714)	lb/ft (kg/m)
Elongation	ASTM D5035	49	%
Tensile Strength	ASTM D5035	960 (1429)	lb/ft (kg/m)
Elongation	ASTM D5035	31	%
Tensile Strength	ASTM D1682	177 (80)	lbs (kg)
Elongation	ASTM D1682	22	% Resiliency
ASTM D1777	>80	%	
UV Stability*	ASTM D4355	151 (68)	lbs (kg)
		86	%
Color(permanent net)		UV Black	
Porosity(permanent net)	Calculated	>95	%
Minimum Filament Diameter (permanent net)	Measured	.03 (.08)	in (cm)

*ASTM D1682 Tensile Strength and % Strength Retention of material after 1000 hours of exposure in Xenon-Arc Weatherometer

1. Physical Specifications (Roll)

Width	6.5 feet (2 m)
Length	55.5 feet (16.9 m)
Weight	37 lbs +/- 10% (16.8kg)
Area	40 yd^2 (33.4 m^2)

2-03 STAPLES AND STAKES

A. Staples shall be 11 gauge .118 to .120 bright basic industrial quality 1008/1010 wire, minimum cast, light oil protection. The staples shall be 6 inch (15.2 cm) x 1 inch (2.5 cm) x 6-inch (15.2 cm) U-shaped configuration.

B. Stakes shall be 100% biodegradable 1" shaped hardwood pins designed to safely and effectively secure erosion control blankets. The wood stake must exhibit ample rigidity to enable being driven into hard ground, with sufficient flexibility to resist breakage. The wood stake shall have the following dimensions:

Leg Length: 11.00 in. (27.94 cm)
Head Width: 1.25 in. (3.18 cm)
Head Thickness: 0.40 in. (1.02 cm)
Leg Width: 0.60 in. (1.52 cm) (tapered to point) Leg thickness: 0.40 in. (1.02 cm)
Total Length: 12.00 in. (30.48 cm) or 6.00 in.(15.24 cm)

C. Plastic stakes shall be 100 % biodegradable "T"- shaped pins designed to safely and effectively secure erosion control blankets. The biodegradable stake shall be fully degradable by biological activity within a reasonable time frame. The bio-plastic resin used in production of the biodegradable stake shall consist of polylactide, a natural, completely biodegradable substance derived from renewable agricultural resources. The biodegradable stake must exhibit ample rigidity to enable being driven into hard ground, with sufficient flexibility to resist shattering. The biodegradable stake shall have serrations on the leg to increase resistance to pull-out from the soil. The biodegradable stake shall have the following dimensions:

Leg Length: 4.00 in. (10.16 cm)
Head width: 1.25 in. (3.18 cm)
Head thickness: 0.25 in. (0.64 cm)
Leg width: 0.50 in. (1.30 cm)
Leg thickness: 0.25 in. (0.64 cm)

PART 3 – EXECUTION

3-01 GENERAL

A. The erosion control blankets shall be installed at the locations and according to the requirements shown on the plans or as directed by the Contracting Officer. For other locations, the erosion control blankets shall be installed when directed by the Contracting Officer.

END OF SECTION
31 25 14.16

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SECTION 31 37 13

RIPRAP

PART I GENERAL

1-01 DESCRIPTION

A. This item consists of the construction of a protective covering of stone, broken concrete or concrete in bags along the slopes of embankment, around culvert outlets or inlets, on slopes and bottoms of ditches, around foundation, or at such locations as may be indicated on the plans, all in accordance with these specifications and in conformity with the lines, grades and dimensions shown on the plans or as established.

PART 2 MATERIALS

2-01 STONES

A. Riprap, of the sized specified or indicated on the drawings, shall meet the requirements for size by weight of the mass as specified in Section 705.04 of the MDOT, Standard Specifications, 2004 edition.

2-02 GROUT

A. Mortar used in bag riprap and grouted riprap shall be Portland Cement. Grout shall be prepared of one (1) part cement and three (3) parts concrete sand thoroughly mixed with clean water to a thick, creamy texture and consistency.

PART 3 EXECUTION

3-01 GENERAL

A. Prior to the construction of riprap, the slopes or ground surface shall be shaped to lines and grades indicated on the plans or as directed, and shall be thoroughly compacted by the use of mechanical or hand tamps. Unless otherwise stipulated or directed, slopes shall not be steeper than the natural angle of repose of the material upon which riprap is to be constructed. Geotextile fabric stabilization (specified elsewhere) shall be placed prior to placing riprap.

B. All the outer edges and the top of the riprap where the construction terminates shall be formed so that the surface of the riprap or slope paving will be embedded and even with the surface of the adjacent slope or ground, and on slopes, the bottom of the riprap or slope paving shall be placed at least (2) feet below the natural ground surface unless otherwise directed. C. All riprap shall be started at the bottom of the slope, progressing upward.

D. No grout or bag riprap shall be placed during freezing weather or while there is frost in the ground, and in hot or dry weather shall be kept moist and protected from the sun for at least three (3) days after placing.

3-02 LOOSE RIPRAP

A. The stones shall be placed upon a slope not steeper than the natural angle of repose of the filling material. The stones shall be laid with close joints. The course shall be laid from the bottom of the bank upward, the larger stones being placed in the lower courses. Larger interstices shall be filled with smaller stones and spalls.

3-03 GROUTED RIPRAP

A. The stones shall be the size designated in the Proposal and shall be placed in the same manner as specified above for Loose Riprap, care being taken during placing to keep earth or sand from filling the spaces between the stones.

B. After the stones are in place, the stones shall be thoroughly wet and the spaces between them shall be completely filled with grout from bottom to top. The surface shall be swept with a stiff broom.

3-04 BAG RIPRAP

A. In this construction, riprap composed of bagged concrete, shall be place to the thickness shown on the plans or as directed. The bags shall be about two thirds (2/3) filled with the concrete, securely tied, and immediately placed by hand.

B. The bagged concrete shall be placed in such a manner as to give a fairly uniform thickness and shall be lapped and staggered as directed.

END OF SECTION
31 37 13

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SECTION 32 11 13.13
LIME TREATED BASE COURSES

PART 1 - GENERAL

1-01 DESCRIPTION

This work shall consist of constructing one or more courses of a mixture of soil, hydrated lime, and water or a mixture of soil and hydrated lime slurry, all in accordance with these specifications and MDOT Standard Specifications for Road and Bridge Construction, 2004 edition, Section 307 in reasonable close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer. When lime slurry is used, the Contractor shall mix hydrated lime with water to produce lime slurry or, at his option, produce lime slurry at the job site by the use of equipment specifically manufactured for the slaking of quick lime.

The work shall include preparation of the roadbed, incorporation of lime, and processing in accordance with the following method:

A. Class C lime treatment shall consist of spreading the specified percentage of lime, mixing compacting, and finishing.

The Owner and Engineer reserves the right to modify by Change Order the class of treatment or to eliminate lime treatment from certain sections or to add other sections for lime treatment depending on the results of soil tests.

PART 2 - MATERIALS

2-01 MATERIALS TO BE TREATED

The material to be treated shall consist of existing roadbed material or material added as directed. Particles of aggregate retained on a three inch sieve and deleterious substances such as roots, stumps, grass, turf, and other vegetable matter shall be removed and replaced with suitable material.

2-02 WATER

Water used in this construction shall meet the requirements of MDOT specifications Section 714.01.3.

2-03 LIME

Lime shall meet the requirements of MDOT specifications Section 714.03.

Lime shall be stored and handled in closed, weather-proof containers until distribution on the section of road being processed. If local storage is provided, lime shall be used only from approved storage facilities and shall meet the requirements of the contract time of use.

The Contractor is reminded of the highly caustic characteristic of quick lime and shall instruct employees as to preventive and protective measures to take prior to their working with quick lime. Further, the Contractor shall take all precaution necessary to prevent injury to persons not in his employ and to livestock. Quick lime which is spilled or deposited at places other than on areas designated to be treated shall be immediately picked up, buried, or slaked by wetting to eliminate to hazard. Dry quick lime shall not be used in the "Dry Application" Method.

2-04 CURING SEAL

Curing seal shall be Emulsified Asphalt, Grade EA-1, CMS-2h, or MS-2h.

2-05 EQUIPMENT

Equipment necessary for proper prosecution of the work shall be on the project and approved by the Engineer prior to its use.

When bulk lime is used, batch-type or platform scales shall be provided. Batch type or platform scales shall meet the requirements for aggregate scales in MDOT Specifications. All scales shall be located at approved locations on or near the project.

When bulk lime is used, the Contractor shall provide approved mechanical spreader(s) having adjustable strike-off gate(s), or other approved spreading equipment constructed so as to provide positive control of the spread. Approval of a spreader will be contingent upon its known or demonstrated ability to make distribution of lime within the tolerances allowable.

Mixing and scarifying equipment shall be capable of positive depth control. Mixing shall be performed with approved rotary-type mixers or other approved equipment.

Rollers shall be of sufficient number, type, size, and weight to accomplish the required compaction.

The Contractor may use approved alternate equipment provided it produces work meeting the requirements of these specifications.

PART 3 - CONSTRUCTION REQUIREMENTS

3-01 GENERAL

Quantities and percentages of lime shown on the plans and proposal are based on preliminary soil investigation and dry laboratory sample test. The actual application rate will be established from tests made just prior to beginning treatment. The Contractor is hereby advised that the estimated

contract quantity of lime is based on application rates of hydrated lime. The use of quick lime will not be permitted in the "Dry Application" method. The Contractor will be permitted to apply only hydrated lime in the "Dry Application" method.

It is necessary that lime treated materials be kept moist at all times. It shall be the Contractor's responsibility to provide sufficient equipment and keep all partially constructed or completed lime stabilizer layers sufficiently and continually moist until a succeeding layer has been placed thereon or until release of maintenance of the project.

The first section of each mixing operation, both initial and final, will serve as a test section. The length of the test section (not less than three hundred fifty (350) linear feet for more than five hundred (500) linear feet for the designated width) will be determined by the capabilities of the equipment provided to perform the work. The Engineer and the Contractor will evaluate the results of the test section in relation to contract requirements. In case the Engineer determines the work is not satisfactory, the contractor shall revise his procedures and augment or replace equipment as necessary to assure work is completed in accordance with the contract and shall correct any deficient work at no additional cost to the County.

3-02 PREPARATION OF GRADE

Before treatment, the roadbed shall be prepared in accordance with the requirements of the Earthwork Section of the specifications contained elsewhere herein.

Prior to the application of dry hydrated lime, a light windrow shall be bladed along the edges of the area to be treated, or the surface on which the lime is to be applied shall be scarified to retain the spread dry lime.

Prior to the application of slurry, the full width of the area shall be scarified or partially pulverized to the depth necessary to retain the lime slurry until it has been incorporated.

The depth of scarification shall be carefully controlled so that the surface of the roadbed below the scarified material will remain undisturbed and conform as closely as possible to the established cross section.

3-03 APPLICATION OF LIME

The rate of application of lime shall be 6 percent of hydrated lime for a depth of 6 inches for the lime modified subgrade. No lime shall be applied between November 1 and March 1 without written authorization from the Engineer.

Lime shall not be applied unless the temperature of the in-place material is at least 50°F during the mixing and mellowing period. In no case shall lime be applied on a frozen foundation.

Application of lime shall be accomplished by either an approved "dry application" or "slurry application" method.

The following guide lines will govern the acceptability of the method to be used:

Dry Application. Hydrated lime applied by this method shall be spread uniformly and shall be sprinkled with sufficient water to prevent loss of lime by wind. Spreading of hydrated lime when wind and weather conditions are unfavorable will not be permitted nor will spreading of lime by motor patrol be acceptable.

Slurry Application. Lime applied by this method shall be mixed with water in approved agitation equipment and applied to the roadbed as a thin water suspension or slurry. The distributing equipment shall be equipped to provide continuous agitation from the mixing sight until applied on the roadbed. The proportion of lime shall be such that the "Dry Solids Contents" shall be at least thirty (30) percent by weight.

The distribution of lime at the rate specified shall be attained by one or more passes over a measured section until the specified percentage of lime has been spread. After each successive pass, the material shall be incorporated into the soil with the mixing equipment. Additional water, if necessary, shall be added and mixed into the mass to hasten mellowing.

Payment will not be made for lime that has been spread and exposed for a period of six hours or more before mixing. Such areas shall be treated again with the full required rate of application.

Additional lime shall be added at the Contractor's expense to all section on which excessive loss has occurred due to washing or blowing.

The quantity of lime applied on a section shall be spread uniformly and shall not vary more than plus or minus five percent of the quantity ordered. No payment will be made for lime application exceeding the five percent plus tolerance. When the quantity applied is deficient by more than five percent, additional lime shall be applied prior to mixing.

3-04 MIXING

Initial Mixing. For Class A and Class B treatments, the lime and water shall be incorporated uniformly into the soil. The mixing and watering operation shall be continued until a homogeneous mixture that will pass a three-inch sieve is obtained. After satisfactory mixing is obtained, the layer shall be reshaped to line, grade, and section and sealed with a light roller no later than the next day following mixing. The sealed mixture shall then be left to mellow for the period specified in the lime mix design furnished by the Contractor's approved testing laboratory and approved by the Engineer. The mellowing period will be measured in degree days. This period will not be less than five (5) calendar days nor more than twenty (20) calendar days. The temperature to be used to determine the degree days mellowing period will be the average of the o high and low temperatures for each day of the mellowing period. In the event the average is 50 F or less, that day will not be used in computing the degree days mellowing period. During the mellowing period the partially treated course or layer shall be kept moist by sprinkling. All sections on which the surface becomes dry during the mellowing period shall be reprocessed to the satisfaction of the Engineer or reconstructed in accordance with the specifications.

For Class C treatment, the lime and water shall be incorporated uniformly into the soil. The mixing and water application shall be continued until a homogeneous mixture of which one hundred (100) percent of the material by dry weight, exclusive of gravel and stone, will pass a two-inch sieve and sixty (60) percent will pass a No. 4 sieve. At the completion of moist mixing and during the compaction operations, the percentages of moisture shall be that necessary to obtain the required density. There will be no mellowing period, and compaction shall begin immediately. The mixing, water application, and final compaction shall be completed during the same work day.

3-05 FINAL MIXING

After the required mellowing period (Class A and B), the layer shall be scarified, and in the case of Class A treatment the second application of lime added. The layer shall then be remixed as prescribed in the initial mixing operations. Mixing shall continue until one hundred (100) percent of material by dry weight, exclusive of gravel and stone, will pass a 2-inch sieve and sixty (60) percent will pass a No. 4 sieve. At the end of mixing and during compaction, the moisture in the mixture shall be that necessary to obtain the required density.

3-06 THICKNESS REQUIREMENTS

For the purpose of determining reasonable conformance with the designated thickness of a course, the specified value (SV) for thickness will be the designated thickness. The unit of deviation will be $\pm$ 0.3 inch. All sections not in reasonably close conformity because of deficient thickness shall be reprocessed to meet specification requirements. In each case, reprocessing and addition of lime shall be at the Contractor's expense.

3-07 COMPACTION

Compaction of the mixture shall begin immediately after the required mixing operation has been completed. Compaction shall be completed during same day it was begun and shall provide uniform and continuous compaction from bottom to top of the layer. The mixture shall be aerated or watered as necessary to obtain the moisture content required for the specified density.

Throughout the entire compaction operation, depression, defective areas, or soft spots which develop shall be corrected immediately by scarifying the area, adding lime when required, or removing the material, and reshaping and compacting in accordance with these specifications and at the Contractor's expense.

The specified value (SV) for density for Classes A, B, and c lime treatment will be ninety six (96) percent. The unit of deviation (UD) shall be one percentage point.

3-08 FINISHING, CURING, PROTECTION AND MAINTAINING

The surface of the layer shall be smooth and conform to the lines, grades, and cross sections shown on the plans or established by the Engineer.

The surface of the lime treated course shall be kept moist and otherwise satisfactorily maintained until placement of the subsequent course or layer. If the next course is to be granular material, the first layer placed shall be at least four inches in thickness. During placement of the subsequent course or layer, the least possible hauling will be permitted over the unprotected lime treated course. Except as provided in the following paragraph, the subsequent layer or course shall be placed and compacted within two days after the lime treated course has been finished.

At his option, the Contractor may defer placement of the subsequent course or layer for up to twentyone (21) days by placing a bituminous curing seal over the lime treated course within two days after finishing the course. The lime treated course shall be kept moist until application of the curing seal. When a curing seal is used, the emulsified asphalt shall be applied at the consistency specified in MDOT State Aid specifications section S-702 without further dilution. The rate of application shall be 0.25 gallon per square yard. A minus tolerance of five percent will be allowed.

Should the Contractor fail to cover a lime treated course with the curing seal or subsequent course within the times specified, the Engineer will suspend all other work and withhold payment of the current estimate(s) until all damage resulting therefrom is repaired and the treated course is covered with the curing seal or the subsequent course, as the case may be.

Maintenance of the curing seal shall be in accordance with the provisions of MDOT State Aid Specification Section S-408.09. When necessary for the maintenance of vehicular traffic, the Contractor shall furnish and apply blotter material in accordance with MDOT State Aid Specifications Section S408.03 and S-408.08.

All damage from freezing, as determined by the Engineer, that may occur in a treated course prior to being covered by the next course shall be corrected by reprocessing the course with Class C treatment at the Contractor's expense. The Contractor shall add the quantity of lime necessary to restore the CBR of the damaged material to that shown on the mix design. In no case shall the quantity of added lime be less than two percent by weight.

END OF SECTION
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SECTION 32 11 23
CRUSHED LIMESTONE BASE COURSE

PART 1 - GENERAL

1-01 DESCRIPTION

A. This item shall consist of furnishing all materials, labor, equipment and performing all work necessary for the construction of a limestone base course on a prepared subgrade in accordance with the lines and grades shown on the CONTRACT DRAWINGS and the requirements of these SPECIFICATIONS.

B. Where directed, limestone base courses shall be installed for use as temporary access and as permanent gravel drives, roadways, roadway bases and shoulders, utility trench repairs, bases and site surfaces for wells, tanks, pumping stations and metering stations etc., with a compacted finished thickness as required by the Contract Drawings.

1-02 APPLICABLE DOCUMENTS

A. The latest edition of the following publications forms a part of this Specification and where referred to by basic designation only, are applicable to the extent indicated.

B. American Association of State Highway and Transportation Officials (AASHTO) 1. T96 Resistance to Abrasion of Coarse Aggregate by Use of the Los Angeles Machine.

2. AASHTO T 99 Moisture-Density Relations of Soils Using a 5.5-lb. Hammer and a 12-inch Drop

C. **Mississippi Standard Specifications for Road and Bridge Construction, 2004 Edition.**

D. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM C 29 (1991a) Unit Weight and Voids in Aggregate

2. ASTM C 88 (1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

3. ASTM C 117 (1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing

4. ASTM C 131 (1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

5. ASTM C 136 (1995a) Sieve Analysis of Fine and Coarse Aggregates

6. ASTM D 75 (1987; R 1992) Sampling Aggregates

7. ASTM D 1556 (1990) Density and Unit Weight of Soil in Place by the SandCone Method

8. ASTM D 1557 (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))

9. ASTM D 2487 (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

10. ASTM D 2922 (1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

11. ASTM D 3017 (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

12. ASTM D 4318 (1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

13. ASTM E 11 (1995) Wire-Cloth Sieves for Testing Purposes

14. ASTM E 548 (1994) General Criteria Used for Evaluating Laboratory Competence

PART 2 - MATERIAL 2-01

GENERAL

A. Crushed limestone shall meet the gradation of the following table.

CRUSHED STONE GRADATION LIMITS	
Sieve Size	Percent Passing
1-1/2 inch	100
1 inch	90-100
3/4 inch	70-100

1/2 inch	62-90
3/8 inch	50-80
No. 4	40-65
No. 40	12-26
No. 200	5-12

B. The portion of the crushed stone passing the No. 40 sieve shall have a liquid limit not greater than 25 and a plasticity index of not greater than 5.

2-02 SOURCE AND TESTING

A. The limestone base material shall be obtained from a source to be furnished by the CONTRACTOR and reviewed by the Engineer. The CONTRACTOR shall designate his proposed source and shall submit certified test results to the Engineer for approval prior to starting the placement of the material on the project.

B. Testing shall be completed as specified herein and as directed by the Engineer. Tests shall be completed by a certified laboratory approved by the Engineer and results shall be submitted in duplicate to the Engineer. Testing shall be an absorbed cost item.

PART 3 - EXECUTION

3-01 GENERAL REQUIREMENTS A. Subgrade:

Prior to placing base course material, the subgrade surface shall be checked by the ENGINEER. Any ruts or soft yielding places that appear by reason of poor drainage conditions, hauling or from any other cause shall be corrected, rolled to required compaction and shaped before the base course is placed thereon. B. Placing and Spreading:

Base course material may be spread in one or two equal lifts. The base material shall be deposited and spread in a uniform layer without appreciable segregation of the material. Addition of water or drying will be required as needed to produce a material which can be compacted to the required density.

C. Compacting:

Base course compaction may be performed with sheepsfoot, pneumatic or steelwheeled rollers, or a combination of rollers; however, if the equipment and product selected by the CONTRACTOR proves to be unsatisfactory, the ENGINEER may order the CONTRACTOR in writing to make the necessary revisions. Compaction equipment found to be in poor condition by the ENGINEER may be ordered replaced. Final rolling shall be accomplished with a pneumatic or steel-wheeled roller.

1. Each layer of base material shall be rolled and compacted to a density of 100% of standard Proctor density at moisture contents within 2 percentage points of the optimum water content.

2. Irregularities or depressions that develop under rolling shall be corrected by loosening the material at such places and adding or removing materials.

   During the rolling operations the shape of the base course shall be maintained by blading.

D. Surface and Thickness Requirements:

The surface of the completed base shall present a uniform appearance and smooth surface without sharp breaks or depressions which will hold water. The finished grade and typical section shall be as close to that shown on the CONTRACT DRAWINGS as can be constructed with proper and expert manipulation of a motor grader to within plus or minus one half (.5) inch of true grade. The thickness of the completed base course shall not vary more than one half (0.5) inch from that shown on the DRAWINGS.

3-02 MAINTENANCE

A. The base material shall be maintained by watering, light blading and rolling, when required, in order to prevent loss of material and in order to preserve the line, grades and cross sections of the construction.

B. Maintenance shall continue until acceptance of the project. Provide additional material as directed by the Engineer to fill low areas as needed to maintain grades.

3-03 SUBMITTAL DATA

A. Submit certified gradation test results for review. Designate source of supply. Submit subgrade compaction analyses to the Engineer.

3-04 TRENCH LIMITATIONS

Whenever utility improvements are to be located along or across an improved surface, the width of the trench shall be held as nearly as possible to the maximum width specified below. Where brick or concrete pavement, sidewalk, driveway or curbing is cut, the width of the cut shall exceed the actual width of the top of the trench by twelve inches (12") on each side or a total of two feet (2'). Exposed surfaces of Portland cement or asphaltic concrete shall be cut with a pavement saw before breaking. Care shall be taken in cutting to insure that a straight joint is sawed.

NOMINAL PIPE DIAMETER (INCHES)	MAXIMUM TRENCH WIDTH (FEET)	MAXIMUM WIDTH OF PREMANENT SURFACE AND CURB & GUTTER REMOVAL (FEET)
6 or less	5.00	7.00
8-18	5.00	7.00
21-24	6.00	8.00
27 or greater	7.00	9.00

END OF SECTION
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SECTION 32 12 16
ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1-01 DESCRIPTION

A. This item shall include the furnishing of all labor, materials, equipment and incidentals required for paving of roads and parking areas in accordance with the Contract Drawings and these Specifications.

B. Paving shall be performed with machinery equipped with a 40 foot ski attachment for grade control.

C. Dimensions shall be as indicated on the Drawings.

D. Where reference is made to Mississippi Department of Transportation Specifications (MDOT), it is intended to be in accordance with Mississippi Standard Specifications for Road and Bridge Construction, 1990 Edition.

PART 2 - MATERIALS

2-01 GENERAL

A. All materials for asphalt paving and related work shall comply with Mississippi Standard Specifications for Road and Bridge Construction, MDOT, 1990 Edition as follows:

1. Plant Mix Pavements General Section 401

2. Hot Bituminous Pavement Section 403

3. Tack Coat Section 407

4. Binder course Section 403

5. Surface course Section 403

B. As used in this specification, the following abbreviations shall apply:

1. BB Black Base

2. TC Tack Coat

3. BC Binder Course

4. SC Surface Course

C. The term "course" used in this Section shall be understood to mean a layer of specified thickness shown on the plans and for which quantities are estimated on the plans and in the proposal as the

basis for bidding. A course may, in some cases consist of a single layer, and, in other cases, may consist of two or more layers depending on the finished thickness specified.

PART 3 - EXECUTION

3-01 BASE COURSE (BLACK BASE): Number BB-1

A. General: Where indicated on the Drawings this work shall consist of the construction of a base course in one or more courses composed of mineral aggregates mixed in a central mixing plant with bituminous materials in the proportions specified and placed hot. The base course shall be constructed on a prepared subgrade foundation in accordance with these specifications and in close conformity with the thickness, lines, grades and sections as shown on the plans.

B. The base course shall comply with Section 403, Hot Bituminous Pavement, of the Mississippi State Highway Department Specifications for Road and Bridge Construction.

C. The Contractor will have the testing lab furnish to the Contracting Officer, for approval, prior to placing any base material, a job mix formula for the project.

D. The job mix formula shall be set within the master range as indicated below. The job mix formula shall be maintained within the job mix tolerance and shall not exceed the limits of the ranges.

1. The job mix temperatures shall be between 250 degrees Fahrenheit minimum and 350 degrees Fahrenheit maximum unless otherwise specified.

2. The job mix formula as approved shall be considered as tentative until a sufficient amount of the mixture has been processed through the plant, spread and compacted.

3. Extractions shall be made on samples of each mixture, produced by the plant, before any mixture is placed on the project.

4. After the job mix formula is approved, the mixture furnished to the project shall remain unchanged, within the tolerances specified for the mixture, throughout the duration of the job. No change in properties or proportions of any ingredient of the mix shall be made without written permission of the Contracting Officer.

E. The gradation of the mixture shall meet the following Design Master range requirements.

Sieve Size	Percentage Passing Sieve (by Weight)	Tolerances For Job Mix Formula
1 - 1/2 inch	100	+6%
1 inch	83 - 100	+6%
3/4 inch	-------	------
1/2 inch	56 - 95	+6%
3/8 inch	------	------
No. 4	29 - 70	+5%

No. 8	19 - 54	+5%
No. 30	8 - 30	+4%
No. 50	4 - 20	+4%
No. 200	2 - 10	+1.5%
Min. %A.C. by wt of Mix	4	+0.4%

F. Bituminous Materials shall be petroleum asphalt cement grade PG 67-22, unless otherwise specified.

G. Mineral Filler shall meet requirements of Section 703.16 of the Mississippi State Highway Specifications. Mineral filler may be used as necessary to obtain desired properties; however, excessive use shall not be permitted in the mix.

H. Weather Limitations: The mixture shall not be placed when weather conditions prevent the proper handling and finishing or the surface on which it is to be placed is wet or frozen. At the time of placement, the air and pavement surface temperature limitations shall be equal to or exceed that specified in the following table:

TEMPERATURE LIMITATIONS			
COMPACTED THICKNESS	SURFACE COURSES	BINDER AND LEVELING COURSES	BASE COURSES
Less than 1-1/2 in.	55°F	55°F	-
1-1/2 in. to 2-1/2 in.	50°F	45°F	45°F
More than 2-1/2 in.	45°F	45°F	45°F

When paving operations are discontinued because of rain, the mixture in transit shall be protected until the rain ceases. The surface on which the mixture is to be placed shall be swept to remove as much moisture as possible and the mixture may then be placed subject to removal and replacement at the Contractor’s expense if contract requirements are not met.

I. Density: The average lot density of all bituminous base courses shall not be less than 93.0 percent nor more than 96.0 percent of the maximum density based on AASHTO T-209. When borderline results are obtained on density tests, it shall be the Contractor's responsibility to furnish and use the appropriate number, type, and size of rollers as necessary to consistently obtain the required density. When the furnished compactive effort does not produce the required density, the Contractor shall make such approved adjustments as necessary to obtain the required density. Pavement samples obtained for determining density and/or correlation of the nuclear density gauge which have a thickness less than three-eights inch greater than the maximum size aggregate permitted by the job-mix formula will not be used as a representative sample.

J. Lower layers of base course shall not exceed four inches in compacted thickness (plus the allowable tolerance). The top layer shall have a maximum compacted thickness of three inches (plus the allowable tolerance).

K. Surface tolerance shall conform to the designated grade and cross section within the tolerances set forth in Section 403.03.2 of MDOT Specifications.

3-02 TACK COAT (Required Full Width)

A. General: This work shall consist of preparing and treating an existing bituminous or concrete surface with bituminous material in accordance with these specifications and in close conformity with the lines shown on the plans or established by the Contracting Officer. A tack coat shall be applied, for the full width of the course to be superimposed on a previously prepared, bonded, and bituminized road surface or base or concrete surface or base. The tack coat may be omitted from a previously primed road when deemed by the Contracting Officer to be unnecessary.

B. Tack coat is to be applied between each lift or course of asphalt pavement unless otherwise specified by the Contracting Officer.

C. A tack coat shall be applied over the base course and shall consist of 0.05 to 0.10 gallons per square yard of bituminous material of the same A.C. grade as specified for the base course mix designs specified in Section 401.02.1.3 of MDOT Specifications.

D. Tack coat shall not be applied during wet or cold weather, after sunset or to a wet surface and only on as much pavement as can be covered with additional courses in the same day. The surface to receive tack coat shall be prepared in accordance with Section 401.03.6 of MDOT Specifications.

E. Separate Payment for tack coat shall not be made. The tack coat shall be an absorbed item.

3-03 BINDER COURSE, NUMBER BC-1

A. This work shall consist of the construction of a binder course, thickness indicated on the drawings, in accordance with Contract Drawings, and MDOT Specifications Section 403, Hot Bituminous Pavement.

B. A job mix formula shall be submitted to the Contracting Officer, for approval, prior to placing any binder course. See paragraph C of this Section.

C. The gradation of the aggregates for the mixture shall meet the following Design Master Range requirements.

D. At least 20% of the total combined aggregate by weight shall be limestone or slag.

Sieve Size	**Percentage Passing Sieve (by Weight)**	**Tolerances For Job Mix Formula**
3/4 inch	100	+6%
1/2 inch	82 - 100	+6%
3/8 inch	71 -91	+6%

4 inch	40 - 73	+5%
No. 8	26 - 58	+5%
No. 30	9 - 30	+4%
No. 50	6 - 20	+4%
No. 200	2 - 10	+1.5%
Min. %A.C. by wt of Mix	4.0	+0.4%

D. Bituminous materials shall be petroleum asphalt cement grade PG 67-22, unless otherwise specified.

E. Density: The average lot density of all bituminous binder courses shall not be less than 93.0 percent nor more than 96.0 percent of the maximum density based on AASHTO T-209. When borderline results are obtained on density tests, it shall be the Contractor's responsibility to furnish and use the appropriate number, type, and size of rollers as necessary to consistently obtain the required density. When the furnished compactive effort does not produce the required density, the Contractor shall make such approved adjustments as necessary to obtain the required density. Pavement samples obtained for determining density and/or correlation of the nuclear density gauge which have a thickness less than three-eights inch greater than the maximum size aggregate permitted by the jobmix formula will not be used as a representative sample.

F. Mineral filler shall meet requirements of Section 703.16 of MDOT Specifications. Mineral filler may be used as necessary to obtain desired properties; however, excessive use shall not be permitted in the mix.

G. Weather Limitations: The mixture shall not be placed when weather conditions prevent the proper handling and finishing or the surface on which it is to be placed is wet or frozen. At the time of placement, the air and pavement surface temperature limitations shall be equal to or exceed that specified in the following table:

TEMPERATURE LIMITATIONS			
COMPACTED THICKNESS	SURFACE COURSES	BINDER AND LEVELING COURSES	BASE COURSES
Less than 1-1/2 in.	55°F	55°F	-
1-1/2 in. to 2-1/2 in.	50°F	45°F	45°F
More than 2-1/2 in.	45°F	45°F	45°F

When paving operations are discontinued because of rain, the mixture in transit shall be protected until the rain ceases. The surface on which the mixture is to be placed shall be swept to remove as much moisture as possible and the mixture may then be placed subject to removal and replacement at the Contractor’s expense if contract requirements are not met.

I. Surface Tolerances: Surface tolerances shall conform to the designated grades and cross-section, within the tolerances set forth in Section 403.03.2. Surface Tolerances of MDOT Specifications.

3-04 SURFACE COURSE, NUMBER SC-1

A. This work shall consist of the construction of a surface course, thickness indicated on the drawings, in accordance with Contract Drawings, MDOT Specifications, Section 403, Hot Bituminous Pavement.

B. A job formula shall be submitted to the Contracting Officer, for approval, prior to placing any surface course. See Paragraph C of this Section.

C. The gradation of the aggregates for the mixture shall meet the following Design Master Range requirements.

D. At least 20% and no more than 30% of the total combined aggregate by weight shall be limestone or slag.

Sieve Size	Percentage Passing Sieve (by Weight)	Tolerances For Job Mix Formula
1/2 inch	100	+6%
3/8 inch	87 - 100	+6%
No. 4	54 - 80	+5%
No. 8	32 - 63	+5%
No. 30	12 - 33	+4%
No. 50	6 - 20	+4%
No. 200	2 - 10	+1.5%
Min. %A.C. by wt of Mix	4.0	+0.4%

E. Bituminous materials shall be petroleum asphalt cement grade PG 67-22, unless otherwise specified.

F. Density: The average lot density of all bituminous surface courses shall not be less than 93.0 percent nor more than 96.0 percent of the maximum density based on AASHTO T-209. When borderline results are obtained on density tests, it shall be the Contractor's responsibility to furnish and use the appropriate number, type, and size of rollers as necessary to consistently obtain the required density. When the furnished compactive effort does not product the required density, the Contractor shall make such approved adjustments as necessary to obtain the required density. Pavement samples obtained for determining density and/or correlation of the nuclear density gauge which have a thickness less than three-eights inch greater than the maximum size aggregate permitted by the jobmix formula will not be used as a representative sample.

G. Mineral filler shall meet requirements of Section 703.16 of MDOT Specifications. Mineral filler may be used as necessary to obtain desired properties; however, no more than 3% of mineral filler by wt. of the total aggregate blend shall be permitted in the mix.

H. Weather Limitations: The mixture shall not be placed when weather conditions prevent the proper handling and finishing or the surface on which it is to be placed is wet or frozen. At the time of placement, the air and pavement surface temperature limitations shall be equal to or exceed that specified in the following table:

TEMPERATURE LIMITATIONS			
COMPACTED THICKNESS	SURFACE COURSES	BINDER AND LEVELING COURSES	BASE COURSES
Less than 1-1/2 in.	55°F	55°F	-
1-1/2 in. to 2-1/2 in.	50°F	45°F	45°F
More than 2-1/2 in.	45°F	45°F	45°F

When paving operations are discontinued because of rain, the mixture in transit shall be protected until the rain ceases. The surface on which the mixture is to be placed shall be swept to remove as much moisture as possible and the mixture may then be placed subject to removal and replacement at the Contractor's expense if contract requirements are not met.

Surface Tolerances: Surface tolerances shall conform to the designated grades and cross-section, within the tolerances set forth in Section 403.03.2, Surface Tolerances of MDOT Specifications.

3-05 PRE-ROLLING

A. Prior to application of base course, the sub-base shall be pre-rolled as may be required to determine possible presence of underlying soil failures.

3-06 TESTING

A. The Contractor shall have the Testing Laboratory furnish certified gradation analysis of aggregates for base, binder and surface courses. These results shall be approved by the Contracting Officer in writing prior to the use of the material tested. Testing for mat density shall be taken a minimum of one (1) each for each 5,000 square feet of pavement installed, or fraction thereof.

B. Results of all testing shall be submitted to the Contracting Officer in triplicate.

C. Any prior use testing or certification costs shall be borne by the Contractor. Testing of the plant mix in the laboratory shall be conducted for every 500 tons of mix produced and shall be paid for by the Contractor.

PART 4 – CONSTRUCTION

A. Construction of asphalt pavements shall be in accordance with Section 403 of the MDOT Specifications for Road and Bridge Construction, 1990 Edition.

B. The job mix temperatures shall be between 250 degrees Fahrenheit minimum and 350 degrees Fahrenheit maximum unless otherwise specified.

C. JOINTS. The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

1. The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. In both methods all contact surfaces shall be given a tack coat of bituminous material before placing any fresh mixture against the joint.

2. Longitudinal joints which are irregular, damaged, uncompacted, or otherwise defective shall be cut back to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

END OF SECTION
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SECTION 32 16 13
CONCRETE CURB AND COMBINATION
CONCRETE CURB AND GUTTER

PART 1 GENERAL

1-01 DESCRIPTION

A. This item consists of the construction of curb and combination curb and gutter for new application or replacement of existing areas removed during other construction. The curb or combination curb and gutter shall be constructed of Portland Cement Concrete with steel bar reinforcement in accordance with the details, dimensions and typical cross section and to the lines and grades as shown in the contract documents.

B. Refer to Section 03 30 00 "Cast-In-Place Concrete" included herein for details concerning cement, reinforcement and other related work.

PART 2 MATERIALS

2-01 GENERAL

A. Insofar as applicable, all materials shall meet the requirements specified in Section 03 30 00 "Cast-in-Place Concrete". Concrete for this construction shall be Class "C". The compressive strength of the cement when tested at 28 days age, shall be 2500 pounds per square inch, minimum except as otherwise required by paragraph "D" below. The water/cement ratio shall in no case exceed the maximum allowed in the design mix.

B. Expansion joint filler shall be premolded bituminous fibre board of the non-extruding resilient type as specified. Joint sealants will not be required.

C. Reinforcing steel bars shall be as specified in Section 03300 "Cast in Place Concrete", herein.

D. Concrete used in the placement of continuous poured curb and gutter by a paving machine shall be Class "B", 3,000 PSI concrete.

PART 3 EXECUTION

3-01 FORMS

A. Metal forms and divider plates or templates between the ten (10) foot sections shall be used in all cases unless otherwise specified except that on curves of short radii the Engineer may permit wooden forms for backing flexible material. On normal curves the Contractor shall use flexible steel forms to avoid the effect of broken chords.

B. Metal forms shall have a flat surface on top for finishing edges of the curbs. All forms shall be securely staked, braced and held firmly against displacement from the required line and shall be sufficiently tight to prevent leakage of mortar.

C. Metal forms shall be free from rust, grease and old concrete accretions and shall be cleaned after each usage.

D. Curb and gutter may be placed by a paving machine in a continuous pour operation on straight sections and on sections with radii in excess of 50 feet.

3-02 EXPANSION JOINTS

A. Curb and gutter expansion joint fillers of the specified thickness shall be placed at intervals not to exceed 30 feet but the spacing shall be adjusted to prevent expansion joint occurring in a driveway. Joint filler shall be preformed and cut to the full cross section of the curb and gutter and extend full depth without horizontal joints. Any filler protruding after the concrete is finished shall be trimmed off flush.

B. Joints shall be 1/2" thick unless otherwise specified.

C. Curb and gutter placed by continuous pour machine using continuous reinforcing may have a maximum space between expansion joints of 60 feet.

3-03 JOINTS

A. Divider plates or templates shall be securely set in forms at ten (10) foot intervals to form a smooth vertical joint. The plates shall be lightly oiled to facilitate removal.

3-04 PLACING AND FINISHING CONCRETE

A. The concrete shall be placed on a moist subgrade, deposited to the proper depth, tamped and spaded sufficiently to compact the concrete and to bring the mortar to the surface, after which it shall be finished smooth and even by means of a wood float. Before the concrete is given the final finishing, the surface of the gutter shall be checked with a ten (10) foot straight edge and any irregularities of more than one eighth (1/8) inch in ten (10) feet shall be eliminated.

B. Concrete curb, gutter or combination curb and gutter shall be constructed true to line, grade and cross section and in uniform sections not to exceed ten (10) feet in length. The lengths of these sections may be reduced where necessary for closures but no section less than six (6) feet will be permitted. The templates shall be set carefully before placing the concrete and allowed to remain in place wherever possible until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place. The forms on the face of all curbs shall be removed as soon as the concrete will hold its shape and the surface shall be floated with a wooden float to a smooth and even finish, but no plastering will be permitted. For gutters, a strike off template, of the form and shape of the gutter, shall be used to shape the top surface of the gutter.

C. In cases where the curb and gutter is placed in straight sections or in curves with radii of 50 feet or greater, it may be placed by continuous pour curb and gutter machine guided to true

line and grade with the use of offset string lines. Concrete curb and gutter placed with continuous pour machines shall be constructed true to line, grade and cross section as shown on the Drawings. The concrete used in the construction shall be poured with the desired slump and consistency that will allow the curb and gutter to hold its shape as the continuously moving template form progresses. Concrete found to have excessive slump and lacking in the desired consistency shall be discarded from use in the continuous pour machine.

D. The edges on the face of the curb shall be rounded with approved finishing tools having the radii shown on the Drawings. Edges where templates have been removed or expansion joint material has been placed shall be finished with an edging tool having a radius of not over one quarter (1/4) inch. Exposed surfaces against which some rigid type of construction is to be made shall be left smooth and uniform so as to permit free movement of the curb, gutter, or combination curb and gutter.

E. All tool marks shall be removed with a wetted brush or wooden float, and the finished surface shall be of uniform color free from discolorations.

3-05 REINFORCEMENT

A. Reinforcing steel for curb and gutter shall be installed in accordance with the detail shown on the Drawings. Longitudinal bars may be supported by pins before placing concrete or they may be placed directly on a layer of concrete struck off at the proper elevation. Bars shall not be disturbed or moved out of position by the concrete placing and spading operations. No reinforcing bars shall extend across expansion joints in curb and gutter construction.

B. Reinforcement shall conform to the requirements specified in the Section 03300 "Cast in Place Concrete" herein.

3-06 PROTECTION AND CURING

A. Immediately after finishing the concrete, it shall be protected and cured in accordance with the provisions and requirements of Section 03300 "Concrete", herein.

B. A section which is damaged, before final acceptance of the work, shall be removed and reconstructed by the Contractor without extra compensation.

3-07 BACKFILLING AND CLEANING UP

A. After the concrete has set sufficiently, the spaces on the sides of the combination curb and gutter shall be refilled to the required elevation with suitable material, which shall be tamped in layers of not over six (6) inches until firm and solid.

B. All surplus material shall be disposed of as directed and the entire work left in a neat and presentable condition.

END OF SECTION
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SECTION 32 16 23
SIDEWALKS

PART 1 - GENERAL

1-01 DESCRIPTION

A. This Section shall include construction of sidewalks as shown on the Contract Drawings and as specified herein.

1-02 REQUIREMENTS

A. All work specified in this Section shall conform to the applicable requirements of Section 03 30 00, Concrete General, of the Specifications.

PART 2 - PRODUCTS

2-01 MATERIALS

A. All materials for concrete work shall conform to the applicable requirements of Section 03 30 00, Concrete General.

B. Base course under concrete walks shall consist of minimum 3" of sand over compacted natural surface soils.

PART 3 - EXECUTION

3-01 CONCRETE WALKS

A. Construct concrete walks in accordance with Section 03 30 00 and as here specified using 3,000 psi concrete and W1.4x1.4 welded wire mesh reinforcement.

B. Check tops of forms and sub-grade with a template cut true to the cross section of the proposed construction immediately prior to placing concrete and correct any irregularities. Introduce short vertical curves in walks as shown on the Contract Drawings, or at points where the change in walk grade exceeds 2 per cent.

C. Provide 1/4 inch per foot cross slope or crown in direction indicated by grading. Make slight adjustment in slopes of walk intersection as necessary to provide proper drainage. The longitudinal surface variations shall be not more than 1/8 inch on a 5 foot transverse section.

D. Concrete walks and aprons shall be one course construction 4 inches thick minimum and of widths shown on the Contract Drawings.

E. Provide expansion joints not to exceed thirty (30) feet on center: at all intersections or changes in direction or cross section and where walks abut curbing, building or other structures.

F. Finish the expansion joints with an edger having a radius of 1/4 inch. Divide the surface of sidewalks into blocks with an approved grooving tool having a groove depth of not less than 1 inch. In walks up to 5 feet wide, space the grooves at intervals equal to the approximate width of the walk. In walks over 5 feet wide, space the grooves at intervals approximately 1/2 the width of the walk and in addition provide a longitudinal groove along the center line of the walk or as shown on the Contract Drawings. Tool all joints within 2 to 3 hours after the concrete is placed. After edging and tooling, remove all marks caused thereby, or otherwise, by brooming so as to give the surface a uniform texture and finish, except where exposed aggregate finish sidewalks are shown on the Contract Drawings.

G. All exterior walks, ramps, pads and similar work shall receive broom finish. Broom finish shall be as specified in Section 03 30 00 for trowel finish with an additional final brushing after troweling.

H. After pouring concrete, leave forms in place at least 24 hours or as directed, pour exposed concrete in accordance with Cast-In-Place Concrete section and protect from pedestrian traffic for 72 hours after pouring. Accomplish the required backfilling as soon as the forms have been removed and the concrete has properly set.

I. Any expansion joint material extruding after the concrete is finished shall be trimmed as directed.

END OF SECTION
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SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1-01 DESCRIPTION

A. This work consists of furnishing materials and applying painted pavement markings as described in the Contract Documents.

B. Where reference is made to Mississippi Department of Transportation Specifications (MDOT), it is intended to be in accordance with Mississippi Standard Specifications for Road and Bridge Construction, Mississippi Department of Transportation (MDOT), 2004 Edition.

PART 2 - MATERIALS

2-01 GENERAL

A. All materials for Pavement Markings and related work shall comply with Mississippi Standard Specifications for State Road and Bridge Construction, MDOT, 2004 Edition.

2-02 PAINTED TRAFFIC STRIPING

A. All painted traffic striping shall conform to the requirements of Section 625, Painted Traffic Stripe, of the MDOT Specifications except as amended herein:

1. Basis of Payment, Subsection 625.05, payment will be absorbed within the Lump Sum bid for the entire project.

B. Paint shall be the color specified and shall meet the applicable requirements of Section 710.

PART 3 - EXECUTION

3-01 GENERAL

A. Preparation of Surface. All areas to be painted shall be thoroughly cleaned. Cleaning may be done by hand brooms, rotary brooms, air blast, scrapers, or whatever combination of equipment is necessary to clean the pavement thoroughly without damage to the surface. Before striping, particular care shall be taken to remove all vegetation, loose soil, and the like from the area to be painted. Should other methods fail, the surface shall be wetted with a water jet and scrubbed as necessary to dislodge all foreign material. After washing, the surface shall be allowed to dry thoroughly, and all films of dried mud apparent after surface drying shall be removed before application of paint. Painting shall follow as closely as practicable after the surface has been cleaned and dried, but no paint shall be applied until the surface has been inspected and permission given to proceed.

B. Application. The paint shall be applied when the ambient temperature is no less than 50°F, the pavement surface is properly prepared and the temperature of the pavement surface is no less than 50°F.

C. Legend. Legend shall be applied by the use of templates cut to the dimensions shown on the plans, or by other methods approved by the Contracting Officer which will provide a clean cut, uniform, and workmanlike appearance. All other requirements for legend shall be in accordance with the applicable materials and construction requirements of this section. Legend which fails to have a uniform, satisfactory appearance shall be corrected by the Contractor or removed and replaced at no additional cost to the Government.

D. Protection. The newly painted markings shall be protected so that, insofar as possible, paint will not be picked up by the tires of passing vehicles. Warning signs shall be placed at the beginning of a wet line and at points well in advance of the marking equipment. For the benefit of the Contractor, small flags or other similarly effective small objects may be placed near freshly applied lines at frequent intervals to reduce crossings by traffic. Damaged portions of stripes shall be effaced and replaced by the Contractor at no additional cost to the Government.

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SECTION 32 31 12
HORIZONTAL SLIDING GATE OPERATOR

PART 1 – GENERAL

1-01 INCLUDED IN THIS SECTION

A. Pre-wired gate operator for horizontal sliding gates, complete with all safety devices, pumps, valves, cylinders, drive rails, wheels and electrical devices to move gate and limit its travel in both directions and to provide a complete and usable installation.

1-02 RELATED WORK SPECIFIED ELSEWHERE

A. Cast in place concrete: See Section 03 30 00.

B. Electrical service and connections: See Division 26.

1-03 SUBMITTALS

A. Shop drawings: Submit drawings showing connections to adjacent construction, range of travel, and all electrical and mechanical connections to the operator. All underground runs of electrical lines and inductive vehicle obstruction loop locations shall be indicated on drawings. Drawings shall also show the size and location of the concrete mounting pad.

B. Installation instructions: Submit two copies of manufacturer's installation instructions for this specific project.

C. Submit manufacturer’s completed warranty registration form to the Contracting Officer.

D. Project list: Submit list of product installations comparable to the subject job. Include date of product installation, installer, and owner's name and location of the project.

E. Test reports:

1. Submit affidavits from the manufacturer demonstrating that the gate operator mechanism has been tested to 200,000 cycles without breakdown.
2. Each operator shall bear a label indicating that the operator mechanism has been tested. Operator is tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components and electrical tests of all overload devices.

1-04 QUALITY ASSURANCE

A. Manufacturer: A company specializing in the manufacture of gate operators of the type specified, with a minimum of five years’ experience manufacturing operators of this type and design.

B. Installer: Must have a minimum of three years' experience installing similar equipment, provide proof of attending the manufacturer's technical training within the previous three years, or obtain other significant manufacturer endorsement of technical aptitude, if required, during the submittal process.

1-05 CODES AND REGULATORY REQUIREMENTS

A. Operators shall be built to UL 325 standards and be listed by a nationally recognized testing laboratory. Complete all electrical work according to local codes and National Electrical Code. All fieldwork shall be performed in a neat and professional manner, completed to journeyman standards.

B Current safety standards require the use of multiple external sensors to be capable of reversing the gate in either direction upon sensing an obstruction. See also 2-02D.

C. Gate must have physical stops to prevent over travel in both the open and close directions.

1-06 PRODUCT DELIVERY AND STORAGE

A. Store products upright in the original shipping containers, covered, ventilated and protected from all weather conditions.

1-07 WARRANTY

A. Provide a warranty against all defects in materials or workmanship for five years or 500,000 gate cycles (whichever occurs first) after the date of installation. Defective materials shall be replaced at manufacturer's discretion with new or reconditioned materials furnished by the manufacturer, at no cost to the owner. Freight, labor and other incidental costs are not covered under the factory warranty, but may be covered by a separate service agreement between installing company and the Government.

PART 2 – PRODUCTS

2-01 GATE OPERATORS

A. HySecurity gate operator model SlideDriver 40 (222 E ST) with Smart Touch Controller, or approved equal.

B. Listing of a specific brand/model is intended to set a standard of quality only and not to limit competition.

2-02 OPERATION

A. Operation shall be by means of a metal rail passing between a pair of reinforced composite wheels with polyurethane treads. Operator motors shall be hydraulic, geroller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 lb (136

kg) without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 4,000 lb (1,814 kg). Gate panel velocity shall not be less than 1 ft/s (304 mm/s) and shall be stopped gradually to prevent shock loads to the gate and operator assembly. The “soft-stop” feature of the gate operator shall be controlled by two adjustable hydraulic brake valves (one for each direction).

B. Minimum standard mechanical components:

1. Supporting arms: Cast aluminum channel. Arms shall incorporate a fully bushed, 1 1/2" (38 mm) bronze bearing surface, acting on arm pivot pins. (item 2 below)
2. Arm pivot pins: 3/4" (19 mm) diameter, stainless steel, with integral tabs for ease of removal.
3. Tension spring: 2 1/2" (63 mm) heavy duty, 800 lb (363 kg) capacity.
4. Tension adjustment: Finger tightened nut, not requiring the use of tools.
5. Drive release: Must instantly release tension on both drive wheels, and disengage them from contact with drive rail in a single motion, for manual operation.
6. Limit switches: Fully adjustable, toggle types, with plug connection to control panel.
7. Chassis: 1/4" (6 mm) steel base plate, and 12 Ga. (3 mm) sides and back welded and ground smooth.
8. Cover: 16 Ga. (1 mm) zinc plated steel with textured TGIC polyester powder coat finish. All joints welded, filled and ground smooth. Finished corners square and true with no visible joints.
9. Finish: Zinc plated steel with textured TGIC polyester powder coat finish, proven to withstand 1,000 hour salt spray test.
10. Drive wheels: Two 6" diam (152 mm) AdvanceDrive wheels. High-strength composite hub with polyurethane over mold.
11. Drive rail: Shall be extruded 6061 T6, not less than 1/8" (3 mm) thick. Drive rail shall incorporate alignment pins for ease of replacement or splicing. Pins shall enable a perfect butt splice.
12. Hydraulic hose: Shall be 1/4" (6 mm) synthetic, rated to 3,000 psi (20.6 MPa).
13. Hydraulic valves: Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.
14. Hose fittings: At manifold shall be quick-disconnect type, others shall be swivel type.
15. Hydraulic fluid: High performance type with a viscosity index greater than 375 and temperature range -40° F to 167° F (-40° C to 75° C).
16. A zero to 2,000 psi (13.7 MPa) pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.
17. The hydraulic fluid reservoir shall be formed from a single piece of metal, nonwelded, and shall be powder painted on the inside and the outside, to prevent fluid contamination.

C. Minimum standard electrical components:

1. Pump motor: 1 hp, 3450 RPM, 56C, TEFC. Voltage shall be 208V, single phase.
2. All components shall have overload protection.
3. Electrical enclosure: Type 1, metal, with hinged lid gasketed for protection from intrusion of foreign objects.

4. Controls: Smart Touch Controller Board containing:
   a. inherent entrapment sensor;
   b. built in audible “warn before operate” system;
   c. built in timer to close;
   d. 32 character OLED display for reporting of functions and codes;
   e. multiple programmable output relay options;
   f. anti-tailgate mode;
   g. built-in power surge/lightning strike protection;
   h. menu configuration, event logging and system diagnostics easily accessible with a PC and HySecurity’s free Smart Touch Analyze and Retrieve Tool;
   i. RS-232 port for connection to laptop or other computer peripheral and RS485 connection for network interface.
   j. Dual gate communication connection for bi-parting, sally port, or sequenced gates.
   k. Electromechanical and solid state relays.
   l. Radio option outputs.
   m. 21 inputs for site specific configurations.
5. Transformer: 75 VA, non-jumpered taps, for all common voltages.
6. Control circuit: 24 VDC.

D. Required external sensors: See 1-05B. Provide photo eyes or gate edges shall be installed such that the gate will reverse in either direction upon sensing an obstruction.

E. Other control devices: Provide open/stop/close pushbutton controller for each gate in the gatehouse. Coordinate location of pushbutton controllers with the Government. Provide vehicle obstruction loop detectors on each side of each gate.

2-03 FACTORY TESTING

A. Fully assemble and test, at the factory, each gate operator to assure smooth operation, sequencing and electrical connection integrity.

B. Proof test with simulated physical and electrical loads to exceed the fully rated capacity of the operator components.

C. Inspect and test all hydraulics are leak free.

D. All testing data shall be individually logged and recorded by serial number.

E. Check all mechanical connections for tightness and alignment. Check all welds for completeness and continuity.

F. Inspect finishes for completeness. Touch up imperfections prior to shipment.

G. Check all hydraulic hoses and electrical wires to assure that chafing cannot occur during shipping or operation.

PART 3 – EXECUTION

3-01 SITE EXAMINATION

A. Locate concrete mounting pad in accordance with approved shop drawings and in compliance with local building codes.

Make sure that gate is operating smoothly under manual conditions before installation of gate operators. Do not proceed until gate panel is aligned and operates without binding. 3-02 INSTALLATION

A. Install gate operator in accordance with the safety regulations and the manufacturer's product literature and installation instructions, current at the time of installation. Coordinate locations of operators with contract drawings; other trades and shop drawings.

B. Installer shall ensure that the electrical service to the operator is at least 20A. Electrical wiring to conform to NEC and manufacturer's installation instructions.

3-03 FIELD QUALITY CONTROL

A. Test operator through ten full open and close cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for proper open and close limit positions.

B. All anchor bolts shall be fully tightened in the finished installation.

B. Contracting Officer shall complete "check list" with installing contractor prior to final acceptance of the installation and submit completed warranty documentation to manufacturer.

3-04 CONTINUED SERVICE AND DOCUMENTATION

A. Train Government personnel on how to safely shut off electrical power, release and manually operate the gate. Additionally, demonstrate the general maintenance of the gate operator and accessories and provide one copy of "Programming and Operations Manual" for the owner's use. Manuals will identify parts of the equipment for future procurement.

END OF SECTION
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SECTION 32 31 13
CHAIN LINK FENCING

PART 1 - GENERAL

1-01 DESCRIPTION

A. This item shall consist of furnishing all materials, labor, tools, equipment, and incidentals, and performing all operations necessary for the erection of chain link fencing on steel posts in accordance with the CONTRACT DRAWINGS and Specifications.

PART 2 - MATERIALS

2-1 CHAIN LINK FENCE FABRIC

A. Shall be of steel and conform to Federal Specification RR-F-191d. The size of mesh shall be two (2) inches. The fence fabric shall be woven of No. 9 wire and shall be 72 inches high. The fence fabric shall be zinc coated, 1.2 ounces of zinc per square foot of surface area.

2-2 BARBED WIRE

A. Shall consist of three lines of wire of No. 12 1/2 gauge wire with No. 14 gauge, 4 point barbs spaced at approximately five (5) inches on centers. The barbed wire shall be zinc coated and conform to Federal Specification RR-F-221d, Class 3, ASTM Specifications A 121, Class 3.

2-3 TENSION WIRE

A. Shall be steel not less that No.7 gauge, zinc coated with a minimum of 0.80 ounce of zinc per square foot of surface area.

2-4 POSTS

A. Shall be galvanized steel pipe, Schedule 40, and conform to Federal Specification RR-F-183 (1), ASTM Specification A 120. Post of different types shall be as follows:

B. End, corner and pull posts shall be 2.875 inches O.D., 5.79 pounds per linear foot.

C. Intermediate posts shall be 2.375 inches O.D., 3.65 pounds per linear foot.

D. Gate posts shall be 2.875 inches O.D., 5.79 pounds per linear foot.

2-05 POST TOPS

A. Shall be of malleable iron or pressed steel, combination type with barbed wire supporting arms or plain post caps, as specified on the drawings.

2-06 POST BRACES

A. Shall be provided for each gate, corner, pull, and end post. Braces shall be galvanized steel pipe, 1.660 inches O.D., 1.806 pounds per linear foot. With each brace provide a truss rod 0.375 inch diameter with a turnbuckle or other provision for adjustment.

B. Provide malleable iron or pressed steel clamps, galvanized, for fastening braces to posts.

2-07 TOP RAIL

A. Shall be provided as specified for post braces.

2-08 STRETCHER BARS

A. Shall be of galvanized steel not less than 3/16 inch by 3/4 inch and shall be in length one (1) inch less than the full height of the fabric.

B. Provide one stretcher bar for each gate and end post and two stretcher bars for each pull and corner post.

2-09 ACCESSORIES

A. Shall be of steel, malleable iron, or ductile iron, galvanized. Ties and clips may be of aluminum.

2-10 GATES

A. The chain link fence gates shall be swing type complete with fabric, latches, stop, keepers, and hinges. Frames shall be constructed of tubular members welded at all corners or assembled with fittings. Frames shall have vertical bracing so that no vertical members are more than eight (8) feet apart.

B. Frame construction and galvanizing shall conform to Federal Specification RR-F-183 (1), ASTM Specification A-120.

C. For attaching barbed wire, extend each end member one foot above the top horizontal member. Attach three lines of barbed wire with band, clips, or hook bolts.

2-11 LATCH, STOP AND KEEPER

A. Shall be provided for the gate. Forked latches shall be provided for gates. Keeper shall consist of a mechanical device for securing the free end of the gate when in full open position.

2-12 LOCK

A. Provide heavy duty padlocks with three keys.

2-13 CONCRETE FOR POST SETTING

A. Shall attain a compressive strength of 2,500 pounds per square inch at 28 days.

PART 3 - EXECUTION

3-1 CLEARING

A. The site of the fence shall be cleared of obstructions and surface irregularities shall be graded so that the fence will conform to the general contour of the ground. The fence line shall be cleared to a minimum width of two (2) feet on each side of the centerline of the fence.

3-2 POST SPACING

A. Line posts shall be spaced at intervals not to exceed 10 feet average when measured from center between terminal posts. Measurements shall be made parallel to the slope of the ground, and posts shall be placed in a vertical position.

3-3 POST SETTING

A. End, gate, corner, pull, and brace posts shall be set 36 inches deep in concrete bases 12 inches in diameter. All line posts shall be set 18 inches deep in concrete bases eight (8) inches in diameter. The top of concrete bases shall be slightly above ground and sloped to drain. Gate posts shall be set with their tops level with one another.

B. To establish the elevation of gate posts if the ground is not level, set the upgrade post first.

C. Concrete bases shall be allowed to cure at least seven (7) days before installing fence fabric.

3-04 HORIZONTAL BRACING AND TRUSS RODS

A. Provide at each terminal and corner post. Braces shall be clamped to posts at each end.

3-5 CHAIN LINK FABRIC

A. The fabric shall be placed on the outside of the posts, stretched taut approximately two (2) inches above the ground, and fastened securely to the post. Fastening to terminal posts shall be by means of stretcher bars, with fabric bands spaced at a maximum of 15 inches on centers.

B. Fabrics shall be fastened to line posts by means of tie wire, metal bands, or other approved method, spaced at maximum of 15 inches on centers. The top edge of the fabric shall be fastened to the top rail by means of wire ties spaced at a maximum of 18 inches on centers. The bottom edge of the fabric shall be fastened to the bottom tension wire by means of wire ties spaced at a maximum of two (2) feet on centers. Ends of abutting rolls of fabric shall be joined by weaving a single strand of wire into the ends to form a continuous mesh.

3-6 GATES

A. Shall be erected to swing in the direction indicated. Concrete in the base on the hinged side of gate leaves shall extend up to the bottom of the lower hinge so as to provide support. Install a keeper for holding the gate.

B. All hardware shall be thoroughly secured, properly adjusted, and left in perfect working order. Adjust hinges and diagonal bracing so that the gates hang level.

3-7 INSTALLATION

A. Fencing shall be chain link, Type II, in accordance with the plans unless otherwise specified.

END OF SECTION
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SECTION 32 92 19
SODDING, SEEDING, FERTILIZER AND MULCH

PART 1 - GENERAL

1-01 DESCRIPTION

A. General: This item consists of preparing the ground surface, furnishing and applying fertilizer and lime, furnishing and sowing grass seeds, furnishing and placing grass sod on prepared areas, finishing, compacting, watering, establishing and repairing same in accordance with these Specifications at the locations shown on the plans or as directed by the Contracting Officer.

B. Seeding: This work shall consist of furnishing the specified kind and variety of seeds and seed treatment materials, treating and planting the seeds in a prepared and approved seedbed; covering the seeds and compacting the seedbed; and providing plant establishment, in accordance with these Specifications and in the locations shown on the Drawings or as established by the Contracting Officer.

C. Fertilizing: This work shall consist of furnishing, transporting, spreading, and incorporating fertilizers of the type and in the amount designated into the prepared ground in the locations shown on the plans.

D. Sodding: This work shall consist of supplying, transporting and placing live, viable sod of the types required in the locations specified on the plans.

E. Mulching: This work shall consist of furnishing, transporting and placing asphalt coated or mechanically stabilized vegetative mulch on seeded areas of slopes, shoulders, medians and other areas indicated on the plans, or as designated by the Contracting Officer.

F. Lime: This work shall consist of furnishing, transporting, and placing lime on slopes, shoulders, ROW, and other areas as directed by the Contracting Officer.

PART 2 - MATERIALS

2-01 SEED

A. Seeds with a minimum pure live seed content of 90 percent shall be used. They shall be of the best grade and of known vitality, purity and germination and shall be delivered in containers bearing seed tags as required by law showing percentages of germination content and purity of seed as well as percentages of weed seed content. All seeds shall be free of wild onion, Canadian thistle, Johnson grass, crab grass or other seeds of noxious weeds. Seed which has become wet, moldy or otherwise damaged in transit or storage will not be acceptable.

B. Purity, Germination and Planting Schedule

Name	Percent Purity	Percent Germination	Mix (Dry Wt. Lbs. Per Acre)
Spring and Summer Seeding (March 1 to September 1)			
Hulled Bermuda	95	90	20
Total			20
Fall and Winter Seeding (September 1 to March 1)			
Unhulled Bermuda	95	90	20
Rye	95	85	15
Total			35

2-02 FERTILIZER

A. Fertilizer shall be an approved commercial grade containing nitrogen, phosphorus and potash and shall be delivered accompanied by identification of the brand and grade being furnished. Fertilizer may be furnished in bulk, in bags or other approved containers.

B. Unless otherwise specified, fertilizer shall be dry granular grade 13-13-13 (triple thirteen) containing equal parts of nitrogen, phosphorus and potash, respectively.

2-03 SOD

A. Sod shall be produced by a commercial sod farm located as close to the contract work as possible. Sod shall be a live, fresh, growing grass mat at least two (2) inches in thickness with soil adhering firmly to the roots. The sod shall be reasonably free from weeds and other grasses. Sod may be delivered in standard blocks neatly stacked on pallets or in rolls.

B. Sod, unless otherwise required, shall be of the variety growing in the location to be sodded. Where little or no identifiable native grass can be found, sod shall be common bermuda.

2-04 MULCH

A. Mulch shall be Class I vegetative material consisting of approved baled straw from cereal grain or common native hay crops in accordance with Section 215 and 715 of the MDOT Standard Specifications. The mulch shall have been cured properly prior to baling and shall be reasonably free of foreign grasses and weeds. All straw material shall be approved by the Contracting Officer prior to use.

B. Where specified on the plans or called for in the Proposal, mulch shall be bituminous coated with Grade SS-1 emulsified asphalt in accordance with Section 702 of the MSHD Standard Specifications.

2-05 LIME

A. Lime shall be dry, native, crushed agricultural rock limestone reasonably free from rock, gravel, dirt, clay, roots and other objectionable material. Lime may be furnished in bulk, in bags or other approved containers.

2-06 EQUIPMENT

A. The Contractor shall provide tractors, trucks, discs, harrows, drags, drills, sprayers, blowers and other incidental equipment as needed to properly place and install the seed, sod, fertilizer, water, lime, compact, grade, mulch and establish a living turf in the areas shown on the Drawings in accordance with these Specifications.

2-07 WATER

A. Fresh, clean potable water shall be provided and used by the Contractor.

PART 3 - EXECUTION

3-01 GENERAL

A. Ground Preparation, Fertilizing and Liming:

1. The area to be planted shall be disced and prepared to a depth of at least four (4) inches. The specified amount of fertilizer and lime shall be applied uniformly over the surface and harrowed lightly so that it will be incorporated into the upper two (2) inches of the soil. If the soil is not moist, it shall be watered until it is in workable condition.

2. The completed area to be planted shall present a smooth, uniform surface true to line and cross section. Planting shall follow immediately.

B. Protection: The Contractor shall be responsible for maintaining and protecting seeded, sodded, mulched areas until final acceptance of the project. He shall take every precaution to prevent unnecessary foot and vehicular traffic and shall repair and restore damaged areas immediately, without extra compensation.

C. Maintenance:

1. The Contractor shall maintain the grassed areas until final acceptance of the work. Maintenance shall consist of refertilizing, watering, preserving, protecting, replacing, and such work as may be necessary to keep the seeded or sodded areas growing in a satisfactory condition.

2. The Contractor shall be responsible for satisfactory growth of the grass, and until final acceptance he will be required to water and mow the grass at such intervals as will insure a living and growing sod at the time of acceptance. A "living and growing sod" shall be interpreted to include sod that is seasonably dormant during the cold or dry season with roots that have taken hold in the topsoil and capable of growing off after the dormant period.

3-02 SEEDING

A. General: Seeding shall be accomplished with approved seed as specified in 2-01.B. herein.

B. No seeding shall be done during windy weather or when the ground is frozen, wet or otherwise in a nontillable condition. Full advantage shall be taken of time and weather conditions best suited for seeding, and such time of seeding shall be subject to the approval of the Contracting Officer.

C. The seeds shall be sown uniformly in the specified amounts, preferably by approved mechanical seeders, and immediately rolled with a cultipacker or other satisfactory equipment; or covered lightly with soil by the use of garden rakes, or other approved methods.

3-03 FERTILIZING

A. Fertilizer shall be spread uniformly at the rate specified preferably by mechanical methods. Lumps shall be broken as specified by the Contracting Officer, where found objectionable.

B. Application: 500 lbs/acre unless otherwise specified.

3-04 SODDING

A. General: Solid sod shall only be placed when weather and soil conditions are deemed, by the Contracting Officer, to, be suitable for proper placement and growth.

B. The solid sod shall be placed on the prepared surface with the edges in close contact. Cracks between blocks or strips of solid sod shall be closed with small pieces of fresh sod and cracks too small for sod shall be filled by a light dressing of topsoil. The entire sodded area shall then be compacted and watered to the satisfaction of the Contracting Officer. Rollers, hand tamps or other approved equipment may be used for compacting.

C. Surfaces of solid sodding which, in the opinion of the Contracting Officer, may slide due to the height and slope of the surface or nature of the soil, shall, upon direction of the Contracting Officer, be "pegged" with wooden pegs driven through the sod blocks into firm earth, sufficiently close to hold the sod in place.

3-05 MULCHING

A. Equipment: When anchoring mulch with bituminous material, the approved equipment shall be capable of maintaining a constant air stream which will blow or eject controlled quantities of asphalt coated mulch in a uniform pattern. A jet or spray nozzle for applying uniform, controlled amounts of asphalt to the vegetative material as it is ejected shall be located at or near the discharge spout. The amount of asphalt applied shall be sufficient to provide a spotty tack at the time of mulch placement. The discharge shall be kept at a relatively high angle to permit the coated mulch to fall properly in place.

B. Mulching shall be placed uniformly on designated areas within twenty four (24) hours following the planting of spot sod, sod, or seeds, as applicable, unless weather conditions are such that mulching cannot be performed. Placement shall begin on the windward side of areas and from top of slopes. In its final position the mulch shall be loose enough to allow air to circulate but compact enough to partially shade the ground and reduce erosion. Mulch shall be bituminous coated where specified on the plans. The baled material shall be loosened and broken thoroughly before it is fed into the machine to avoid placement of unbroken clumps.

C. Application Rate: Two (2) tons of mulch per acre. If bituminous material is used, the rate of application shall be 150 gallons emulsified asphalt per acre.

3-06 LIMING

A. General: Agricultural lime shall be spread uniformly at the rate specified, preferably by mechanical methods. Lumps shall be broken as specified by the Contracting Officer where found objectionable.

B. Application Rate: Two (2) tons per acre unless otherwise specified.

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SECTION 33 05 23.19
ROADWAY CROSSINGS FOR UTILITY LINES

PART I - GENERAL

1-01 DESCRIPTION

A. The work includes providing labor, materials, equipment and incidentals to install the transmission pipeline beneath roadway or railroad rights-of-way within steel casing, by boring and jacking as herein specified and shown on Drawings.

B. Work shall comply with the terms and conditions as set forth by the Owner and those having jurisdiction over the affected right-of-way, including approved MDOT and Railroad permits.

C. The work shall include excavation, backfill, construction of cribbing and cofferdams, dewatering, casing material, carrier pipe and all incidental work associated with installation of the crossing.

D. It must be anticipated that existing piping, cable, telephone lines and utilities shown on Drawings will vary. When encountered during excavation or other work, Contractor shall immediately notify Engineer and applicable utility company. Cost for any required repairs shall be paid by the Contractor.

E. Installer shall be experienced in this type of work and be approved by the Engineer.

F. Contractor is solely responsible for contacting the owners of buried utilities in the vicinity, locating and protecting such utilities.

PART 2 - MATERIALS

2-01 MATERIALS

A. Casing: Steel casing shall be ASTM A-53, Grade B, plain end steel pipe, butt welded of the size and wall thickness specified below.

OUTSIDE DIAMETER	WALL THICKNESS (INCHES)	
(INCHES)	UNDER HIGHWAY	UNDER RAILROAD*
12 AND UNDER	0.188	0.250
16	0.250	0.250
18	0.250	0.250
20	0.250	0.281

24	0.250	0.344
30	0.312	0.438
36	0.375	0.469
42	0.438	0.500

*Meets AREA "Specifications for Pipelines for Conveying Nonflammable Substances".

B. Carrier pipe shall be as specified in Technical Specification Section 02560, herein.

C. Casing end seals shall be 1/8 inch minimum thickness, specially compounded synthetic rubber casing end seals provided by a manufacturer that is regularly engaged in producing casing end seals.

D. Casing spacers shall be projection type totally non-metallic spacers constructed of preformed sections of high density polyethylene. Projection type spacers shall be RACI type spacers as marketed by Public Works Marketing, Inc. or approved equal.

PART 3 - EXECUTION

3-01 CONSTRUCTION REQUIREMENTS

A. Restore the work and adjacent areas to original appearance and compaction.

B. Installation of crossings under highways and railroad rights-of-way shall be performed in accordance with these specifications and requirements of the applicable permit(s) issued for such work.

C. Contractor shall install the carrier pipe through the casing at no additional charge to the Owner.

3-02 BORES

A. The transmission main shall be installed in steel encasement pipe as shown on the plans and in conformance with profile details. All boring shall be performed in accordance with the approved permits from Mississippi Department of Transportation, as well as in conformance with all applicable federal, state, city, or other requirements.

B. The installation of carrier pipe within encasement pipe shall be carried out in strict accordance with the pipe manufacturer's recommendations. At no time shall the Contractor be allowed to pull or push the pipe through the encasement pipe without taking proper care and, in the judgement of the Engineer, adequate measures to protect the pipe from any structural or coating damage.

C. The carrier pipe shall be installed in the encasement pipe in such a manner so that the pipe shall be electrically isolated from the encasement pipe.

1. Dry Boring

a. The encasement pipe shall be installed by drilling a hole of a size not larger than 1" greater than the outside radius of the encasement pipe.

b. Water bearing sands and mucky soils will be well pointed as necessary prior to commencing the bore.

c. All bores will be accomplished with the auger inside the casing pipe with the cutting edges position just ahead of the pipe.

d. Care should be exercised at all times to keep the auger properly positioned within the encasement pipe and to maintain sufficient forward pressure upon the encasement pipe to quickly run through any pockets of loose soil.

e. Borings shall be carefully observed for comparison between the amount of cuttings removed from the hole and the diameter of the bore together with the distance the auger has traveled in the bore. An excessive amount of cuttings removed from the bore indicates caving or spalling of the bore wall and the bore will be stopped until a method for completing the bore has been determined.

f. An acceptable fluid may be introduced by gravity flow approximately 3 feet back of the forward end of the encasement pipe to lubricate the cuttings in order to facilitate the removal thereof; however, the intemperate use of such fluid causing undue flow back and erosion of the bore shall not be permitted.

2. Wet Boring

a. The drilling fluid shall be used to lubricate the cutters or reamers, as a binder to bind the cuttings into plugs of appropriate length and to form a filter cake around the circumference of the bore in order to prevent cave-ins or spalling, to maintain the arch and also to lubricate the bore for easy removal of masses or plugs of cuttings from the bore by using compressed air. Liquids other than the drilling fluids described in Alternative 1 and 2 will not be used in the bore. The intemperate use of drilling fluid causing undue flow back and erosion of the bore shall not be permitted.

END OF SECTION

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SECTION 33 11 00
WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1-01 DESCRIPTION

A. These specifications shall govern the furnishings and installing of water distribution lines, fittings, valves, fire hydrants, and other appurtenances. The pipe and accessories shall be installed in accordance with the requirements of these specifications at the locations and depths indicated on the plans and shall be of the classes, sizes and dimensions shown thereon.

B. The installation of pipe shall include all joints, connections to new or existing pipes, and the installation of all fittings, valves, fire hydrants, and other appurtenances. The pipe and accessories shall be of the classes, sizes and dimensions shown thereon.

C. Water main shall be of PVC or DI manufacture as specified herein.

PART 2 - MATERIALS

2-01 PIPE, COUPLINGS AND ACCESSORIES

A. PVC Pipe:

1. All PVC pipe and fittings four (4”) inches and larger in diameter shall conform to the latest edition of AWWA C-900 and shall be made from Class 12454-A or B materials per the latest edition of ASTM D-1784. Pipe shall be a minimum of SDR 18 unless otherwise specified, for a working pressure rating of 150 PSI. All pipe shall conform with the outside diameter (OD) dimensions of ductile iron pipe to facilitate use of DIP fittings, standard cast iron valves and specials. All joints shall be elastomeric seals conforming to the latest edition of ASTM F-477. All pipe shall bear the seal of the National Sanitation Foundation (NSF). All jointing shall be made in accordance with the manufacturer's recommendations.

2. All PVC pipe three (3”) inches to (1-1/2”) inches in diameter shall conform to the latest edition of ASTM D-2241 and shall be made from Type 1120 material. Pipe shall be a minimum of SDR 26 unless otherwise specified, for a working pressure of 150 PSI. All joints shall be integral bell gasket in accordance with the latest edition of ASTM D-3139. Pipe shall bear the seal of the NSF. All jointing shall be made in accordance with the manufacturer's recommendations.

3. All PVC pipe (1”) inch and smaller in diameter shall conform to the latest edition of ASTM D2241 and shall be made from Type 1120 material. Pipe shall be a minimum af SDR 26 unless otherwise specified, for a working pressure of 150 PSI. All joints shall be solvent weld in accordance with latest edition of ASTM D-2855 with the solvent cement conforming to the latest edition of ASTM D-2564. All pipe shall bear the seal of the NSF. All jointing shall be made in accordance with the manufacturers recommendations.

B. Ductile Iron Pipe:

1. All pipe shall be centrifugally cast in metal or sand lined molds manufactured in accordance with the later edition of ANSI A21.51 (AWWA C-151). Pipe shall be class 350 Ductile Iron unless otherwise specified. All pipe and fittings shall be tested for minimum 150 PSI water working pressure laying conditions Type 2 flat bottom trench without blocking, tamped, backfilled and under five (5) feet of cover. All pipes and fittings shall be factory coated on the outside with coal tar enamel conforming to the latest edition of A 21.5 and lined inside with a minimum of 1/16 inch cement lining in accordance with the latest edition of ANSI A 21.4 (AWWA C-104).

2. Ductile iron pipe installed pursuant to these specifications shall be encased with an 8 mils thick loose polyethylene encasement in accordance with the latest edition of A 21.5 (AWWA C105).

3. Joints for ductile iron pipe shall be slip on type unless otherwise specified. All joints for fittings, valves and specials shall be mechanical joints. Slip on pipe joint for ductile cast iron pipe shall conform to the latest edition of ANSI A 21.11 (AWWA C 111) except that the joints shall be made with a special gasket seal Super-Bel Tite as manufactured by Clow Corporation or approved equal. Lubricants shall be non-toxic, odorless, tasteless and shall not support bacteria and shall be specifically manufactured for the pipe utilized. Mechanical joint pipes shall conform to the latest edition of ANSI A-21.11 (AWWA C-111).

4. All fittings shall be cast from ductile iron in accordance with ANSI/AWWA C153/A21.53. Fittings shall be listed by an approved certifying agency as conforming to the requirements of ANSI/NSF 61. The working pressure rating shall be 350 psi.

5. All fittings shall be tar coated outside and cement lined inside in accordance with the latest edition of AWWA C-104 (ANSI 21-4), except cement lining may be half of thickness (enameline type) with bituminous seal coating, per Federal Specification WW-PO42A where approved by the Engineer.

C. Valves:

1. Gate Valves shall comply with the latest edition of AWWA C-500 as manufactured by Mueller, American Darling or approved equal. Gate 0valves shall be iron body, fully bronze mounted, double disc, parallel seat, non-rising stem, and shall open counterclockwise. All gate valves shall have a maximum working pressure of 200 PSI and be tested at 400 PSI. The thrust collar and other bearing surfaces shall be permanently lubricated with oil. The disc mechanism shall be designed so that the seating pressure is applied equally at multiple separate contact points near the outer edge of each disc by a bronze or alloy wedging mechanism. Gate valves shall be equipped with mechanical joint connections unless otherwise specified.

2. Check Valves shall be iron body, spring loaded, swing type with straight away passage of full pipe area and renewable bronze seat ring with resilient faced disc. Valves shall be as manufactured by Mueller, American Darling or approved equal.

D. Services: Service piping shall be 200 PSI Polybutyl or Type "K" copper as specified on the Proposal and shall conform to the applicable AWWA/ASTM/ANSI Standards and designed for working pressure compatible with the water mains specified above.

E. Fire Hydrants:

1. Fire hydrants shall be Mueller Model "Centurion", American Darling Model B-84-B or approved equal. Hydrants shall be of the compression type with a 5 1/4 inch valve opening. All hydrants shall be nominal 6" size, 3-way construction with one 4-1/2" pumper nozzle and two 2-1/2" hose connections. Nozzle threads shall be National Standard unless otherwise specified. The depth of bury shall be 4 feet unless otherwise specified.

2. Hydrants shall be furnished with a sealed oil reservoir located in the bonnet so that all threaded and bearing surfaces are lubricated when the hydrant is operated. Hydrant shall be furnished with a breakable feature that will break cleanly on impact and shall consists of two part breakable flange with a breakable stem coupling.

3. Hydrants shall be wire brushed as needed and painted one coat of zinc primer and two coats of epoxy paint of the color specified by the Contracting Officer.

F. Valve Boxes:

1. Valve Boxes shall be two piece, screw type, 5 1/4 inch shaft, as manufactured by the Mueller Company, or approved equal. Contractor shall supply boxes with the correct base for all valves and in correct length for field conditions. The letter "W" or the word "WATER" shall be cast in the valve box cover.

2. Valve box castings shall be manufactured of clean, even grain, gray cast iron conforming to ASTM Designation A 48, Class 30B, Gray Iron Castings; and be smooth true to pattern, free from blow holes, projections, or other harmful defects. Coat the valve boxes with a single coat of coal tar pitch before machining, so that machined seating surfaces will be free of any coating. Machine the seating surfaces so that the cover will not rock.

G. Corporation Stops and Curb Stops: Corporation stops and curb stops shall be as manufactured by Mueller Company or approved equal.

H. Service Clamps: Service clamps shall be Smith Blair No. 315, coated, stainless steel straps.

I. Water Meters: Water meters shall be the positive displacement type with hermetically sealed registers and shall be read in gallons. They shall be manufactured by Rockwell Manufacturing Company, Badger Manufacturing Company or Neptune Company, or other passing test of apparent equivalence. Meters shall be complete with stub connections.

J. Specials: Specials shall be of the same material as the pipe material being used or as approved by the Engineer. The term specials shall include plugs, caps, and other items as needed. Specials shall conform to the applicable AWWA/ASTM/ANSI Standards and shall be designed for the working pressure of the water mains on which they are being installed.

2-02 BEDDING AND BACKFILL

A. Native material excavated from the trench shall be used for bedding and backfill under normal circumstances where allowed by the Contracting Officer.

B. Select bedding and backfill shall be provided where called for by the Contracting Officer and in additional areas where requested by the Contractor and deemed appropriate by the Contracting Officer. Select bedding may not be used as a means of avoiding trench dewatering. Select bedding and backfill shall meet the following characteristics:

Type A: A well graded uniform mixture of coarse concrete aggregate and course sand.
Type B: A sand-clay material with a maximum liquid limit (LL) of 30 and a plasticity index (PI) of less than 10.
Type C: A silty-clay material with a maximum liquid limit (LL) of 30 and a plasticity index (PI) of 5-15.
Type D: A freely draining sand with not more that 15% (by weight) silt or clay content.

PART 3 - EXECUTION

3-01 EXCAVATION

A. The Contractor shall perform all excavation of every description and of whatever substances encountered to the depth specified in the Contract Documents or as directed by the Contracting Officer. The bottom of all trenches shall be carefully shaped, graded and aligned in accordance with the instructions of the Contracting Officer and to his complete satisfaction before any pipe is placed. All trenches shall be excavated to a depth to maintain minimum cover over the installed pipe of at least 36" for pipe installed under ordinary conditions. The Contractor may reduce or increase the depth of bury at fire hydrant locations to avoid undesirable fire hydrant setting with the approval of the Contracting Officer. Minimum cover over the installed pipe shall be 42" under existing creeks or ditches, or as directed by the Contracting Officer.

B. Care should be taken in shaping and grading the ditch bottom to assure that the barrel of the pipe rests in uniform and continuous contact with the supporting ground over its entire length and that the bells or joints are entirely free from the bottom of the trench.

C. In the event it is necessary to place fill in the bottom of the ditch to obtain such uniform contact, it shall be made with approved material and thoroughly compacted in a manner satisfactory to the Contracting Officer. Holes of ample size shall be cut under and around all bells and joints to provide adequate room for making joints. A tolerance of 8 inches from the established grade may be permitted, when approved by the Contracting Officer, if excessive breaks in alignment at the joints prevent proper installation of the pipe.

D. When rock is encountered, the Contractor shall excavate to a depth at least 4 inches below the required grade and backfill to grade with 4 inches of select bedding.

E. If the established grade conflicts with other utilities, the water line grade shall be changed to avoid the conflict in a manner acceptable to the Contracting Officer.

3-02 SHEETING AND BRACING

A. The Contractor shall furnish and place to the satisfaction of the Contracting Officer, such sheeting and bracing as may be required to support the sides of the trench and to protect the workmen and pipe or adjacent structures from injury by the sloughing or caving of the trenches. The sheeting and bracing may be removed as the trench is backfilled, or may be left in place when necessary to prevent damage.

B. In the event sheeting or bracing is left in place, it shall not extend nearer than 1 foot to the surface of the ground. In no case will extra compensation be allowed for furnishing, placing, or removing any sheeting and bracing. The cost of this work shall be included in the lump sum bid for the project.

3-03 PIPE LAYING

A. General: PVC pipe shall be installed in accordance with the latest edition of ASTM D-2321 assuming the use of Class IV native material or better. Ductile iron pipe shall be installed in accordance with the latest edition of AWWA C-151 using Type 2 bedding and native material. Select bedding or backfill for PVC or DIP water main shall be provided where called for by the Contracting Officer in accordance with the Contract Documents.

B. Pipe, appurtenances, and fittings shall be laid to the line and grade established on the Plans and as directed by the Contracting Officer.

C. The inside of the bells and the outside of the spigots shall be thoroughly cleaned before they are placed. The inside of all pipe shall be thoroughly swabbed to ensure that the pipe is clean and free of obstructions and foreign matter until the work is completed.

D. Where pipe laying ceases at the end of the day or for any cause, the end of the pipe shall be securely closed in order to prevent the entrance of water, mud or any other objectionable matter.

E. Pipe shall not be laid when water is in the trench.

F. Thrust Block shall be installed at locations shown on the Plans and as otherwise directed by the Contracting Officer.

3-04 MAKING JOINTS

A. All joints shall be constructed in accordance with the manufacturer's recommendations using the jointing materials, specials and lubricants specified by the manufacturer and approved by the Contracting Officer.

3-05 SETTING FITTINGS, VALVES, HYDRANTS AND SPECIALS

A. All fittings, valves, valve boxes, hydrants and other appurtenances shall be set at the location indicated on the Plans or as directed by the Contracting Officer. Omission of any of these items shall be corrected by the Contractor without extra cost to the Government. The addition of any of these items not shown on the plans and not requested by the Government or Contracting Officer which are installed without the expressed consent and agreement of the Contracting Officer shall not be allowed for payment but shall be considered as absorbed costs to the Contractor. In addition, any fittings or specials installed by the Contractor purely for his convenience shall not be allowed for payment unless specifically approved by the Contracting Officer. Valves and fittings shall be jointed to pipe as recommended by manufacturers.

B. All valves, including bypass valves, shall be provided with a valve box. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut with the cover flush with the pavement surface or such other level as directed. Valve box slabs or marker posts shall be provided where specified in the Contract Documents or as directed by the Contracting Officer as an absorbed cost to the Contractor.

C. Hydrants shall be located as shown on the Plans and in a manner that will provide complete accessibility and will prevent damage from vehicles. All hydrants shall stand plumb and shall have their pumper connections at right angles to the curb line. The center of streamer nozzle shall be 18" above top of finished ground or top of curb where applicable. Where necessary, hydrant extensions shall be furnished at no additional cost to the Government, to meet this requirement.

1. Each fire hydrant shall set truly vertical and securely braced with concrete or stone blocks until it is self standing. It shall be set on a stone or concrete slab not less than four (4) inches thick and not less than one square foot of surface area placed on well compacted soil surrounded by a minimum of seven (7) cubic feet of sound broken stone or clean gravel to permit free draining of the hydrant. The gravel or stone shall reach from the bottom of the trench to a least six (6) inches above the waste opening of the hydrant.

2. All hydrants, valves and fittings shall be anchored with steel all-thread rods (3/4" minimum) as indicated on the Plans or with anchor couplings approved by the Contracting Officer.

3-06 SERVICE ASSEMBLIES AND SERVICE LINE INSTALLATION

A. Assemblies shall consist of a corporation stop, service clamp, curb stop and other appurtenances needed to complete the assembly in accordance with the Contract Documents. They shall be installed in a good and workmanlike manner in the places designated on the Plans or as directed by the Contracting Officer. The ends of the service shall be plugged, permanently marked with a metal "T" post, painted "Blue" and extending a minimum of 24" above finished grade. Ends of services shall be located from two property corners and shown on Contractor's record drawings also during the construction of the curb a **"W"** shall be inscribed into the curb at the service crossing locations.

B. Meter boxes, meters and service line shall be as specified herein and will be included in the lump sum bid for the project.

3-07 CONNECTION TO EXISTING MAINS

A. Where indicated on the Plans, cut-ins must be made by the Contractor in order to connect the new main with existing water mains. The Contractor shall furnish all labor and materials and service required for the excavating, cutting the existing mains, removal and relocation of sections of old pipe, dewatering the trench, connection the new main with the old and the setting of necessary fittings, specials and valves as shown on the Plans.

B. The Contractor shall provide temporary blocking and bracing properly placed to prevent movement or blowing off of any pipe, valves or fittings due to water pressure on the main. All connections shall be made in a most expeditious and workmanlike manner to cause the least inconvenience to water customers and to traffic, and shall be made at night unless otherwise approved by the Contracting Officer.

C. Any time that the interruption of water service in the existing system is necessary because of operations under this Contract, the Contractor shall notify the Government at least 48 hours in advance. Interruptions of water service shall not extend over night or through the weekend unless approved by the Contracting Officer.

3-08 BACKFILLING TRENCHES

A. Backfilling shall be carefully performed and the original surface restored, to the full satisfaction of the Contracting Officer. The trenches shall be backfilled with fine, loose earth, free from large clods or stones, carefully rammed until enough has been placed to provide a cover of not less than 1 foot above pipe. The remainder of the backfill material in unpaved areas shall be placed in the trenches, and any excess materials shall be windowed over the trench. As settlement occurs, trenches shall be refilled, smoothed off, and made to conform to the surface of the ground until settlement ceases.

B. Backfill in roadways, drives or in areas to be paved shall be made as specified above except that fill above the pipe shall be deposited in layers not to exceed 6 inches. Such fill shall be compacted with mechanical tampers so that the compacted soil shall have a density of at least that of the undisturbed adjacent ground or 95% maximum optimum moisture density. Backfill material shall be sand-clay, clay-gravel or other approved material. Disposal of surplus material shall be as directed by the Contracting Officer.

3-09 TEMPORARY SURFACES OVER TRENCHES

A. Whenever the wastewater improvements are constructed under traveled roadways, driveways, sidewalks or other traveled surfaces, a temporary surface shall be placed over the top of the trench as soon as possible after placement and compaction of the backfill has been satisfactorily completed. The temporary surface shall consist of a minimum of twelve inches (12") of clay gravel.

B. The top of the temporary surface shall be smooth and meet the grade of the adjacent undisturbed surface. The temporary surface shall be maintained at the Contractor's expense until final restoration of the street surface is completed as specified. No permanent restoration of street surface shall be initiated until authorized by the Contracting Officer. The temporary surfacing shall be required over the entire width of the trench.

3-10 REPLACEMENT OF PERMANENT SURFACES, STRUCTURES AND PROPERTY

A. General: The Contractor shall restore all permanent type pavements, sidewalks, driveways, curbs, gutters, shrubbery, fences, poles and other property and surface structures removed or disturbed during or as a result of construction operations to a condition which is equal in appearance and quality to the condition that existed before the work began. The surface of improvements shall be constructed of the same material and match in appearance the surface of the improvement which was removed. Where select granular trench backfill is used, the restoration shall be made as soon as possible after compaction of the backfill has been completed.

B. Concrete Pavement Surface: Where the existing pavement surface is Portland Cement concrete, the pavement replacement shall consist of a minimum of six (6) inches of reinforced concrete placed over six (6) inches of compacted clay gravel or sub-base. Concrete shall conform to Section 03 30 00 "Castin-Place Concrete". The concrete surface shall be finished equal to the existing finish (ie., trowel, broom, exposed aggregate, etc.). Pavement joints in the replacement surface shall conform to and match the joints in the adjacent pavement area.

C. Asphalt Pavement Surface: Where the existing pavement surface is bituminous concrete and 12" of clay gravel has been placed in the trench the, top 6" of gravel shall be removed and replaced with 4" of black base and 2" of surface course.

3-11 CONCRETE SIDEWALKS, DRIVEWAYS, CURB, CURB AND GUTTER

A. General: Where necessary to remove and replace concrete sidewalks, driveways, curbs and curb and gutters, replacements shall be made as follows:

B. Concrete sidewalks, driveways, curbs and curb and gutters shall be replaced with concrete meeting the applicable provisions of Section 03 30 00 "Cast-n-Place Concrete" of these Specifications. Minimum thickness shall be four inches (4") for sidewalks and six inches (6") for driveways. Materials and construction requirements shall conform to the various Sections of these Specifications. Curb and gutter shall be formed as detailed on the Drawings or as directed by the Contracting Officer. Sidewalks and driveways shall be finished to match existing adjacent surfaces, unless otherwise specified or directed by the Contracting Officer.

3-12 RESTORATION OF LANDSCAPED AREAS

A. Sod, shrubbery, decorative planting and other landscape items shall be replanted, replaced or restored in the manner removed.

B. Should new construction be required to replace damaged or unsalvageable items, then the Contractor shall furnish all labor, materials, equipment, tools, and incidentals set forth in the applicable Sections of these Specifications.

3-13 MAINTENANCE OF SITE:

A. The Contractor shall prevent, control and correct dust nuisance or muddy conditions developing on roadways as a result of his operation. No payment for maintenance of the site shall be made but shall be considered as a subsidiary obligation of the Contractor.

3-14 COORDINATION WITH INTERESTED PARTIES OTHER THAN OWNER

A. The Contractor shall duly notify and coordinate all work with the City, the local Health Department and other interest parties. No work which affects these interested parties will commence until satisfactory coordination has been achieved.

3-15 HYDROSTATIC TESTS

A. After the pipe is laid and the line flushed, it shall be filled with water with care being exercised to expel all air from the pipe. During the test period all pipe, valves, fittings, and joints shall be examined carefully for defects. Any observed leaks or defective pipe shall be satisfactorily repaired or replaced, at the expense of the Contractor and the test repeated until the section tested is within the limits prescribed hereinafter. The entire distribution system or parts thereof shall be tested under hydrostatic pressure of 150 psi, for a period of 4 hours, if joints are exposed, or for an 8 hour period, if joints are covered. Repairs shall be made using approved materials and new replacement fittings, specials, or gaskets where leakages occur.

B. Leakage shall be measured by an approved calibrated meter through which all of the water required to maintain test pressure shall be pumped. All testing shall be performed in the presence of the Contracting Officer, and the Contracting Officer shall be notified at least 24 hours in advance of the start of the test.

C. The Contractor shall furnish the pump, pipe connections, fittings, gates, meters, and all necessary apparatus and shall furnish all labor and work required to make the tests. All costs of testing shall be borne by the Contractor and testing operations shall remain in operation until approved by the Contracting Officer. Allowable leakage shall not exceed 10 gallons per 24 hours per inch of diameter per mile of pipe, at the specified test pressure.

D. Tests shall be completed in accordance with the latest edition of AWWA C-600 except as modified herein.

3-16 STERILIZATION OF PIPELINES

A. General: Thoroughly disinfect all water pipe on potable water lines prior to being placed in service. Follow the applicable provisions of the procedure established for the disinfection of cast iron pipe as set forth in the latest edition of AWWA C-601 entitled "Disinfecting Water Mains."

B. During the Construction: Workmen shall be required to use utmost care to see that the surface of parts of the structures, the inside of pipes, fittings, jointing materials, valves, and specials which come in contact with the City's water, are maintained in a sanitary condition. Every effort shall be made to keep the inside of the pipe, fittings and valves free of all foreign matter, sticks, dirt, rocks. As each joint of pipe is being laid, it shall be swabbed so that all foreign matter is removed. All fittings and exposed open ends of pipe shall be blocked or capped until the line is completed.

C. When the entire pipe line or certain selected sections thereof have been completed, tested and made ready for turning over to the Government ready for use, the line or section of line shall be thoroughly

sterilized according to the following procedure: The new pipe shall be disinfected by introducing HTH, Percloron, or a similar hypochlorite solution, through taps made by the Contractor. The water shall be turned into the mains slowly to allow a thorough mixing of the solution which shall be brought to a strength of 50 parts per million of available chlorine. All valves shall then be closed and the sterilizing solution permitted to remain in the pipe line section for not less than 24 hours, after which the mains shall be flushed thoroughly until a chlorine residual not exceeding two tenths (0.2) part per million is obtained.

D. Samples shall be collected under supervision of the Contracting Officer, using only approved bottles furnished by the State and will be tested by the State Health Department. **All samples shall be taken by a Registered Engineer, Certified Operator, or a representative of the Mississippi State Department of Health.** The Contractor shall arrange for the collection of samples from the end of each dead end line or from each major loop for bacteriological examination. A copy of test results shall be furnished to the Government and the results obtained shall be deemed conclusive. If the test shows satisfactory quality of water, the line so sterilized may then be placed in service. If the sample shows unsatisfactory quality of water the process of sterilization shall be repeated until a satisfactory water is obtained. All materials, testing and labor required for complete sterilization of the system shall be furnished by the Contracor at no expense to the Government.

E. Prior to final acceptance, the Contractor shall sterilize and resterilize the water mains until two (2) consecutive samples of water are found to meet the State Health Department standards for water supplies. No coliform bacteria and no indication of confluent growth shall constitute a satisfactory sample when analyzed by the Mississippi Department of Public Health Laboratory or a laboratory certified by the Department.

3-17 DISPOSAL OF CHLORINATED DISINFECTING WATER

A. The Contractor shall be responsible for the disposal of chlorinated used for disinfecting mains under this contract. Chlorinated waters shall be dechlorinated to a residual concentration of no greater than 0.5 mg/l total residual chlorine prior to disposal to water courses, on land or through storm or sanitary sewers. The method of disposal shall be in conformance with requirements of the Mississippi Office of Pollution Control, the Mississippi Department of Health, and other state, federal or local agencies holding jurisdiction. The Contractor will provide written confirmation from these agencies that the method of disposal is acceptable and will provide licenses or permits required for the discharge of the dechlorinated water. The Contractor will comply with requirements of agencies having jurisdiction whether additional to or different from those included herein, at no additional cost to the Government. Cost associated with disposal of chlorinated disinfecting water shall be considered incidental to the cost of the pipeline and shall be absorbed in the cost of the project.

3-18 CLEAN-UP

A. In areas where the water mains have been backfilled, the CONTRACTOR shall clear the right-of-way and surrounding ground, and shall dispose of all waste materials and debris resulting from his operations. He shall fill and smooth holes and ruts and shall repair all miscellaneous and unclassified ground damage done by him and shall restore the ground to such a stable and suitable condition as may be reasonably required, consistent with the condition of the ground prior to construction.

B. Clean-up, including grading, disposal, dress work and other incidentals shall be completed by the Contractor at no additional cost to the Government to the extent directed by the Contracting Officer.

3-19 CLEARANCE BETWEEN WATER AND SEWER LINES

A. Where water and sewer lines run parallel to each other, there shall be maintained a 10 foot horizontal clearance between the water line and the sewer line.

B. Whenever sewer lines cross water lines, the sewer line shall be a depth of not less that 18" below the water line and the water line joints shall be at least 10 feet from the sewer line.

C. Where these conditions cannot be maintained, DIP water main shall be used for a distance of 10 feet either side of the sewer at crossings.

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SECTION 33 30 00
SANITARY SEWERAGE – GRAVITY PIPING

PART 1 - GENERAL

1-01 DESCRIPTION

A. In accordance with the requirements of these Specifications, the Contractor shall furnish and install materials and perform work necessary for or incidental to constructing sanitary sewer gravity piping complete and ready for use.

B. The work shall include excavation, trenching and backfilling; furnishing and installing trench sheeting, shoring and bracing; furnishing and installing pipe, specials, services, manholes and related appurtenances; storage and protection of materials; testing, cleanup and other operations necessary to complete the work in accordance with the Specifications and Drawings. C. Sanitary sewer installed by pipe bursting is specified elsewhere.

1-02 CONTRACTOR'S EQUIPMENT

A. The Contractor shall provide and maintain the equipment necessary to prosecute the work in an orderly and safe manner. The equipment shall consist of suitable units designed or selected to perform and expedite the work and incidental items of construction.

1-03 CONFLICTS WITH OTHER UTILITIES

A. Where the location of the sewer is not clearly defined by dimensions on the Drawings or unless otherwise directed by the Engineer, the sewer shall not be laid closer horizontally than ten feet (10') to a water supply main except that where the bottom of the water pipe will be at least eighteen inches (18") above the top of the sewer pipe, horizontal spacing may be a minimum of six feet (6'). **Water and sewer pipe shall NOT be laid in the same trench.** Where gravity flow sewers cross above water lines, the sewer pipe, for a distance of ten feet (10') each side of the crossing shall be fully encased in concrete.

B. Where sewer construction conflicts with underground utilities which are indicated to remain in place, the Contractor shall be fully responsible for protecting these facilities and for restoring the portions of those lines which are damaged or severed as a result of his operations. Where existing lines in conflict are indicated to be removed by others, the Contractor shall cooperate with the Owner of these utilities to the end that these conflicts may be removed prior to excavation for the
sewers.

1-04 APPLICABLE DOCUMENTS

A. All referenced publications form a part of this Specification and, where referred to by basic designation only, are applicable to the extent indicated. Reference is to the latest edition of each unless specified otherwise.

B. Local Building Codes: City, County, States or Federal Codes applying to the work.

C. Miss. Standard Specifications for Road and Bridge Construction, latest edition: Sections as referenced herein.

1-05 SUBMITTALS: The Contractor shall submit testing reports, manufacturer's certifications, shop drawings, manufacturer's catalogs, specification sheets and other incidentals, to the Engineer, prior to ordering material.

PART 2 - PRODUCTS

2-01 GENERAL

A. The Contractor shall furnish materials necessary for or incidental to constructing a gravity sanitary sewer system. Materials shall be new and of first quality with certified tests for pipe and pipe fittings made at the manufacturers plant to assure conformance with these technical provisions. Three (3) certified copies of each test result shall be furnished to the Engineer prior to installation.

B. The kinds and classes of materials incorporated into the work shall be designated by the Engineer. The Contractor shall not construe or interpret the several kinds of materials described herein as being equal in their application for the project.

2-02 WATER FOR CONSTRUCTION AND TESTING

A. The Contractor shall be responsible at his expense for water needed in constructing the work, flushing the completed system, testing and other incidental needs. Water used shall be from an approved source relatively free of pollution and shall be of a satisfactory bacteriological quality. Contractor shall remove all water from pipelines upon completion of testing at his expense.

B. Water used in mixing concrete and mortar shall be fresh, clean and potable, suitable for drinking.

2-03 PIPE AND FITTINGS

A. PVC Large Diameter Heavy Wall Closed Profile Pipe

1. General: The work in this section includes furnishing all labor, equipment, and materials required to supply, install, and test (PVC) closed profile wall pipe, including accessories, as shown on the drawings and/or specified herein. All pipes shall be furnished by a manufacturer with a minimum of five years experience producing closed profile PVC pipe. The pipe manufacturer will also be required to provide a list of not less than 10 successfully completed projects.

2. Quality Assurance:

a. The contractor shall submit to the Engineer written evidence that the pipe furnished under this specification is in conformance with the material and mechanical requirements specified herein. All pipes to be installed under this contract shall be inspected at the plant and certified by an independent agency, pre-approved and chosen by the design engineer for compliance with this section.

Each PVC closed profile wall pipe length and fitting shall be clearly marked with the following:

1) Manufacturer's Name
2) Nominal Pipe Size
3) Cell Classification
4) ASTM F 1803 Designation
5) Uni-Bell Plastic Pipe Association Designation ("UNI-B-9")
6) **Pipe Stiffness - 60 PSI per ASTM D-2412**

b. All pipe shall be factory air tested with gasket in place and marked accordingly.

3. Handling/Storage

a. The pipe shall be handled carefully with nylon slings. The pipe can be unloaded/transported with construction equipment rigged with an "extra long fork" attachment.
b. All pipe and accessories shall be stored on flat, level ground with no rocks or other objects under the pipe.
c. The maximum stacking height for PVC closed profile wall pipe shall be as directed by the manufacturer.

Pipe Size	Number of Rows
21"	6
24"	5
27"	5
30"	4

4. PVC Pipe Materials

a. General
   1) Apart from structural voids and hollows associated with profile wall designs, the pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions and other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density and other physical properties.
   2) Unless otherwise shown on the drawings or directed by the Engineer or manufacturer, the maximum depth of cover, measured from the pipe crown to the ground surface, permitted for all 21" to 54" sizes will be 30 ft. with standard bedding. The allowable depths are based on the assumption that the ground water level or phreatic surface is at surface grade elevation.

b. PVC Large Diameter Heavy Wall Closed Profile Pipe

1) PVC profile wall pipe and fittings shall be manufactured in accordance with the requirements of ASTM F 1803 latest edition.
2) PVC profile wall pipe shall be made from a compound meeting the requirements of cell classification 12364A as defined by ASTM D 1784.

c. Joints
1) PVC profile wall pipe joints shall be the bell and spigot type, and shall conform to ASTM D-3212.
2) Gaskets shall meet the requirements of ASTM F 477 and be molded into a circular form or extruded to the proper section, then spliced into circular form, and shall be made of a properly cured high grade elastomeric compound.
3) Gaskets shall be factory installed and chemically bonded to the bell end of the pipe. Field installed gaskets and field cut beveled lengths of pipe shall be done in accordance with the manufacturer's instructions and recommended equipment and materials.
4) All pipe gaskets and spigots will be thoroughly cleaned and lubricated before assembly.
5) The use of putty, filler, rubber or plastic inserts to form either the inner or outer wall of the pipe will not be allowed on spigots or bells.
6) Gaskets shall be of a four finned design and shall have a minimum sealing width of 3.25 inches.

5. Service Connections

a. Lateral connections to PVC profile wall pipe may be made using Inserta- tee as manufactured by the Fowler Manufacturing Company, of the Predco Fast Fit tap system or approved equal.

b. All saddle or tapping tees will be installed per manufacturer's recommendation. If exposed, channels in the PVC profile will be filled with 3M industrial sealant No. 602.

c. All straps, housings, fasteners, and other hardware for any lateral connections, including transition from building or the source piping stub-out, shall be constructed of stainless steel.

6. Customer Inspection: The Engineer shall be entitled to inspect pipes and witness the manufacturing process.

C. **Solid Wall PVC sewer pipe and fittings**: Shall be solid wall in accordance with ASTMD-3034, SDR 26 minimum for sizes 4" through 18". Joints shall conform to ASTM D-3212 and be elastomeric gasket conforming to ASTM F-477. Depth of bury for PVC pipe shall not exceed limits acceptable to the Engineer. Jointing shall be completed in accordance with manufacturer's specifications.

PVC pipe shall be designed to provide a minimum pipe stiffness value of 115 psi for SDR 26 for all sizes when tested in accordance with ASTM Standard Specification D-2412 at a deflection of five percent (5%).

Solid Wall PVC pipe shall be limited to the maximum trench depths shown in the following table. MAXIMUM TRENCH DEPTHS FOR SOLID WALL PVC PIPE

PIPE	PIPE	BEDDING DESIGNATION	TYPE	DIAMETER	MAXIMUM DEPTH TO INVERT OF PIPE CLASS "1"	CLASS "2"
SDR 26		6"		20'	20’-30'	SDR 26
	8"		20'		20’-30'	
SDR 26		10"		20'	20’-30'	
SDR 26		12"		20'	20’-30'	
SDR 26		15"		20'	20’-30'	SDR 26
	18"		20'		20’-30'	

2-04 MARKING SEWER PIPE

A. Each pipe or fitting shall have plainly and permanently marked on the outside the following: (1) pipe class or D-Load; (2) date of manufacture; and (3) manufacturer's name or trademark. Marking shall be neatly stamped in the pipe or painted thereon with waterproof paint.

2-05 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall be responsible for the condition of excavations made by him. Slides and caveins shall be removed without extra compensation, at whatever time and under whatever circumstances that may occur. **The Contractor is solely responsible for maintaining safe working conditions in accordance with OSHA regulations.**

B. Installation of sheeting, shoring and bracing shall be the responsibility of the Contractor. Shoring left in place shall not entitle the Contractor to claims for extra compensation unless so indicated on the Bid Form as a separate pay item.

2-06 INCIDENTAL MATERIALS

A. Gray Iron Castings: Shall conform to the standard specifications for gray iron castings ASTM A-48, Class 25.

B. Foundations: Shall be either precast units or poured in place reinforced concrete as detailed, set on undisturbed earth or select bedding, where required by the Engineer or detailed on the

Drawings. Concrete shall be Class "B" 4,000 PSI as specified in Section 03300 "Concrete General"

C. Bituminous Waterproofing: Shall be applied to the exterior of all concrete structures up to the ground line.

D. Grout: Grout shall be commercial non-shrink, non-stain grout by Euclid or approved equal.

2-07 MATERIALS FOR SUPPLEMENTARY WORK

A. Materials for supplementary work consisting of repairs and replacement of street paving, sidewalks, driveways, parking areas, clay gravel areas, curbs, lawns, grass plots and other related items shall conform to the respective Sections of these Specifications, or as specified on the Drawings.

2-08 BEDDING AND BACKFILL

A. The pipe shall be installed in accordance with the requirements specified in Part 3, hereafter. Native material excavated from the trench may be used for backfill, where allowed by the Engineer from one foot above the top of pipe to the top of the trench. Such native material shall be non-organic, debris-free soil. Material required for select bedding and backfill is specified in paragraph B hereafter.

B. Select Bedding and Backfill: Select bedding and backfill material shall be considered as material hauled in from off site. Material used in meeting this specification shall be measured or paid for separately and shall be only at the approval of the Engineer. Testing costs incurred for tests required to verify that material meets this Specification shall be borne by the Contractor.

1. Select Bedding: Select granular material for bedding all pipe shall be crushed limestone aggregate or crushed gravel aggregate. The aggregate shall conform with the gradation sizing Number 67 specified in Table 2 of ASTM Standard Specification C-33 as follows:

GRADING REQUIREMENTS FOR COARSE AGGREGATE (ASTM C-33. TABLE 2, SIZE 67)

	PERCENT SIEVE SIZE PASSING BY WEIGHT
1 Inch	100
3/4 Inch	90-100
3/8 Inch	20-55
No. 4	0-10
No. 8	0-5

2. Select Backfill: Select material for backfilling pipe trenches shall be select sand-clay material meeting the following gradation limits.

SIEVE SIZE PASSING SQUARE MESH SIEVES	PERCENTAGE (BY WEIGHT)
No. 10	30-100

The material passing the No. 10 sieve shall meet the following:

No. 10	100
No. 40	20-85
No. 60	15-70
No. 200	8-40

The material passing the No. 40 sieve shall meet the following:

Liquid Limit Max.	25

Plasticity Index (P.I.)	NP to 6 Max.

PART 3 - EXECUTION

3-01 GENERAL

A. Install gravity sanitary sewer mains where shown on Drawings, in compliance with manufacturer's instructions.

3-02 SITE PREPARATION

A. The Contractor shall prepare, on a timely basis, rights-of-way, easements and sites indicated on the Drawings for construction of the wastewater improvements. The work shall include clearing and grubbing, removal of structures and obstructions, and the removal of permanent surfaces and landscaping items designated to be restored upon completion of the installation.

B. Clearing and grubbing shall conform to the requirements specified elsewhere herein and shall include the removal of trees, roots, vegetation, structures and obstructions unless separate pay items are specifically provided for on the Bid Form. The completion of clearing and grubbing shall leave the site clear and free from undesirable obstructions, ready for trench excavation.

C. The removal of permanent surfaces and the subsequent restoration of the surfaces shall be as set forth below and in other sections herein where applicable.

3-03 REMOVAL OF PAVEMENT, SIDEWALKS, DRIVEWAYS AND CURBS

A. Whenever the wastewater improvements are to be located along or across an improved surface, the width of the trench shall be held as nearly as possible to the maximum width specified below. Where brick or concrete pavement, sidewalk, driveway or curbing is cut, the width of the cut shall exceed the actual width of the top of the trench by twelve inches (12") on each side or a total of two feet (2'). Exposed surfaces of Portland cement or asphaltic concrete shall be cut with a pavement saw before breaking. Care shall be taken in cutting to insure that a straight joint is sawed.

NOMINAL SEWER DIAMETER (FEET) (FEET)	MAXIMUM TRENCH WIDTH PREMANENT SURFACE AND (INCHES)	MAXIMUM WIDTH OF PIPE CURB & GUTTER REMOVAL
12 or less	5.00	7.00
15	5.00	7.00
18	5.00	7.00
21	6.00	8.00
24	6.00	8.00
27	7.00	9.00
30	7.00	9.00

3-04 REMOVAL OF LANDSCAPE VEGETATION: Developed areas, yards, lawns, shrubbery and other decorative plantings that must be removed shall be stored and growth maintained by watering and fertilizing. The work shall be accomplished in accordance with prevailing local nursery practices with consideration given to seasonal limitations.

3-05 SELECTED STRIPPING: In landscaped, agricultural or cultivatable areas, the top twelve inches (12") of the ground shall be stripped and stockpiled for subsequent replacement after backfilling the pipe trench. The Contractor shall strip an area that will include the open limits of the trench plus the area that will be used to stockpile all suitable backfill material from the trench excavation. The stripped material shall be stockpiled in an area that will not hinder or endanger the construction process. The location and manner of stockpiling shall be reviewed by the Engineer.

3-06 EXCAVATION AND TRENCHING

A. Excavation of every description and of whatever substances encountered shall be performed to the depths indicated on the Drawings or as otherwise specified. Excavation shall be done by open cut from the surface except when tunneling or boring is specified or directed in writing by the Engineer. Trench width shall be kept as narrow as practical to provide a safe working area and to minimize excavation, and shall be maintained in strict compliance with OSHA regulations.

B. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Excavated materials not required or not suitable for backfill shall be removed and wasted as directed by the Engineer. Grading shall be done as necessary and at Contractor’s expense to prevent surface water from flowing into trenches or other excavations. Water accumulating therein shall be removed by pumping or by other approved methods. Temporary sheeting and shoring shall be used where necessary for the protection of the work and for the **safety of the personnel.**

C. During excavation, materials meeting select bedding and/or backfill requirements shall be either separately or selectively stockpiled for use as pipe bedding and pipe backfill material. Aggregate bedding material and sand material shall be handled and stockpiled in such a matter to prevent mixing with clay material when re-handled for backfilling.

D. Excavation for manholes shall be sufficient to permit the carrying out of the construction as required.

E. Trenches for process piping and other appurtenances shall be of only such width as necessary for proper lying of the pipe and for adequate select backfill. The net width of the trench at and below the top of the pipe shall be at least the pipe O.D. plus twenty four (24) inches. The width of the trench above this level may be as wide as necessary for sheeting, bracing, and shoring or **for proper safe performance of the work.**

F. The sides of the trench shall be maintained in strict compliance with OSHA regulations.

G. The bottom of the trench shall be carefully graded, formed and aligned according to these Specifications and reviewed by the Engineer's observer before piping is laid thereon. The bottom of the trench shall be hollowed under each pipe joint to conform to the shape of the pipe, and

holes shall be cut for the bells, allowing the body of the pipe a uniform contact and support throughout its entire length.

H. The Contractor shall leave a minimum 2 foot berm width on each side of the trench between the trench and the excavated earth, to allow the free passage of workmen, the Engineer's representative, and to permit work in a safe, expeditious and satisfactory manner.

I. No more than three hundred (300) feet of trench shall be opened in advance of the completed sewer, nor shall more than one hundred (100) feet be left unfilled except by permission from the Engineer. In special cases, the Engineer, when so requested by the Contractor, may waive the distance restriction to which the trench may be opened by notifying the Contractor in writing.

3-07 TUNNELING OR BORING

A. Tunneling will be permitted only where indicated on the Drawings or by special permission of the Engineer and in accordance with sections entitled – Roadway Crossings for Utility Lines or Horizontal Directional Drilling.

3-08 SHEETING, SHORING AND BRACING

A. Sheeting, shoring, and bracing shall be furnished, placed and maintained by the Contractor as may be required to support the sides of the excavation. The Contractor shall be fully responsible for the sufficiency of such supports to prevent movement which can injure or delay the work or endanger or cause damage to adjacent pavements, buildings or other structures, channels and drainage structures, **or create undue hazards to workmen.** Where in the opinion of the Engineer, damage is likely to result from withdrawing sheeting, the sheeting shall be left in place. **The material and installation requirements for sheeting, shoring and bracing shall be in accordance with applicable sections of the Mississippi Standard Specifications for Road and Bridge Construction, latest edition.**

B. Sheeting, shoring and bracing which are not ordered by the Engineer to be left in place shall be removed in such manner as not to endanger the constructed sewer or other structures, utilities or property. Voids left or caused by the withdrawal of sheeting shall be immediately refilled with sand by tamping with tools specifically adapted to the purpose, by watering, or otherwise as may be directed.

3-09 EXCAVATED MATERIAL

A. Excavated material from trench and structure excavation suitable for backfill shall be placed compactly on the sides of the excavation and kept up so as not to endanger the work and be of as little inconvenience as possible to the public travel and abutting property, and so that free access is maintained to fire hydrants and water valves in the vicinity of the work. Material encountered in the excavation which, in the opinion of the Engineer, is not suitable for use in the work, shall be removed and wasted as directed and shall not be stockpiled along the side of the excavation.

B. The disposal of surplus and unsuitable excavation shall be the responsibility of the Contractor at his own expense. Surplus and unsuitable material not to be used in the construction of the project

shall not be left on the right-of-way or easement of the project or adjacent thereto, except by written permission of the affected property owner.

3-10 DEWATERING

A. The Contractor shall be solely responsible for implementation of adequate dewatering provisions.

B. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of surface and ground water entering excavations, trenches or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built or the pipe to be installed therein is complete to the extent that no damage from hydrostatic pressure, flotation or other cause will result. The normal water table shall be restored to its natural level in such a manner as not to disturb the pipe and its foundation.

C. Excavations for trenches which extend down to or below static ground water shall be dewatered by lowering and keeping the ground water level beneath such excavations eighteen inches (18") or more below the bottom of the excavation; except where the pipe is laid in an impervious strata, the lower trench section shall be maintained in a dry condition for bedding. The dewatering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the trench.

D. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

E. The Contractor will be held responsible for the carrying capacity of pipe or conduit which he may use for drainage purposes. Pipes or conduits shall be kept clean and free of sediment or other restrictions.

3-11 STEEL SHEET PILING

A. Unless required by the drawings, steel sheet piling shall be driven at locations to be determined by the Contractor as necessary for protection of buildings, structures, utilities, channels or to prevent hazards to workmen. Piling may be new or used and shall be in such condition that it can be interlocked and driven satisfactorily.

B. The Contractor shall be responsible for adequately bracing the units against lateral forces. Piling shall be driven before final adjacent excavations are made.

C. Pile driving equipment used shall be maintained in first class condition and shall operate efficiently in the space provided. Equipment shall be subject to the review of the Engineer.

D. **The material and installation requirements for sheet piling shall be in accordance with applicable sections of the Mississippi Standard Specifications for Road and Bridge Construction, latest edition.**

3-12 PIPE PLACEMENT

General: Unless otherwise noted on the Drawings or directed by the Engineer, the bed for the pipe shall be so shaped that at least the lower quarter of the pipe shall be in continuous contact with the bottom of the trench.

1. When bell and spigot pipes or pipe couplings are used, spaces shall be cut to accommodate the bells or couplings. These spaces shall be deep enough to ensure that the bells or couplings do not bear the load of the pipes. When the pipes are laid, the barrel of each section of pipe shall be in contact with the quadrant shaped bedding throughout its full length, exclusive of the bell or coupling, to support the entire load of the pipe. Adjustments to line and grade shall be made by scraping away or filling in and compacting the earth under the body of the pipe and not by wedging or blocking up the pipe. Pipe shall not be laid on frozen ground.

2. Before pipe is laid in the trench, the section in which pipe is to be placed must be dry and must be kept dry while joints are completed. Pipes, prior to being lowered into the trench, shall be thoroughly inspected by the Contractor's forces so that when jointed in the trench, there shall not be shoulders or unevenness along the lower half of the pipe. The faces of spigot ends and shoulders in the hubs or sockets shall be true. Abnormal enlargements on these faces shall be cut away before the pipe is lowered into the trench.

3. The pipe shall be laid upstream, without breaks and with the bell end upgrade. Whenever the work ceases for any reason, the unfinished end of the pipe line shall be securely closed with a tight-fitted plug or cover. Pipe shall be so placed and maintained, that at the time of final acceptance of the project, the completed lines will be true to the established alignment and flow line grades.

4. Gravity sewer - Construction shall begin at the lowest point, or elevation, and the pipe shall be laid continuously upstream without omitting sections or reaches.

B. The installation and joining of pipe shall be in strict accordance with the applicable ASTM or AWWA Standards and the pipe manufacturer's recommendations.

C. The trench subgrade shall consist of firm, stable, non-organic, debris-free soil. In locations where trench excavation exposes unsuitable material, as classified by these specifications, or in the judgment of the Engineer, the subgrade shall be undercut as directed by Engineer for the full design width of the trench and backfilled with select bedding material meeting the requirements of Part 208, herein, and installed in accordance with the requirements of Part 3-12.

3-13 PIPE BEDDING

A. The pipe shall be placed on compacted select bedding material shaped and placed on the trench bottom. The initial lift and each successive bedding lift up to the level of 1 foot above the top of the pipe shall be placed in lifts of six (6) inches or less and should be compacted to not less than **92** percent of standard Proctor maximum dry density (ASTM D 698) by hand tamping or by utilizing a hand-held mechanical compactor. Material shall be in accordance with Paragraph 2-08. The moisture content within the bedding soils should be as required to provide a firm and stable condition for compaction. The bedding material shall be brought up simultaneously at the same level on both sides of the pipe. Backfill shall be placed and tamped equally and thoroughly along each side of the pipe in a manner to avoid displacement of or damage to the pipe.

3-14 ALIGNMENT

The Contractor shall utilize a commercial grade laser beam specifically manufactured to aid in maintaining grade and alignment of gravity pipelines during installation. The primary unit shall be mounted on a heavy duty base and firmly anchored in the downstream manhole of the reach under construction. The maximum distance shall not exceed four hundred feet (400') per set up unless otherwise approved by the Engineer.

B. Each joint of pipe will be installed using an approved target to align the pipe with the projected laser beam. The methods and procedures shall be in strict accord with the manufacturer's recommendations and instructions. Proper ventilation shall be maintained at all times. Care shall be exercised in order to prevent bumping or misalignment of the projected beam.

3-15 VYLON PIPE JOINT CONSTRUCTION

A. Jointing and installation of Vylon PVC pipe shall be accomplished in accordance to the pipe manufacturer’s recommendations. Gaskets shall be factory installed and chemically bonded to the bell end of the pipe. Field installed gaskets and field cut beveled lengths of pipe shall be done only in accordance with the manufacturer’s instructions and recommended equipment and materials.

All pipe gaskets and spigots will be thoroughly cleaned and lubricated before assembly.

B. Field cutting and sealing of the Vylon PVC pipe shall be accomplished in accordance with the manufacturer’s recommendations. Contractor shall provide all equipment, labor and materials to properly seal cut sections of the pipe. All field cuts shall be sealed using 3M Scotch Guard DP-605 urethane sealant.

3-20 TRENCH BACKFILL:

Backfill shall consist of the material placed as indicated on the detail shown in the construction drawings. As pipe is laid and suitably bedded in accordance with these Specifications, trenches and excavation shall be promptly backfilled to a level 12” above the top of the pipe in relatively thin lifts with select backfill material defined in Part 2-08.

Backfill material placed from the trench level 12 inches above the pipe shall be placed per the following criteria. In undeveloped areas, the backfill should be compacted in relatively thin lifts (6”-8”) to not less than **85** percent of standard Proctor maximum dry density. In developed areas where existing or future construction is planned, the backfill should be compacted in relatively thin lifts to not less than **95** percent of standard Proctor maximum dry density. Excavations should be backfilled as soon as possible and special care and planning will be required in the area of existing structures. Contractor shall use extreme care and safety methods while excavating along the embankments to prevent instability of the embankments.

The final surface at the top of the backfill over the pipeline should be sloped to provide effective and rapid drainage of rainfall and surface water away for the pipe alignment. In areas where the existing drainage flows will allow the placement of additional material on top of the backfill, the backfill

material should be crowned or mounded along the length of the pipeline in undeveloped areas at least 12 inches higher at the centerline and sloped downward to natural ground levels.

A. Tamping: The backfill shall be placed in equal thickness lifts, each lift being thoroughly compacted to the density specified. Each lift of the backfill material shall have proper moisture content to permit compaction to this density.

B. Jetting: This method of backfill shall not be used.

3-21 MAINTENANCE OF SITE

The Contractor shall prevent, control and correct dust nuisance or muddy conditions developing on roadways as a result of his operation. No payment for maintenance of the site shall be made but shall be considered as a subsidiary obligation of the Contractor. The contractor shall provide adequate traffic control and warning signs to alert and protect the public during material deliveries and construction work near public roadways.

3-22 PIPELINE TESTING

A. General: Before any backfill is placed, the sewer line shall be checked by the Engineer for line, grade and workmanship. Before acceptance, each section of the line between manholes or such other length as determined by the Engineer to be suitable, shall be thoroughly inspected and any defects in workmanship identified shall be immediately corrected.

B. Deflection Tests: After installation, each segment of PVC pipe shall be checked for deflection by use of a "go-no-go" mandrel. Test sections may consist of more that one manhole segment at a time. Tests must be completed before live sewer is introduced into the new mains.

1. The mandrel shall be constructed on one-half inch (1/2") thick angle iron or Number 4 steel bars (ASTM A-15) welded to steel pipe to measure a five percent (5%) deflection. The mandrel design must be approved by the Engineer.
2. The average inside diameter of the pipe shall be used in calculating the five percent (5%) deflection.
3. The line shall be flushed to clean any mud or debris which would hinder the mandrel passage.
4. The mandrel shall be pulled by hand through the pipe after backfill and trench settlement has occurred.
5. The system will be subject to a mandrel check at the eleven (11) month warranty inspection.
6. If any irregularities or obstructions are encountered they shall be corrected by the Contractor at no expense to the Owner and the repaired section of the line again checked for excessive deflection.

C. General: Before any backfill is placed, the piping shall be checked by the Engineer for line, grade and workmanship. Before acceptance, each section of the line between manholes, structures, valves or such other length as determined by the Engineer to be suitable shall be thoroughly inspected and any defects in workmanship identified shall be immediately corrected.

D. Location: Each individual joint of the installed sewer line shall be tested. Joint Testing: Prior to backfilling, each joint shall be tested from the inside of the pipe using a -Cherne "Air-Loc Joint Tester" or equal. Testing procedures shall be as described in ASTM C 1103, Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.

E. The Contractor shall submit for approval by the Engineer a large diameter pipe "joint tester" mechanism. Such mechanism shall be of standard manufacture and designed specifically to test large diameter pipe in accordance with ASTM C1103, latest revision.

F. All test procedures and methods shall be in accordance with ASTM C1103, latest revision. G. The Contractor shall be responsible for all materials, methods, and safety during all testing.

H. Test results must be submitted to the Engineer for approval prior to request for payment for the affected length(s) of pipe material. All test results must be submitted to the Engineer for approval prior to a final request for payment.

I. The Contractor shall conduct either an exfiltration or an infiltration test of each reach of sewer between manholes. The entire system shall be tested. An infiltration test will be required where the crown of the entire reach of sewer pipe being tested lies three (3) feet or more under the existing water table. An exfiltration test shall be required for all other conditions. Specials, tees, manholes, plugs, service lines, etc. shall be designed and constructed to meet the infiltration/exfiltration requirements herein.

1. Exfiltration tests shall be conducted by blocking off all manhole openings except those connecting with the reach being tested, filling the line and measuring the water required to maintain a constant level in the manhole. During the exfiltration test, the average water depth above the pipe invert shall be ten (10) feet, unless manhole depths are such that this is impossible. The maximum depth at the lower end shall not exceed twenty five (25) feet and the minimum depth at the upper end shall be at least five (5) feet above the crown of the pipe.

   The total exfiltration shall not exceed one hundred (50) gallons per inch of nominal diameter per mile of pipe per 24 hours for each reach tested. For purposes of determining maximum allowable leakage, exfiltration tests shall be maintained on each reach for at least two (2) hours and as long as necessary (in the opinion of the Engineer) to locate all leaks.

   The Contractor shall provide at his expense all the necessary piping between the reach to be tested, the test water, all labor and equipment required to complete the tests. The methods used and the time of conducting exfiltration tests shall be acceptable to the Engineer.

2. The allowable infiltration rate shall not exceed one hundred (100) gallons per inch of nominal diameter per mile of sewer per day. For purposes of determining maximum allowable infiltration, manholes shall be considered sections of equivalent diameter pipe.

   If the infiltration rate in any reach exceeds the allowable maximum, the reach shall be retested after the leaks are repaired.

The Contractor shall be required to repair all visible leaks although both the infiltration and the exfiltration requirements have been met.

The Contractor shall provide at his expense all necessary equipment, materials, and personnel required for the tests. The methods used and the time of conducting the infiltration test shall be acceptable to the Engineer.

J. Air Testing

1. In lieu of the exfiltration test specified above, the Contractor may at his option, complete an air test in accordance with the following specifications. The air test shall in no case replace the infiltration test where ground water is present.

2. Procedure: The sewer line to be tested shall be tested between manholes in accordance with ASTM F-1417. The line shall be sealed at both ends. The seal at one end shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice at one end of the line. The air supply line will contain an on off gas valve and a pressure gauge having a range of 0 to 15 psi. The gauge shall have minimum divisions of .10 psi and shall have an accuracy of +.04 psi. Pressuring equipment should include a regulator or relief valve to avoid overpressuring and damaging an otherwise acceptable line.

3. The pipe line under test shall be pressurized to 4 PSIG. The line will be allowed to stabilize between 4 PSIG and 3.5 PSIG for a period of no less than 5 minutes. If necessary, air should be added to the line to maintain the pressure above 3.5 PSIG. After stabilization period, the gas valve shall be closed. When the line pressure drops to 3.5 PSIG, commence timing with a stop watch. The stop watch should be allowed to run until such time as line pressure drops to 2.5 PSIG. Then the watch should be stopped and time lapse compared with the allowable time lapse in **Table 1** at the end of this Section, and for pipe size and leakage allowance specified by the Engineer. If the time lapse is greater than that specified, the section undergoing testing shall have passed, and the test may be discontinued at that time. If the time is less than that specified,
the line has not passed the test and the Contractor will be required to find the leaks, repair them and retest until the section passes, at his own expense.

3-23 FLUSHING

A. The completed gravity flow system shall be free of mud, siltation and other foreign matter deposited or collected during construction. Flushing shall commence at the upstream end of the completed system and continue downstream manhole to manhole. Only water from an approved source will be permitted. Contractor shall furnish at his expense all flush water and pump water from the pipeline at the end of line flushing. **No water shall remain in the pipelines after testing and flushing the system.**

B. Water used in flushing will not be permitted to enter into the existing system but shall be disposed of in a manner acceptable to the Engineer.

C. Flushing shall be accomplished prior to testing should the collected matter be sufficient in quantity to obstruct or affect the testing. Flushing will not be required in those sectors of the installed pipes and manholes where the exfiltration test has adequately cleaned the mains.

3-24 CLEAN-UP

A. After the backfill is completed, the Contractor shall dispose of surplus material, dirt and rubbish from the site. Surplus dirt shall be disposed of in Contractor furnished and approved disposal areas or in on site areas as directed by the Engineer.

B. After work is completed, the Contractor shall remove tools and other equipment used by him, leaving the entire site free, clear and in clean condition.

Table 1

TIME IN SECONDS REQUIRED FOR PRESSURE TO DROP TO 2.5 LAMENTS (Based on 0.003 cfm per sq. ft. and 2.o cfm)

Length of test section in ft.	Pipe Diameter in Inches											
	4	**6**	**8**	**10**	**12**	**15**	**18**	**21**	**24**	**27**	**30**	**36**
25	4	16	22	28	93	62	89	121	158	200	248	356
50	10	33	43	55	158	124	178	243	317	401	495	713
75	19	49	66	83	240	186	267	364	475	601	743	1020
100	30	66	87	95	305	248	375	525	639	765	851	
125	41	82	109	110	349	372	510	650	680			
150	60	98	131	132	381	455	610					
175	79	115	153	154	413	575						
200	86	131	174	176	436							
225	95	147	196	294	459							
250	109	164	218	338								
275	113	189	240	382								
300	122	197	262									
350	131	213	306									
400	139	230	306									
450	147	246	306									
500	156	246	306									
550	165	246	306									
600	174	246	306									
650	183	246	306	382	459	575	610	650	680	765	851	1020

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SECTION 33 32 17
PACKAGE WASTEWATER GRINDER PUMP STATION

PART 1 - GENERAL

1-01 DESCRIPTION

A. General: In accordance with the requirements of these Technical Specifications, the Contractor shall furnish and install simplex submersible centrifugal sewage grinder pumping stations as specified herein and at the location designated on the Contract Drawings. The simplex unit shall consist of factory-built grinder pump core and all necessary parts, equipment and appurtenances installed in a fiberglass reinforced polyester wet well and an electric control panel with appurtenances.

B. The Contractor shall be required to furnish equipment, materials, labor and tools incidental to the work; perform excavation, trenching, dewatering, sheeting, shoring, bracing and backfilling; connect and test electrical and mechanical work; provide materials and construct access roadways and fences as required and complete the installation ready for use by the Owner.

C. Wherever Contractor's work borders, connects to, or affects work by other Contractors or contracts, Contractor shall coordinate his work to minimize inconvenience to the total job effort.

D. Contractor is responsible for coordination with and relocation of power as necessary to supply the units and control panels with power.

E. Interruptions in service shall be less than 8 hours when replacing septic systems with grinder pumps. Contractor is responsible for bypass during times of interrupted service. Contractor is responsible for coordinating any interruption of service with the Engineer and Resident at least 96 hours in advance.

F. Contractor shall be responsible for satisfactory operation of the entire grinder pumping station system.

1-02 SUBMITTALS

A. The Contractor shall submit to the Engineer shop drawings and manufacturer's catalog sheets on equipment, piping, electrical, and mechanical work prior to initiating any work on same.

B. The Contractor shall submit shop drawings of other items when requested by the Engineer.

C. The sewage pumps shall be factory tested prior to incorporation into the work. Manufacturer's certifications of pump flow and head delivery and rating curves shall be submitted in duplicate to the Engineer for review.

D. After shipment of the equipment, five (5) copies of an operation and maintenance manual for each grinder pump shall be submitted. The manual shall include: installation instructions, assembly view, lubrication instructions, replacement parts list, and manufacturer's warranty.

E. After start-up of the equipment, a written report describing the results of the tests for each grinder pump shall be submitted.

1-03 APPLICABLE CODES

A. All pressure piping shall be completed in accordance with ASME requirements, where applicable.

B. All electrical work shall conform to NEC requirements, where applicable.

C. Any other City, County or State Codes in force in the area of the work.

1-04 PUMP DESCRIPTION

A. Operating Conditions - Each pump shall meet the following conditions:

Simplex Grinder Pump Units at house connections shall be of a semi-positive displacement type, rated 2 horsepower, 230 volts, 3 phase, 60 hertz, and 3450 rotations per minute. The unit shall produce 38 U.S. GPM at 74 feet TDH.

Contractor shall verify voltage and phase requirements for each installation prior to ordering equipment.

PART 2 - MATERIALS

2-01 MANUFACTURER

A. Grinder Pump manufacturer shall be Pentair Hydromatic HPG200 or approved equal.

B. The cost of any required construction changes required by use of alternate equipment is the responsibility of the Contractor.

2-02 PUMPING UNITS

A. General – Each pump shall be the sealed submersible grinder type, manufactured by Pentair Hydromatic or an equal approved by the Engineer. The pump volute, motor, and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30. All external mating parts shall be machines and Nitrile O-ring sealed on a beveled edge. Gaskets shall not be acceptable. All fasteners exposed to the pumping liquid shall be 31 series stainless steel.

B. Motor: The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F insulation (155°C or 311°F), and a dielectric oil-filled motor,

NEMA B design (three phase), NEMA L design (single phase). Air-filled motors shall not be acceptable.

The pump and motor shall be specifically designed so that they may be operated partially dry or completely submerged in the liquid being pumped. The pump shall not require cooling water jackets. Dependence upon, or use of, water jackets for supplemental cooling shall not be acceptable.

Stators shall be securely held in place with a removable end ring and threaded fasteners so they may be easily removed in the field without the use of heat or a press. No special tools shall be required for pump and motor disassembly.

Pump shall be equipped with heat sensors. The heat sensor(s) (one on single phase, two on three phase) shall be a low resistance, bimetal disc that is temperature driven. It shall be mounted directly in the stator and sized to open at 120°C or 130°C and automatically reset at 30-35°C differential. The sensor shall be connected in series with the motor starter coil so that the starter is tripped if a heat sensor opens. The motor starter shall be equipped with overload heaters so all normal overloads are protected by an external heater block.

C. Bearings and Shaft: An upper single row ball radial bearing and a lower single row ball thrust bearing shall be required. These shall be permanently lubricated by the dielectric oil which fills the motor housing. Sealed grease packed bearings shall not be acceptable. Bearings which require lubrication according to a prescribed schedule shall not be acceptable.

The shaft shall be machined from a solid 400 series stainless steel and be designed with large diameter and minimum overhang to reduce shaft deflection and prolong bearing and seal life.

D. Seals and Sensors: The rotor and stator in the motor housing shall be separated and protected from the pumped liquid by an oil-filled seal housing incorporating two type 21 carbon mechanical seals mounted in tandem. The seal housing shall be equipped with a moisture sensing probe installed between the seals, and the sensing of moisture in the seal chamber shall be automatic, continuous, and not require the pump be stopped or removed from the wetwell.

E. Impeller: The impeller shall be designed for rough duty service and shall be of a five-vane, semi-open design with hydrodynamic sealing vanes on the rear shroud. The impeller shall be constructed of engineered thermoplastic, with a permanently molded, hexagonally locked bronze insert. The impeller shall be of a non-overloading design and be factory or field trimable to meet specific performance conditions.

F. Grinder Cutters: The combination centrifugal pump impeller and grinder unit shall be attached to the common motor and pump shaft made of 416 stainless steel. The grinder unit shall be on the section side of the pump impeller and discharge directly into the impeller inlet leaving no exposed shaft to permit packing of ground solids. The grinder shall consist of two stages. The cutting action of the second stage shall be perpendicular to the plane of the first cut for better control of the particle size. The grinder shall be capable of grinding materials found in normal domestic sewage, including plastics, rubber, sanitary napkins, disposable diapers, and wooden articles into a finely ground slurry. Both stationary and rotating cutters shall be made of 440C stainless steel hardened to Rockwell 60C and ground to close tolerance.

The upper (axial) cutter and stationary cutter ring shall be reversible to provide new cutting edges to double life. The stationary cutter ring shall be pressed into the suction opening of the volute and held in place by three (3) 300 series stainless steel screws. The lower (radial) cutter shall macerate the solids against the I.D. of the cutter ring and extrude them through the slots of the cutter ring. The upper (axial) cutter shall cut off the extrusions, as they emerge from the slots of the cutter ring to eliminate any roping which may occur in single stage cutting action. The upper (axial) cutter shall fit over the hub of the impeller and the lower (radial) cutter shall be slip fit and secured by means of peg and hole and rotate simultaneously with the rotation of the shaft and impeller. The grinding mechanism shall be locked to the shaft by a 300 series stainless steel countersunk washer in conjunction with a 300 series stainless steel flat head screw threaded into the end of the shaft.

G. Electrical Power/Control Cord: Electrical power/control cord shall be SOOW water resistant 600V, 90°C, UL and/or CSA approved. The single cord shall incorporate both power and sensor leads and shall be a minimum or seven (7) 12 gauge conductors.

The pump shall be protected with compression fitting and epoxy potted area at the power cord entry to the pump. A separation between the junction box areas of the pump and the motor by a stator lead sealing gland or terminal board shall not be acceptable.

The power cable entry into the cord cap assembly shall first be made with a compression fitting. Each individual shall be stripped down to bare wire, at staggered intervals, and each strand shall be individually separated. This area of the cord cap shall then be filled with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary attraction.

The power cord leads shall then be connected to the motor leads with heavy duty connectors having copper inserts with a crimped wire-to-wire connection, rather than a terminal board that allows for possible leaks.

The cord cap assembly shall be sealed with a Nitrile O-ring on a beveled edge to assure proper sealing.

H. Painting: The pump shall be painted with waterborne hybrid acrylic/alkyd paint. The paint shall provide superior levels of corrosion and chemical protection.

I. Testing: Commercial testing shall be required and include the following:

a. The pump shall be visually inspected to confirm that it is built in accordance with the specifications as to horsepower, voltage, phase, and hertz.
b. The motor and seal housing chambers shall be hi-potted to test for moisture content and/or insulation defects.
c. Pump shall be allowed to run dry to check for proper rotation.
d. Discharge piping shall be attached, the pump submerged in water, and amp reading taken in each leg to check for an unbalanced stator winding. If there is a significant difference in readings, the stator windings shall be checked with a bridge to determine if an unbalanced resistance exists. If so, the stator will be replaced.

2-03 CHECK VALVE AND PIPING

A. The discharge piping shall include double redundant ball check valves with hydraulically sealed discharge flange and a gate valve for each pump. Discharge from the station shall be fitted with NPT couplings.

2-04 WET WELL – NON-GUIDERAIL LIFTOUT PUMP STATION

A. The liftout pump stations shall be as described in these specifications and accompanying drawings and shall consist of (but not be limited to) to following:

a. Fiberglass sump basin
b. Sump cover
c. Inlet pipe connection
d. Discharge pipe assembly
e. Pump lifting assembly
f. Sump level control switches
g. Level control suspension bracket
h. Conduit connections

Stations shall be as manufactured by PumpCon or approved equal.

B. Sump Basin shall be in accordance with 2-05.

C. Solid Fiberglass Sump Cover: The sump cover shall be molded fiberglass reinforced polyester resin with a natural finish. Materials used for construction shall be the same as those used for construction of the sump basin. The sump cover shall have the same outside diameter as the sump basin top flange. There shall be six (6) holes in the cover and six (6) stainless steel bolts with flat washers for securing the cover to the basin. Foam gasket materials shall be applied between the sump cover and the top flange of the basin.

D. Inlet Hub Connection (Option 1): A bolt-on, cast iron, caulking type inlet hub for the inlet pipe(s) shall be furnished. The quantity and size of the hubs per each station shall be as shown on the station drawing. The inlet hubs shall be shipped loose for location and installation in the field.

E. Inlet Grommet Connection (Option 2): Compression type rubber pipe grommets for the inlet pipe(s) shall be furnished. The quantity and size of the grommets per each station shall be as shown on the station drawing. The inlet grommets shall be shipped loose for location and installation in the field.

F. Inlet Flex Boot Connection (Option 3): A bolt-on, flexible type entry boot for schedule 40 pipe shall be furnished for the inlet pipe connection. The entry boot shall be shipped loose for location and installation in the field.

G. Discharge Piping: The discharge piping shall include a PVC swing check valve, a polypropylene quick disconnect fitting and a brass gate valve, per pump. All other piping shall be of schedule 80 PVC or schedule 40 304 stainless steel, as shown on the station drawing.

H. Pump Foot Kit: A stainless steel pump foot kit shall be furnished to support the pumps approximately
3.5 inches above the floor of the wetwell.

I. Pump Lifting Assembly: A non-corrosive lifting handle shall be supplied for attachment to the top of each pump. A one half (1/2) inch polyethylene rope assembly shall also be supplied to aid in the removal and installation of the pump. The lifting rope shall be attached to the lifting handle on one end and have a loop on the other end.

J. Sump Level Control Switches: Mercury level control switches shall be provided for pump on, pump off, and high level alarm. The mercury switch shall be encapsulated in polyurethane foam for corrosion and shock resistance. Level switches shall be weighted to hold position in the pump. The cord connecting the control shall be No. 16-2, rated for 13 amps, and shall be type C-SJO. To ensure optimum longevity, mercury contacts shall be mercury to mercury type and encapsulated in a glass tube and shall be rated for 20 amps at 115 VAC.

K. Level Control Suspension Bracket: A bracket assembly shall be furnished for suspension of up to four (4) level control cords. Construction shall be of 304 stainless steel material, with stainless steel hardware.

L. Conduit Connections: Two (2) 1.5 inch bolt-on conduit connections shall be installed on the station. The conduit connections shall consist of aluminum couplings with an aluminum mounting plate. Stainless steel hardware shall be used for attaching the conduit connections to the basin wall.

M. Vent Assembly: A two (2) inch wetwell vent assembly with schedule 40 PVC pipe and fittings and a steel vent with a bronze screen and powder coat finish shall be furnished. The vent assembly shall be designed for installation through the sump wall.

N. Guarantee: The manufacturer of the lift station shall furnish a limited warranty for eighteen (18) months from the date of shipment or twelve (12) months from start-up (whichever occurs first) that all equipment shall be free from defects in design, materials, and workmanship. The lift station manufacturer shall furnish replacement parts for any component proven defective, whether of his or other manufacturer during the warranty period, excepting only those items which are normally consumed in service, such as (but not limited to) light bulbs, oil, grease, packing, etc.

O. Packaging and Marking: Installation instructions shall be furnished with the station.

2-05 FILAMENT WOUND FIBERGLASS WETWELL

A. General: Shell design shall be in accordance with the methods and formulas in AWWA C950 M-45. Design of flat bottoms shall account for both limiting stress and deflection. Design shall be based on industry standard lamination analysis for the glass reinforcement layers and resins system. Design shall determine cylinder and flat bottom thickness.

B. Standards:
   a. ASTM D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
   b. ASTM D3753, Standard Specification for Glass-Fiber Reinforced Polyester Manholes and Wetwells
   c. AWWA C950, Fiberglass Pressure Pipe
   d. ASME RTP-1 MN3-321

C. Laminate Properties: The minimum flexural modulus in the circumferential direction shall be 2,000,000 p.s.i. and in the longitudinal directions shall be 1,000,000 p.s.i.

D. Wall Thickness: Wall thickness shall vary with the basin/wetwell height. Calculated wall thickness shall be based on the following site assumed conditions: a. Soil Modulus: 700 P.S.I.
   b. Soil Density: 120 Lbs. per cubic foot
   c. Calculations shall employ a Lucher's safety factor of 2

E. Materials
   a. Resin: Resin used shall be commercial grade unsaturated polyester type, suitable for the intended service as indicated by usage history or resin manufacturer's recommendation.
   b. Cure System: Resin promotion and catalyst system used shall follow resin manufacturer's guidelines.
   c. Fillers and Additives: No fillers or resin extenders of any type shall be utilized. A maximum of two percent by weight of any commercial grade thixotropic agent may be added to resins for the purpose of viscosity control.
   d. Reinforcing Materials: Reinforcing material shall be commercial grade "E" type glass fibers in the form of chopped strand mat, chopped roving woven roving or continuous roving. Uni-directional glass shall be used in addition to any other glass used. Glass fibers shall be treated with a coupling agent that facilitates bonding between the reinforcement and the resin.

F. Laminate:
   a. General: Basin laminates shall consist of three layers (inner surface, interior layer and structural layer).
   b. Inner Surface: The inner surface shall consist of resin rich layer with no exposed fibers.
   c. Interior Layer: The interior layer shall consist of a resin rich reinforced layer with a nominal fiber content of 30 percent. Reinforcements shall be chopped strand mat or chopped roving.
   d. Structural Layer: The structural layer shall be chop-hoop filament wound consisting of chopped strand and continuous roving reinforcement oriented in the hoop direction. As required, unidirectional roving shall be incorporated into this layer to enhance longitudinal properties. The exterior surface shall be relatively smooth with no exposed fibers or sharp projections. Nominal fiber content on the structural layer shall be a minimum of 62 percent.

G. Appurtenances
   a. Top Flange: The basin shall have a top flange that is 3" larger in diameter than the interior of the tank.
   b. Bottom: The bottom of the wet well shall be built to withstand full exterior water column with a maximum deflection of 3/8".

c. Bottom Anti-Flotation Flange: The bottom anti-float flange shall be a minimum of 3" larger in diameter than the wetwell and be constructed to withstand the maximum uplifting force that could be exerted with an empty well and full water column outside the tank.
d. Basin/Wetwell: The basin/wetwell shall be designed to withstand H-20 traffic load, when properly installed.
e. Cover Attachments: Stainless steel threaded inserts shall be installed in the top flange of the basin/wetwell to accommodate attachment of covers. The inserts shall be 3/8 inch diameter in a 6-bolt pattern, 60 degrees apart and secured using polyester resin to permanently hold in place.
f. Lifting Lugs: Three (3) epoxy coated lifting lugs, strategically located on the wetwell shall be supplied to assist in handing and setting of the basin

H. Quality Assurance
a. Visual Acceptance: The inner surface shall be free of exposed fibers, crazing and delaminations. No Blisters larger than 1/2 inch or wrinkles more than 1/8 inch in depth will be allowed.
b. Laminate Cure: Laminate cure shall be indicated by means of Barcol hardness measured in accordance with ASTM D2583. The average Barcol hardness shall not be less than 90 percent of the resin manufacturer's recommendation for clear resin castings.
c. Workmanship: All workmanship and materials throughout shall be of the highest quality available.

I. Installation: The instructions shall be laminated into the wall of each basin/wetwell. The contractor is responsible for ensuring the installation complies with the installation instructions.

2-06 CONTROLS

A. General: The motor control panel shall be assembled and tested by the same manufacturer supplying the pump to insure suitability and assurance of experience in matching controls to motors and to insure single source responsibility for the equipment.

Control panel shall be as manufactured by Custom Control Technologies, or approved equal.

B. Electrical Control Panel and Appurtenances:

Control panel shall be equipped with float switch operation and shall be a simplex – weather proof controller with alarm. A Complete wiring diagram and installation instructions shall be provided. The control panel assembly shall be completely factory tested and shall be "cUL" 508A listed and labeled.

C. Scope and Panel Operation: The control panel shall provide power and logic control to operate one 2 horsepower pump with 230 volts, 1 phase, 60 hertz, 4-wire service.

The control logic shall provide for the automatic operation and alternation of the pump based on a three (3) float system – off, on, high level.

The float switch liquid level control system shall control the operation of the pump according to level variations.

After pump motor has been actuated and the liquid continues to rise and reaches the “high level” float switch, it shall energize a local visual and audible alarm if the wetwell level reaches past the preset maximum.

D. Enclosure: The enclosure shall be designed to house electrical and electronic controls, instruments, or components for indoor and outdoor applications. The enclosure shall be well suited for high temperature and corrosive environments. The enclosure shall protect from dust, dirt, oil, and water.

The enclosure construction shall meet the following standards:

a. Construction meets NEMA/EEMAC Type 4, 4X, 12 specifications
b. UL 508 listed, Type 1, 2, 3, 3R, 4, 4X, 12, 13
c. CSA certified LR 89590 for use with industrial control equipment CSA Enc. 1, 2, 3, 4, 4X, 12, 13
d. Compliant with Restriction of Hazardous Substances (RoHS) directive

The enclosure should be constructed as such:

a. Strong, molded Ultraguard fiberglass reinforced polyester material construction with matching raised cover
b. 304 stainless steel snap latches feature padlock hasp
c. Continuous stainless steel hinge
d. Gasket made of closed-cell neoprene cord encased in a continuous channel
e. 304 stainless steel wall mounting feet with 10-32 stainless steel screws included
f. 10-32 threaded inserts are installed for optional back panel g. JIC sizing
h. Ultraguard fiberglass material is easily punched, drilled, or sawed
i. UV stabilized for outdoor use
j. The panel shall have a hinged aluminum inner door with a latch to protect all live internal wiring from operator personnel. The inner door shall be able to be opened to a minimum of 150° to allow safe access to the components. Cutouts for breaker handles shall be provided to allow the operation of all circuit breakers through the inner door. All control switches and pilot lights shall be mounted on the inner door.
k. All components shall be mounted to the back plate with plated machine screws through machine thread tapped holes in the back plate. The screws shall be of adequate size for the device being secured. Self-tapping screws shall not be allowed.

E. Power Distribution: The panel power distribution shall include all components as indicated below and be completely wired with stranded conductors having a minimum of 90° insulation rating and an ampacity rating a minimum of 125% of the motor ampere rating. All power wiring shall be neatly
routed and totally accessible. All conductor terminations shall be as recommended by the device manufacturer and be secure to provide adequate electrical conductivity.

F. Circuit Breakers: Circuit breakers shall be provided for motor and for the control circuit. Circuit breakers shall be of the thermal-magnetic type rated 10,000 AIC @ 230 volts. Circuit breakers will be Square D QOU series.

G. Motor Starter: Motor starter shall be IEC rated, minimum 18 amp and be provided with bi-metallic overload relays. A normally open holding contact shall be provided. The starter shall be 3-pole polyphase type units as manufactured by Square D – LC1D and LRD series.

H. Motor Starting Components: The control panel shall contain the proper start components – start/potential relays, start capacitors, and run capacitors as directed by the pump manufacturer.
I. Selector Switch: All pilot lights shall be mounted on the inner door and be supplied as follows:
a. Pump Run – Green
b. Seal Fail - Red

J. Seal Fail Alarm: Pump shall be provided with a seal failure alarm relay and a red pilot light to indicate the condition. The relay shall have a secondary circuit wired to terminals, for pump to be connected to the moisture sensing probe in pump seal chamber. If probe senses moisture, the seal failed relay shall turn on the Seal Failed alarm pilot light to indicate same. The pump shall not be taken out of service.

K. Alarm: Alarm light shall be constructed of shatter- resistant Lexan. The light shall be rated NEMA 4X and be supplied with a heavy duty one piece lamp holder and rough service bulb. The light shall be mounted on the top of the enclosure. The light shall be activated by a high level condition, and glow bright and flash, via a solid- state flasher.

L. Testing: Each control panel shall receive a factory test to ensure proper operation prior to shipment.
Factory tests shall include, at a minimum:
a. All control logic functions, including turn on, turn off, alarms, etc.
b. All fuses and circuit breakers
c. Audible and visual alarm indicators
d. Power transfer circuit to pump motor
e. Float switch input circuits

M. Other: Terminal strips shall be provided for all wiring terminations. All components mounted on the inner- door shall be identified with Brady Thermatab Markers.
The control panel assembly shall be completely factory tested and shall be “UL” 508A listed and labeled, and manufactured by Custom Control Technologies or approved equal.

PART 3 - EXECUTION

3-01 GENERAL

A. The Contractor shall complete final assembly of equipment and accessories necessary for proper functioning of such equipment.

B. The Contractor shall furnish shop drawings and manufacturer's catalog sheets as requested by the Engineer.

3-02 ASSEMBLY: The Contractor shall complete final assembly of equipment delivered to the job site unassembled. Included in the work shall be the interconnection of equipment with electric wiring and piping, as required for an operable installation.

3-03 EQUIPMENT SETTING

A. No basin shall be set into any excavation until written excavation and installation procedures by the Contractor have been reviewed and approved by the Engineer.

Basin shall be installed on suitable bedding material compacted to a density of at least ninety-eight percent (95%) of standard Proctor maximum dry density or as directed by the Engineer.

B. Once installed, the bottom of the basin lid shall be one (1) to four (4) inches above finished grade.

C. Finished grade shall slope away from the basin.

D. Equipment shall be set plumb, level and true in elevation, alignment and dimensions. The Contractor shall check dimensions necessary for installation of equipment and be responsible for the correctness and proper fitting of his work.

E. It shall be the responsibility of the Contractor to coordinate with the Engineer and the individual property owner(s) to determine where to locate the disconnect and alarm panel.

F. Upon completion of equipment installation, the Contractor shall thoroughly clean lubrication reservoirs and install lubricants recommended by the manufacturer at no extra cost to the Owner.

3-04 MECHANICAL: A thorough visual inspection will be made of piping, valves, fittings, brackets, mountings, seals, conduit, painting, sheaves, belt guards, sleeves, gauges, welds, clips, overall appearance, etc. This visual inspection will be conducted while components are being tested to ensure proper field performance.

3-05 FIELD WIRING: Included in the work shall be the interconnection of equipment with electric wiring and conduit, including road borings, if required, for an operable installation.

3-06 START-UP SERVICE: The Contractor will provide the services of a factory-trained representative for the maximum period of one (1) day to perform the initial start-up of the pumping station and to instruct the Owner's operating personnel in the operation and maintenance of the pumping station at no extra cost to the Owner.

3-07 CLEAN-UP AND RESTORATION OF SITE

A. After the work has been completed, the Contractor will dispose of surplus materials, dirt and rubbish from the site at an offsite location determined by the Contractor.

B. The Contractor will further remove tools and other equipment used by him, leaving the site clean, clear and in good condition.

3-08 GUARANTEE

A. In addition to the Contractor's one (1) year guarantee, the manufacturer of the entire pumping station, including, but not limited to electrical panel, shall guarantee for one (1) full year from the date of acceptance by the Owner that all equipment will be free from defects in design, material and workmanship.

Whether of his own manufacture or not, the Contractor will furnish replacement parts of any component which is proved defective during the guarantee period.

B. Manufacturing or operating defects found during the warranty period will be reported to the Contractor by the Owner/Engineer and will be corrected by the Contractor at no cost to the Owner.

3-09 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall be responsible for the condition of excavations made by him. Slides and caveins shall be removed without extra compensation, at whatever time and under whatever circumstances they may occur.

B. Installation of sheeting and shoring shall be the responsibility of the Contractor. Shoring left in place by the Contractor shall not entitle the Contractor to any claim for extra compensation.

3-10 TESTING

A. Contractor shall demonstrate a fully functional grinder pump station system prior to final acceptance.

PART 4 - COMPENSATION

4-01 The Grinder Pump Station shall be measured and paid for in units of EACH as indicated on the Bid Form, which price shall constitute full compensation for furnishing all materials, labor, tools, equipment, specials, incidentals, testing and performing necessary work for installing required items in accordance with the Drawings and Specifications.

4-02 Base Bid price for Item No. 3 – Grinder Pump Station shall include the following:

A. Grinder pump, wet well/basin, control panel and related appurtenances.
B. One sewer service house connection.
C. Approximately twelve (12) feet of 4” PVC SDR 35 gravity service lateral.
D. Adding a breaker to the existing electrical panel on the exterior of the residence with approximately twelve (12) feet of conduit and wire from the electrical panel to the control panel.

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SECTION 33 34 00
SEWAGE FORCE MAIN

PART 1 GENERAL

1-01 DESCRIPTION

A. General: The work to be performed under this section of the Specifications shall consist of furnishing labor, equipment, materials, and performing operations in connection with the excavation, trenching, installation and backfilling of sanitary sewage force main. Place, joint, and test pipe, fittings, couplings and adaptors, as shown on the Drawings and specified herein.

B. Materials installed as a part of the work shall include the pressure pipe, appurtenances, specials, bends, tees and other items such as bedding, sand, gravel, thrust blocking, etc.

1-02 SUBMITTALS: The Contractor shall submit manufacturer's manuals, specifications, catalog sheets, tests and other information for pipe, fittings, valves, select bedding and backfill and other material requested for review by the Engineer for apparent conformance to these Specifications. Wherever "approved equal" appears in this Specification, material may be reviewed to determine if the proposed substitute meets the test of apparent equivalence for use in this project.

1-03 INSPECTION: When the term "inspection" is used in this Specification, it means visual observation of materials, equipment and construction methods, on an intermittent basis, to determine that the work is in conformance with the Contract Documents and the design intent. Such inspection does not constitute acceptance of the work, nor shall it be construed to relieve the Contractor in any way from his responsibility for the means and methods of construction **or for safety on the construction site.**

1-04 CONTRACTOR'S EQUIPMENT: The Contractor shall provide and maintain the equipment necessary to prosecute the work in an orderly and safe manner. The equipment shall consist of suitable units designed or selected to perform and expedite the work and incidental items of construction.

1-05 PROTECTION OF PROPERTY

A. General: Existing power lines, telephone lines, trees, property corners or monuments, shrubbery, fences, water mains, gas mains, sewers, cables, conduits, ditches, embankments and other structures in the vicinity of the work not authorized to be removed shall be supported and protected from injury by the Contractor during the construction and until completion of the work affecting them. The Contractor shall be liable for damages done to such existing facilities and structures, as herein provided, and he shall save the Owner harmless from liability or expense for injuries, damages or repairs to such facilities. No additional compensation will be allowed for any operations of the Contractor in completing the work near, over, under or around existing utilities unless otherwise specified.

B. Underground Utilities: The type, size, location and number of known underground utilities have been shown on the Drawings; however, no guarantee is made as to the true type, size, location or number of such utilities. It shall be the responsibility of the Contractor to verify the existence and location of underground utilities along the route of the work. The omission from, or the inclusion of utility locations on the Drawings is not to be considered **as the nonexistence of** or **a definite location of** existing underground utilities. The Contract unit prices bid shall provide full and complete compensation for operations necessary to complete the work in accordance with the Drawings and Specifications in working near, over, under or around existing utilities unless specified otherwise.

C. Relocation of Existing Utilities

1. The Contractor shall notify the Owner of the existing utilities, whether above the ground or underground; prior to proceeding with trench excavation whenever such trenching operations are within ten feet (10') of any existing utility.

2. In the event that during construction it is determined that underground utilities, including sanitary sewers, water mains, gas mains, telephone cables, storm sewers, etc., and above ground utility facilities require relocation, the Contractor shall notify the utility Owner well in advance of his approach to such utility so that arrangements for such relocation by the Owner or the Owners of the affected utility can be completed without delay to the Contractor's work.

3. Should a utility be damaged in the trenching operations, the Contractor shall immediately notify the Owner of the utility, the project Owner and Engineer. If the damaged utility transports hazardous material, electricity, or type material carried is not known, the Contractor shall also notify appropriate Emergency Operations Agency and Law Enforcement Agency. **The Contractor shall not attempt to make repairs unless so authorized, in writing, by the affected utility owner. Duplicate copies of written authorization given to the Contractor to make repairs shall be filed with the Engineer and shall be so worded as to save harmless the Owner and Engineer of responsibility relative to the sufficiency of the repairs.**

D. Landscape Vegetation

1. Reasonable care shall be taken during construction to avoid damage to landscape vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

PART 2 MATERIALS

2-01 PRESSURE PIPE AND APPURTENANCES

A. PVC Pipe and Fittings

1. All PVC pipe and fittings four (4”) inches to twelve (12”) inches in diameter shall conform to the latest edition of AWWA C-900 and shall be made from Class 12454A or B materials per the latest edition of ASTM D-1784. Pipe shall be a minimum of DR 18 unless otherwise specified, for a minimum pressure class rating of 235 PSI per UL standard. All pipe shall conform to the outside diameter (OD) dimensions of ductile iron pipe to facilitate use of DIP fittings, standard cast iron valves and specials. All joints shall be elastomeric seals conforming to the latest edition of ASTM F-477. All pipe shall bear the seal of the National Sanitation Foundation (NSF). All jointing shall be made in accordance with the manufacturer's recommendations.

2. All PVC pipe and fittings greater than twelve (12”) inches in diameter shall conform to the latest edition of AWWA C-905 and shall be made from Class 12454-A or B materials per the latest edition of ASTM D-1784. Pipe shall be a minimum of DR 18 per UL standard unless otherwise specified, for a minimum pressure class rating of 200 PSI. All pipe shall conform to the outside diameter (OD) dimensions of ductile iron pipe to facilitate use of DIP fittings, standard cast iron valves and specials. All joints shall be elastomeric seals conforming to the latest edition of ASTM F-477. All pipe shall bear the seal of the National Sanitation Foundation (NSF). All jointing shall be made in accordance with the manufacturer's recommendations.

3. All PVC pipe (1-1/2”) inches to three (3”) inches in diameter shall conform to the latest edition of ASTM D-2241 and shall be made from Type 1120 material. Pipe shall be a minimum of SDR 26 unless otherwise specified, for a working pressure of 160 PSI. All joints shall be integral bell gasket in accordance with the latest edition of ASTM D3139. Pipe shall bear the seal of the NSF. All jointing shall be made in accordance with the manufacturer's recommendations.

4. Rubber ring gaskets shall conform to the manufacturer's standard dimensions and tolerances to meet the requirements of ASTM F-477 and solvent cement shall conform to ASTM D-2564.

5. Joints shall be gasket type or, if less than 3 inches in diameter solvent weld, at the Contractor's option, and be in accordance with the manufacturer's specifications. Joint bells shall be formed integrally with the pipe and spigots shall be beveled with insertion stop to facilitate proper installation.

6. Pipe and PVC fittings shall be tested for a minimum 100 PSI working pressure for sizes greater than 12 inches and 150 PSI working pressure for smaller sizes.

7. For PVC pipe 6” and larger all fittings shall be ductile iron with restrained joints. The unbalanced forces at pipe bends, tees, etc., shall be restrained by transmitting those forces to the pipe wall by means of a flexible and tied jointing system, which shall be

accomplished at the joint and not between joints. All joints for fittings and bends shall be restrained. Each of the restrained joints shall be designed to withstand and transmit

the longitudinal thrust forces due to the pipe pressure of 300 psi. For ductile iron pipe, the system to be used shall be American "Lok-Ring", U.S. Pipe "TR Flex", or approved equal. Mechanical joint retaining glands with set screw will not be accepted. Joints shall be in accordance with ANSI/AWWA C111 A21.11-90. All restrained joint materials shall be non-corrosive low-alloy steel. The manufacturer of the pipe shall supply the necessary devices for restrained joints. All pipe joints within the below listed distances of the fitting shall be restrained.

	Main Diameter / Restrained Length							
Angle of Bend	**4"**	**6"**	**8"**	**12"**	**16"**	**18"**	**24"**	**30"**
11.25º	2'	3'	3'	4'	5'	6'	8'	10'
22.5º	3'	5'	6'	8'	11'	12'	16'	20'
45º	7'	9'	12'	17'	23'	25'	33'	41'
90º	15'	21'	25'	42'	55'	61'	80'	99'
Dead End	16'	22'	29'	37'	49'	55'	82'	102'

B. Ductile Iron Pipe and Fittings

1. Ductile iron pipe shall be centrifugally cast in metal or sand lined molds manufactured in accordance with the latest edition of ANSI A21.51 (AWWA C 151). Pipe shall be pressure Class 200 Ductile Iron unless otherwise specified. Pipe and fittings shall be tested for minimum 100 PSI water working pressure, laying conditions type 2 flat bottom trench without blocking, tamped, backfilled and under five (5) feet of cover. Pipes and fittings shall be factory coated on the outside with coal tar enamel conforming to the latest edition of ANSI A 21.5. **Pipe shall be lined inside in accordance with requirements of Technical Specification Section 33 30 00.01 contained herein. Ductile iron pipe installed pursuant to these specifications shall be encased with a minimum 8 mil thick loose polyethylene encasement, in accordance with the latest edition of ANSI/AWWA C-105**

2. Joints for ductile iron pipe shall be slip-on type unless otherwise specified. Joints for fittings, valves and specials shall be mechanical joints, except where shown by the Drawings to be flanged. Accessories (glands, bolts and standard styrene butadiene rubber (SBR) gaskets shall be furnished per ANSI/AWWA C111/A21.11, RubberGasket Joints for Ductile Iron Pressure Pipe and Fittings.

3. Fittings shall be compact ductile iron as specified on the Bid Form and shall conform to the latest edition of ANSI/AWWA C153/A21.53 for ductile iron fittings. The minimum wall thickness of the fittings shall be determined consistent with trench conditions `B' and less than five (5) feet cover. Fittings shall be tar coated outside in accordance with the latest edition of AWWA C-104 (ANSI 21.4). **Fittings shall be lined inside in accordance with requirements of Technical Specification Section 33 30 00.01 contained herein.**

C. Sewage Air Release Valves and Air & Vacuum Valves

1. Air release valves shall be designed for sewer service and be sized per the manufacturer's recommendations. Valves shall have an elongated body and be designed to operate while pressurized, allowing entrained air in the system to escape thru the air release orifice without spillage or spurt. Valve shall automatically cycle to release entrained air and shall be equipped with inlet and blowoff valves, quick disconnect couplings and a minimum of 5 feet of heavy duty, sunlight stable hose for backflushing. Internal linkage, stems and floats shall be of stainless steel and shall be designed to prevent sewage or grease from clogging orifices. Manufacture shall be by APCO, Model 400, Model 450 or equal.

2. Sewage combination air valves shall allow unrestricted venting or reentry of air thru it, during filling or draining of the force main, to prevent vacuum. An internal baffle shall protect the shutoff float from direct air flow, and internal linkage, stems and floats shall be of stainless steel. Manufacture shall be by APCO, Crispin or other exhibiting apparent equivalence in operation and quality. Valve shall be equipped with inlet and blowoff valves, quick disconnect couplings and 5 feet of heavy duty, sunlight stable hose for backflushing. Vacuum relief valves shall be furnished with a removable vacuum check valve.

D. Gate valves

1. Gate valves shall comply with the latest edition of AWWA C-509 as manufactured by Mueller. Gate valves shall be iron body, encapsulated high strength cast iron wedge, resilient seat, non-rising stem, and shall open counterclockwise. All gate valves shall have a maximum working pressure of 200 PSI and be tested at 400 PSI. The thrust collar and other bearing surfaces shall be permanently lubricated with oil. Gate valves shall be equipped with mechanical joint connections unless otherwise specified. Valve boxes will be required for each valve. Valves shall be attached to the adjacent pipe with the Megalug Series 1100 restraint system.

E. Check Valves

1. Check valves in the force main, 8 inches and smaller, shall be resilient seated, AWWA approved, 150 psi working pressure, with external spring and lever for exposed installation with connections as indicated on the Drawings where applicable.

F. Marking Tape

1. Shall be detectable underground marker tape, 2" wide, with "CAUTION SEWER" printed continuously along its length. Shall be green with silver-colored trim and lettering, or other color combination acceptable to the Owner. This item is an absorbed cost.

G. Tracer Wire

1. Tracer wire shall be #12 solid copper wire type THHN or THWN VW-1 600V gasoline and oil resistant insulated wire taped to the top of each joint of pipe. Tracer wire terminals shall be located every 500’ or as otherwise shown on the drawings. Terminals shall be “Big Fink”, or “Flush Fink” where specified, as manufactured by Cott Manufacturing Company, or engineer approved equal. Top covers shall be green. This item is an absorbed cost.

H. Valve Boxes

1. Valve boxes shall be three piece cast iron. Boxes shall be five and one-quarter inch (5-1/4") shaft diameter with covers marked "SEWER". Base sections to be selected in accordance with manufacturer's recommendation for valve size. Valve boxes shall be Opelika Foundry Company, Buffalo Style Cast Iron Roadway Box or approved equal.

I. Marking Posts

1. Fiberglass utility markers (66”L x 3-3/4” W) as supplied by Forestry Suppliers, or approved equal, shall be installed every 500 feet or at locations indicated on the Plans. The color of utility marker shall be green. The label shall be provided and affixed to each utility marker as shown in the Plans. This item is an absorbed cost.

2-02 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall be responsible for the condition of excavations made by him. Slides and caveins shall be removed without extra compensation, at whatever time and under whatever circumstances that may occur. **The Contractor is solely responsible for maintaining safe working conditions.**

B. Installation of sheeting, shoring and bracing shall be the responsibility of the Contractor. Shoring left in place shall not entitle the Contractor to claims for extra compensation unless so indicated on the Bid Form as a separate pay item.

PART 3 EXECUTION

3-01 GENERAL

A. Install force mains where shown on Drawings, in compliance with manufacturer's instructions. PVC pipe shall be installed in accordance with ASTM D-2321. Ductile iron pipe shall be installed in accordance with AWWA C-151. Unless otherwise specified by the Engineer, PVC pipe shall be installed on a prepared trench bottom using Class IV native materials or better for select backfill and bedding, and DIP shall be installed on flat-bottom trench, Type 2 bedding, using native materials.

B. Where indicated by the Drawings, force main shall be laid on grade to prevent air entrapment. Air release valves and air & vacuum valves shall be installed at grade changes as shown on the Drawings. When required by Drawings, grade shall be maintained by using an appropriate laser system. Placement tolerance shall be ± 1 tenth (.1) foot from the elevation shown by the laser.

3-02 INSPECTION: Pipe specials and jointing materials must be inspected for conformance to these Specifications immediately prior to use. Remove from site of work, materials not conforming with these Specifications. Protect pipe against impact shocks and free fall. Keep pipe clean at all times.

3-03 JOINTING

A. Preparatory to making pipe joints, clean the surfaces of the portion of pipe to be jointed of dirt and foreign matter and then paint with factory made jointing lubricants, primers, adhesives and other materials in accordance with the pipe or joint manufacturer's recommendations.

B. As soon as possible after the joint is made and the pipe is aligned, place sufficient approved backfill material along each side of the pipe to prevent movement from line or grade. Keep trenches free of water and as dry as possible during bedding, laying and jointing.

3-04 OBSERVATION & INSPECTION: Do not cover any pipe joints prior to observation by the Engineer.

3-05 COVER: Maintain forty two inches (42") minimum bury along force main unless otherwise shown on Drawings or directed by the Engineer.

3-06 CARE: Provide temporary bulkheads at the open end of the pipe to prevent the entrance of dirt, water or foreign objects into the line during construction. Lay each section of PVC pipe upon a shaped pipe bed such that the full length of the pipe barrel bears directly on the trench bottom. Recesses should be excavated to accommodate pipe bells or joints for both PVC and DIP materials.

3-07 HYDROSTATIC TEST:

A. After the pipe is laid and the line flushed, it shall be filled with water, with care being exercised to expel all air from the pipe. During the test period pipe, valves, fittings, and joints shall be examined carefully for defects. Observed leaks or defective pipe shall be satisfactorily repaired or replaced, at the expense of the Contractor, and the test repeated until the section tested is within the limits specified. The entire system or parts thereof shall be tested under hydrostatic pressure of 150 psi, for a period of 4 hours, if covered. Repairs shall be made using approved materials and new replacement fittings, specials, or gaskets where leakages occur.

B. Leakage shall be measured by an approved calibrated meter through which the water required to maintain test pressure shall be pumped. Testing shall be performed in the presence of the Engineer, or his authorized representative and the Engineer shall be notified at least 24 hours in advance of the start of the test.

C. The Contractor shall furnish the pump, pipe connections, fittings, gates, meters, and necessary apparatus and shall furnish all labor and work required to make the tests. Costs of testing shall be borne by the Contractor and testing operations shall remain in operation until approved by the Engineer. Allowable leakage shall be zero at the specified test pressure.

3-08 CLEAN-UP: The job site shall be maintained in a neat, and sanitary manner during construction. As portions of the work are completed, excess excavation, bricks, concrete, pipe and other materials shall be removed and disposed of by the Contractor in a manner acceptable to the Engineer.

3-09 SEPARATION FROM WATER LINES: There shall be a ten (10) foot horizontal separation between sanitary sewer mains and parallel water mains, **and** an eighteen (18) inch vertical separation between the bottom of a water line crossing over the top of a sewer main. In instances where such separation is not possible, special precautions, as determined by the Engineer, shall be taken by the Contractor to prevent contamination of waterworks facilities.

3-10 CROSSINGS: All utility, railroad or highway crossings shall be constructed in accordance with the applicable permits issued for such crossings.

3-11 PROVING: Upon completion of the hydrostatic pressure test, the force main shall be proved by "pigging" in accordance with the recommendations of the polyfoam pig manufacturer. Contractor shall supply the material and labor to successfully complete the test.

3-12 SITE PREPARATION

A. The Contractor shall prepare, on a timely basis, rights-of-way, easements and sites indicated on the Drawings for construction of the wastewater improvements. The work shall include clearing and grubbing, removal of structures and obstructions, and the removal of permanent surfaces and landscaping items designated to be restored upon completion of the installation.

B. Clearing and grubbing shall conform to the requirements specified elsewhere herein and shall include the removal of trees, roots, vegetation, structures and obstructions unless separate pay

items are specifically provided for on the Bid Form. The completion of clearing and grubbing shall leave the site clear and free from undesirable obstructions, ready for trench excavation.

C. The removal of permanent surfaces and the subsequent restoration of the surfaces shall be as set forth below and in other sections herein where applicable.

3-13 SELECTED STRIPPING: In landscaped, agricultural or cultivatable areas, the top twelve inches (12") of the ground shall be stripped and stockpiled for subsequent replacement after backfilling the pipe trench. The Contractor shall strip an area that will include the open limits of the trench plus the area that will be used to stockpile all suitable backfill material from the trench excavation. The stripped material shall be stockpiled in an area that will not hinder or endanger the construction process. The location and manner of stockpiling shall be reviewed by the Engineer.

3-14 EXCAVATION AND TRENCHING

A. Excavation of every description and of whatever substances encountered shall be performed to the depths indicated on the Drawings or as otherwise specified. Excavation shall be done by open cut from the surface except when tunneling or boring is specified or directed in writing by the Engineer. Trench width shall be kept as narrow as practical to provide a safe working area and to minimize excavation, and shall be maintained in strict compliance with OSHA regulations.

B. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave ins. Excavated materials not required or not suitable for backfill shall be removed and wasted as directed by the Engineer. Grading shall be done, as necessary, to prevent surface water from flowing into trenches or other excavations. Water accumulating therein shall be removed by pumping or by other approved methods. Temporary sheeting and shoring shall be used where necessary for the protection of the work and for the **safety of the personnel.**

C. Trenches for force main pipe and other appurtenances shall be of only such width as necessary for proper laying of the pipe. The net width of the trench at and below the top of the pipe shall be at least the pipe O.D. plus twelve inches but not more than the pipe O.D. plus twenty four inches. The width of the trench above this level may be as wide as necessary for sheeting, bracing, shoring or **for proper safe performance of the work.**

D. The sides of the trench shall be maintained in strict compliance with OSHA regulations.

E. The bottom of the trench shall be carefully graded, formed and aligned according to these Specifications. The bottom of the trench shall be hollowed under each pipe joint to conform to the shape of the pipe, and holes shall be cut for the bells, allowing the body of the pipe a uniform contact and support throughout its entire length.

F. The Contractor shall leave a minimum 2 foot berm width on each side of the trench between the trench and the excavated earth, to allow the free passage of workmen, the Engineer's representative and to permit work in a safe, expeditious and satisfactory manner.

G. No more than three hundred (300) feet of trench shall be opened in advance of the completed sewer, nor shall more than one hundred (100) feet be left unfilled except by permission from the Engineer. In special cases, the Engineer, when so requested by the Contractor, may waive the distance restriction to which the trench may be opened by notifying the Contractor in writing.

3-15 SHEETING, SHORING AND BRACING

A. Sheeting, shoring, and bracing shall be furnished, placed and maintained by the Contractor as may be required to support the sides of the excavation. The Contractor shall be fully responsible for the sufficiency of such supports to prevent movement which can injure or delay the work or endanger or cause damage to adjacent pavements, buildings or other structures, channels and drainage structures, **or create undue hazards to workmen.** Where in the opinion of the Engineer, damage is likely to result from withdrawing sheeting, the sheeting shall be left in place. **The material and installation requirements for sheeting, shoring and bracing shall be in accordance with applicable sections of the Mississippi Standard Specifications for Road and Bridge Construction, 2004 Edition.**

B. Sheeting, shoring and bracing which are not ordered by the Engineer to be left in place shall be removed in such manner as not to endanger the constructed sewer or other structures, utilities or property. Voids left or caused by the withdrawal of sheeting shall be immediately refilled with sand by tamping with tools specifically adapted to the purpose, by watering, or otherwise as may be directed.

3-16 EXCAVATED MATERIAL

A. Excavated material from trench and structure excavation suitable for backfill shall be placed compactly on the sides of the excavation and kept up so as not to endanger the work and be of as little inconvenience as possible to the public travel and abutting property, and so that free access is maintained to fire hydrants and water valves in the vicinity of the work. Material encountered in the excavation which, in the opinion of the Engineer, is not suitable for use in the work, shall be removed and wasted as directed and shall not be stockpiled along the side of the excavation.

B. The disposal of surplus and unsuitable excavation shall be the responsibility of the Contractor at his own expense. Surplus and unsuitable material not to be used in the construction of the project shall not be left on the right-of-way or easement of the project, nor adjacent thereto, except by written permission of the affected property owner.

C. The trench subgrade shall consist of firm, stable, non-organic, debris-free soil. In locations where trench excavation exposes unsuitable material, as classified by these specifications, or in the judgment of the Engineer, the subgrade shall be undercut as directed by Engineer for the full design width of the trench and backfilled with washed gravel bedding. Such undercutting and select bedding material will be compensated in accordance with the requirement of Part 4, hereafter. **Select bedding material in the pipe envelope will not be considered for payment.**

3-17 JOINTING DISSIMILAR PIPES: Suitable water-tight adaptor couplings, acceptable to the Engineer, shall be used for connecting dissimilar pipes. Straps shall be stainless steel. No separate payment for adaptor couplings will be made.

3-18 BACKFILLING: Backfill shall consist of the material placed as indicated on the detail shown in the construction drawings. As pipe is laid and suitably bedded, trenches and excavation shall be promptly backfilled to a level one-foot above the top of the pipe in relatively thin lifts and compacted to a minimum 90% standard Proctor maximum dry density (ASTM D 698). Backfill shall be placed and tamped equally and thoroughly along each side of the pipe in a manner to avoid displacement of or damage to the pipe.

A. Tamping: The backfill shall be placed in equal thickness lifts, each lift being thoroughly compacted to the density specified. Each lift of the backfill material shall have proper moisture content to permit compaction to this density.

1. In areas where street paving, sidewalks, driveways and other restoration work is required, the backfill above the one (1) foot cover level shall be compacted to the subgrade level or as directed and maintained to eliminate voids and future settlement. Special compaction procedures involving 95% density on 6" lifts are required at such locations and at other locations shown on the Drawings.

2. In open fields or undeveloped areas, the backfill above the one (1) foot cover level may be placed in twelve inch (12") layers and compacted to a density of not less than that of the surrounding earth. The top of the filled trench shall be mounded slightly above the natural ground to allow for settlement.

3. Landscape and cultivatable areas shall be restored by the replacement of the stockpiled topsoil stripping to a depth of at least twelve inches (12").

B. Marking Tape: Marking tape shall be placed continuously along the force main above the center of the pipe and to a depth of not less than 18 inches.

C. Tracer Wire: Tracer wire shall be placed on the of the force main pipe and securely taped at least once to every joint of pipe. Tracer wire terminals shall be located every 500’ or as otherwise shown on the drawings. This item is an absorbed cost.

3-19 TEMPORARY SURFACES OVER TRENCHES

A. Whenever the wastewater improvements are constructed under traveled roadways, driveways, sidewalks or other traveled surfaces, a temporary surface shall be placed over the top of the trench as soon as possible after placement and compaction of the backfill has been satisfactorily completed.

B. The top of the temporary surface shall be smooth and meet the grade of the adjacent undisturbed surface. The temporary surface shall be maintained at the Contractor's expense until final

restoration of the street surface is completed as specified. No permanent restoration of street surface shall be initiated until authorized by the Engineer. The temporary surfacing shall be required over the entire width of the trench. Any width in excess of the specified width shall not be used in computing payment quantities.

3-20 REPLACEMENT OF PERMANENT SURFACES, STRUCTURES AND PROPERTY

A. General: The Contractor shall restore all permanent type pavements, sidewalks, driveways, curbs, gutters, shrubbery, fences, poles and other property and surface structures removed or disturbed during or as a result of construction operations to a condition which is equal in appearance and quality to the condition that existed before the work began. The surface of improvements shall be constructed of the same material and match in appearance the surface of the improvement which was removed. Where select granular trench backfill is used, the restoration shall be made as soon as possible after compaction of the backfill has been completed. This item is an absorbed cost.

B. Concrete Pavement Surface: Where the existing pavement surface is Portland Cement concrete, the pavement replacement shall consist of reinforced concrete equal to the original depth of pavement placed over six (6) inches of compacted clay gravel or crushed limestone base. Concrete shall conform to Section 03 30 00 "Cast in Place Concrete". The concrete surface shall be finished equal to the existing finish (ie., trowel, broom, exposed aggregate, etc.). Pavement joints in the replacement surface shall conform to and match the joints in the adjacent pavement area.

C. Asphalt Pavement Surface: Where the existing pavement surface is bituminous concrete and clay gravel or crushed asphalt has been placed in the trench, the top layer of gravel to the depth of the existing pavement shall be removed and replaced with black base under 2" of surface course.

3-21 CONCRETE SIDEWALKS, DRIVEWAYS, CURB, CURB AND GUTTER

A. General: Where necessary to remove and replace concrete sidewalks, driveways, curbs and curb and gutters, replacements shall be made as follows:

B. Concrete sidewalks, driveways, curbs and curb and gutters shall be replaced with concrete meeting the applicable provisions of Section 033 00 00 "Cast in Place Concrete" of these Specifications. Minimum thickness shall be four inches (4") for sidewalks and six inches (6") for driveways. Materials and construction requirements shall conform to the various Sections of these Specifications. Curb and gutter shall be formed as detailed on the Drawings or as directed by the Engineer. Sidewalks and driveways shall be finished to match existing adjacent surfaces, unless otherwise specified or directed by the Engineer.

3-23 RESTORATION OF LANDSCAPED AREAS

A. Sod, shrubbery, decorative planting and other landscape items shall be replanted, replaced or restored in the manner removed.

B. Should new construction be required to replace damaged or unsalvageable items, then the Contractor shall furnish all labor, materials, equipment, tools, and incidentals set forth in the applicable Sections of these Specifications.

3-24 MAINTENANCE OF SITE: The Contractor shall prevent, control and correct dust nuisance or muddy conditions developing on roadways as a result of his operation. No payment for maintenance of the site shall be made but shall be considered as a subsidiary obligation of the Contractor.

3-25 CLEAN-UP

A. After the backfill is completed, the Contractor shall dispose of surplus material, dirt and rubbish from the site. Surplus dirt shall be disposed of in Contractor furnished and approved disposal areas or in on site areas as directed by the Engineer.

B. After work is completed, the Contractor shall remove tools and other equipment used by him, leaving the entire site free, clear and in clean condition.

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SECTION 33 41 00
STORM DRAINAGE

PART 1 - GENERAL

1-01 DESCRIPTION

A. This item shall consist of furnishing all materials, labor, tools, equipment, and incidentals and performing all work necessary for the installation of pipe culverts, curb inlets, catch basins, and concrete headwalls and other specials in accordance with the Contract Documents. The work shall include all excavation, grading, backfill and other incidentals necessary for the installation of drainage structures as specified herein.

1-02 APPLICABLE DOCUMENTS

A. The following publications form a part of this Specification and where referred to by basic designation only, are applicable to the extent indicated. Reference is to the later edition of each unless specified otherwise.

1. American Society for Testing and Materials (ASTM):

a. C-76 Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
b. C443 Joints for Circular Concrete Sewer and Culvert Pipe.
c. C478 Precast Reinforced Concrete Manhole Sections.
d. F667 Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings.

2. American Association of State Highway and Transportation Officials (AASHTO):

a. M190 Bituminous Coated Riveted Corrugated Metal Culvert Pipe and Pipe Arches.
b. M36 Corrugated Metal Culvert Pipe, Aluminum Coated.
c. M294 Standard Specification for Corrugated Polyethylene Pipe, 12" to 24" diameter.

3. American Concrete Institute (ACI):

a. ACI 301 Specifications for Structural Concrete for Buildings.
b. ACI 318 Building Code Requirements for Reinforced Concrete.

B. Local Building Codes: Any City, County and State Codes applying to the work.

C. Standard Specifications for Road and Bridge Construction (MDOT): 2004 edition, as referenced herein.

1-03 SUBMITTALS

A. Certified Test Reports: Before delivery of materials and equipment, certified copies of the reports of all tests specified herein or elsewhere shall be submitted to the Contracting Officer for review. The testing shall have been performed in a laboratory meeting the Contracting Officer's approval. Test reports shall be accompanied by notarized certificated from the manufacturer certifying that the tested material and equipment is of the same type, quality, manufacturer and made as that proposed to be supplied.

B. Concrete Pipe: Certified copies of test reports shall include strength tests of concrete pipe. Strength tests for concrete piping shall be the three edge bearing tests. Test reports shall be furnished prior to installation of piping.

C. Shop Drawings: Contractor shall supply shop drawings as specified herein or as directed by the Contracting Officer. Review of shop drawings by the Contracting Officer shall be required prior to incorporation of the subject item into the work.

PART 2 - MATERIALS

2-01 REINFORCED CONCRETE PIPE

A. Shall conform to ASTM C76, Class III, Wall B minimum, unless otherwise specified. Joints shall be rubber gasket or bituminous plastic. Jointing shall be in conformance with the manufacturer's recommendations, applicable ASTM Standards, and MSHD Standards.

2-02 CORRUGATED METAL PIPE

A. Shall be bituminous coated on the inside and outside. Manufacture of pipe, galvanizing and coating shall conform to AASHTO M190, Type A. Joints shall be fully bituminous coated coupling bands and conform to AASHTO M36. Bands shall not be less than 7 inches wide for pipe diameters from 8 inches to 30 inches, inclusive; and 12 inches wide for pipe with diameters from 36 inches to 60 inches, inclusive. Jointing shall be completed in accordance with the manufacturer's recommendations and applicable ASTM/AASHTO Standards.

2-03 CORRUGATED POLYETHYLENE PIPE

A. Shall conform to ASTM F-667. Bands and jointing shall be installed and completed in accordance with the manufacturer's recommendations and applicable ASTM/AASHTO Standards.

2-04 CONCRETE

A. Cement, reinforcement, forms, jointing and other incidentals shall be as specified in the Section "Concrete".

A. All concrete work shall be in accordance with the provisions of "Building Code Requirements for Reinforced Concrete", ACI 318 and ACI 301. Any questions regarding acceptable concrete practice shall be decided by reference to ACI 301 and to ACI Standards listed in Chapter 4 of ACI 318.

2-05 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall be responsible for the condition of all excavations made by him. All slides and cave-ins shall be removed without extra compensation, at whatever time and under whatever circumstances they may occur.

B. The failure of the Contracting Officer to order the use of bracing or sheeting or the failure to order sheeting, bracing, struts, or shoring to be left in place, shall not in any way or to any extent relieve the Contractor of any responsibility concerning the condition of any excavation. Any delay resulting in keeping the excavation open longer than would have otherwise have been necessary, shall not relieve the Contractor of responsibility for properly and adequately protecting the excavation from caving or slipping at all times, nor from any of his obligations under the Contract relating to injury of persons or property.

C. Installation of sheeting and shoring, or shoring left in place by the Contractor shall not entitle the Contractor to any claim for extra compensation.

2-06 INCIDENTAL MATERIALS

A. Masonry brick shall conform to the standard specifications for sewer brick, made from clay or shale, ASTM C-32, Grade MS.

B. Mortar: Portland Cement Mortar shall consist of one (1) part Portland Cement complying with ASTM C-150, Type 1, and three (3) parts mortar sand and sufficient water to mix mortar to proper consistency.

C. Gray iron casting shall conform to the standard specifications for gray iron castings ASTM A-48, Class 25.

D. Manhole Steps: Steps for manholes shall be cast aluminum alloy meeting the requirements of the Aluminum Association (Alloy AA-514) and Federal Specifications G4A.

E. Foundations: Shall be either poured in place reinforced concrete as detailed, or precast sections set on undisturbed earth or select bedding, where ordered by the Contracting Officer or detailed on the Contract Drawings. Concrete shall be Class "B" as specified in Section 03300,"Concrete General" herein.

F. Flared End Section: Shall be of the same class and type of pipe installed where specified.

PART 3 - EXECUTION

3-01 EXCAVATION

A. General: The Contractor shall perform all excavation of every description and of whatever substances encountered, to the depths indicated or as otherwise specified.

B. During excavation, material suitable for backfilling in the opinion of the Contracting Officer shall be stock piled in an orderly manner a sufficient distance from the banks of trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or not suitable for backfill shall be removed and wasted as approved by the Contracting Officer. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved method.

3-02 TRENCHES

A. The trenches shall be of the necessary width for the proper laying of the pipe, and the banks shall be as nearly vertical as practicable. The bottom of the trenches shall be accurately graded and shaped to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portion of the pipe where it is necessary to excavate for pipe bells or joints.

B. Depressions for joints shall be dug after the trench bottom has been graded in order that the pipe rest upon the prepared bottom for as nearly its full length as practicable. Depressions shall only be of such length, depth and width as required for properly making the particular type of joint.

C. Care shall be exercised not to excavate below the depth indicated. Over excavated depths shall be backfilled with loose, granular, moist earth, and thoroughly tamped.

D. The width of the trench at and below the top of the pipe and the trench wall shall not exceed the pipe O.D. plus 16 inches.

E. The bottom of the trench shall be rounded so that at least the bottom quadrant of the pipe shall rest firmly on undisturbed soil for as nearly the full length of the barrel as proper jointing operations will permit. This part of the excavation shall be done manually only a few feet in advance of the pipe laying by men skilled in this type of work. The pipe bed shall be prepared to the Contracting Officer's complete satisfaction.

F. Whenever unstable soil that is incapable of properly supporting the pipe is encountered in the bottom of the trench, such soil shall be removed for the full width of the trench and to the depth required. The trench shall be backfilled to the proper grade with an aggregate composed of coarse sand, fine gravel or other suitable material approved by the Contracting Officer. The backfill shall be thoroughly compacted and shaped to form a bed for the pipe.

G. Select backfill or bedding hauled in from off site shall be included in the Lump Sum bid for the project. Use of select backfill from on site excavations shall not be eligible for separate or additional payment.

3-03 DEWATERING

A. The Contractor shall perform all pumping or well pointing necessary to perform the excavation and to maintain excavation in dry state during the work. This shall be an absorbed cost and shall not be measured for separate payment.

3-04 BACKFILLING

A. General: The trenches shall not be backfilled until the system as installed conforms to the requirements specified. The trenches shall be carefully backfilled with the excavated materials, approved for backfilling.

B. Backfill material shall consist of earth, loam, sandy clay, sand and gravel or other approved materials free from large clods of earth or stones. Backfill shall be carefully rammed and compacted in place.

C. Trenches within roadways shall be backfilled to the top of the subgrade or the ground surface in 6 inch layers, and each layer shall be compacted to a density at least 95% of maximum density as determined by AASHTO Method T-99. The surface shall be graded to conform with the surrounding ground surface.

D. Trenches in open areas shall be backfilled to a point one (1) foot above the top of the pipe in 6 inch layers. Each layer shall be compacted to a density of at least 90% of the maximum density as determined by AASHTO T-99. The remainder of the backfill above the 1 foot level shall be properly and carefully compacted to the density of the adjacent earth, and the surface shall be mounded over the trench and left in a uniform and neat condition satisfactory to the Contracting Officer.

E. Trenches improperly backfilled in the opinion of the Contracting Officer shall be reopened to the depth required for proper inspection, then refilled and re-compacted as specified. There shall be no extra compensation for such corrective work.

3-05 PIPE LAYING

A. Pipe laying shall proceed upgrade with the spigot ends of bell and spigot pipe and tongue ends of tongue and groove pointing in the direction of flow in the case of concrete pipe. Corrugated metal pipe shall be laid with outside laps of circumferential joints pointing upstream and with longitudinal laps on the side. Corrugated polyethylene pipe shall be installed in accordance with ASTM recommended practice D-2321 and in accordance with manufacturer's recommendations.

B. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe and to avoid sudden off sets of the flow line. As the work progresses, the interior of the pipe shall be cleared of all dirt and superfluous materials of every description.

C. Trenches shall be kept free of water and pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work.

D. Pipe shall be plugged or sealed at the end of work day to inhibit the entrance of foreign objects into the line.

3-06 JOINTS

A. Concrete Pipe: Joints shall be rubber gasket complying with ASTM C-443.

a. All rubber gaskets shall be extruded or molded and cured in such a manner that any cross section will be dense, homogeneous, and free of porosity, blisters, pitting, and other imperfections. The gaskets shall be extruded or molded to the specified size within a tolerance of ± 6% on any dimension, measured at any cross section. The rubber gasket shall be fabricated from a high grade rubber compound. The basic polymer shall be natural rubber, synthetic rubber or a blend of both acceptable to the purchaser.

B. Corrugated Metal Pipe: Joints shall be made with coupling bands. Bands shall be seated and made up tightly in accordance with the recommendations of the pipe manufacturer. The exterior surface of all bands and any other defects shall receive a field coat of bituminous paint.

C. Corrugated Polyethylene Pipe: Joints shall be made with split couplings corrugated to engage the pipe corrugations, and shall engage a minimum of 4 corrugations, 2 on each side of joint. A neoprene gasket shall be utilized with the coupling to provide a soil tight joint.

3-07 CONSTRUCTION OF CONCRETE HEADWALLS

A. General: Construction of concrete headwalls shall be of reinforced concrete and conform to dimensions, grades and details shown on the Contract Drawings. Forms for exposed surfaces of headwalls shall be provided with liners and chamfers strips. Chamfers shall be 3/4".

B. Exposed surfaces of parapets and wing walls shall be given a rubbed finish with a medium coarse carborundum stone.

C. The structures shall be cured for a minimum of 7 days. The structures shall be kept wet by the use of wetted burlap or may be cured with membrane curing compound.

D. The headwalls shall be carefully backfilled to a density at least that of the surrounding ground. All costs involved in excavation and backfilling shall be included in the Lump Sum price for the project.

3-08 CONSTRUCTION OF CATCH BASINS, CURB INLETS AND STORM MANHOLES

A. Brick masonry and concrete work for catch basins and inlets shall be constructed in conformity with the details shown on the Contract Drawings.

B. Where irons or other fittings enter the brick work, they shall be placed as the work is laid up, thoroughly bonded, accurately spaced and lined. Upon completion of the masonry and settings of castings and fittings, the inside and outside surfaces of the brick masonry shall be neatly plastered with mortar to the thickness of one half (1/2) inch. Plastering shall be finished to a uniform, smooth surface and neatly pointed to all fittings.

with mortar to the thickness of one half (1/2) inch. Plastering shall be finished to a uniform, smooth surface and neatly pointed to all fittings.

C. The concrete or brick and mortar shall be carefully constructed around the inlet and outlet pipes so as to prevent leakage and form a neat connection.

D. Basins, inlets and manholes may be constructed partially or totally of precast reinforced concrete manhole sections and specials. All precast units shall comply with ASTM C-478 and joints shall be preformed plastic joints. Preformed plastic joint compound shall be "Butyl-Tite" as manufactured by Blue Ridge Rubber Company, Fletcher, North Carolina; "Kent-Seal" as manufactured by Hamilton Kent Manufacturing Company of Kent, Ohio; or approved equal. Preformed plastic joint compound shall meet Federal Specification SS-S-SS-00219 and AASHTO M-198.

E. Drop inlets are to be manufactured by “Nyloplast” as shown in the contract drawings, or approved equal.

3-09 TRENCH DRAINS

A. Trench drain grates are to be galvanized slotted grates manufactured by “NDS”, or approved equal. Trench drain covers used for condensing lines are to be “Balco TSD – Diamond Plate”, or approved equal.

3-10 CLEAN-UP

A. After backfill of pipe and structures is completed, the area shall be graded to conform with the surrounding ground or to grade indicated, as applicable. The Contractor shall dispose of all surplus material, dirt and rubbish. Surplus material shall be deposited at locations and in a manner approved by the Contracting Officer.

3-11 INSPECTION

A. Prior to final approval of the system, the Contractor and Contracting Officer shall conduct a thorough inspection of the entire installation. Any indication of defects on material or workmanship or any obstruction to the flow in the pipe system shall be corrected.

B. All defects shall be corrected by the Contractor without additional compensation and in a manner acceptable to the Contracting Officer.

3-12 MAINTENANCE

A. The Contractor shall be responsible, until final acceptance and without extra compensation, for the maintenance of all sewers and structures to the lines and grades established for the construction, for the stability of all backfills and the finished grades above the sewers and around the structures, and for the repair and replacement of all items which were damaged or removed during the construction. Restoration of pavement, base courses, driveways, curb and gutter, sidewalks and other items shall conform to the requirements specified in other sections of these Specifications.

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SECTION 46 25 13
COALESCING OIL-WATER SEPARATOR

PART 1 – GENERAL

1-01 DESCRIPTION

A. General: In accordance with the requirements of these Technical Specifications, the Contractor shall furnish and install one (1) single-wall oil-water separator with coalesce plate system and all necessary appurtenances of the type specified on the Drawings and at the location designated.

B. The Contractor shall be required to furnish all equipment, materials, labor and tools incidental to the work; perform all excavation, trenching, dewatering, sheeting, shoring, bracing and backfilling; connect and test all electrical and mechanical work; and complete the installation ready for use by the Owner.

C. Wherever Contractor's work borders, connects to or affects work by other Contractors or contracts, Contractor shall coordinate his work to minimize inconvenience to the total job effort.

1-02 SUBMITTALS

A. The Contractor shall submit to the Engineer shop drawings and manufacturer's catalog sheets on all equipment, piping, electrical, and mechanical work prior to initiating any work on same. Six (6) copies of the submittals should be transmitted, bound in durable binders.

B. The Contractor shall submit shop drawings of other items when requested by the Engineer.

C. The sewage pumps shall be factory tested prior to incorporation into the work. Manufacturer's certifications of pump flow and head delivery and rating curves shall be submitted in duplicate to the Engineer for review.

1-03 DESCRIPTION

A.The separator shall be designed for gravity separation of free oils (hydrocarbons and other petroleum products) along with some settleable solids from the surrounding area.

B.Separator shall be prefabricated with inclined, parallel, flat/corrugated plate and impingement coalescers.

C.Separator shall be installed underground with top access at or above grade level. The source of the influent to the separator shall be gravity flow from stormwater runoff, hydrocarbon spills, and/or cleaning/maintenance operations

PART 2 - MATERIALS

2-01 MANUFACTURER

A. Oil-Water Separator shall be Highland Tank Model HTC-550 Underground Single-wall Parallel Flat/Corrugated Plate Gravity Displacement Oil/Water Separator or approved equal.

B. The cost of any required construction changes required by use of alternate equipment is the responsibility of the Contractor.

C. Highland Tank and Mfg. Co., One Highland Road, Box 338, Stoystown, PA 15563, Phone 814 893-5701, FAX 893-6126, shall manufacture the Oil/Water Separator. For additional information visit **www.highlandtank.com**

2-02 SPECIFICATIONS

A. Separator shall be furnished with oil level alarm and leak detection systems having a total volume of 550 gallons to comply with Spill Prevention Control and Countermeasures (SPCC) plan requirements. The sizing of this oil/water separator is consistent with industry protocols for complying with the minimum federal spill and discharge regulations. A separator of smaller volume is not permissible

B. Separator to be furnished with a Corella® inclined parallel flat/corrugated plate coalescer to simultaneously separate free oil droplets and settleable or suspended solids particles from water without clogging of the coalescer.

C. Nominal Dimensions:
   a. Nominal Diameter: 3-feet, 6-inches, or as indicated on the drawings.
   b. Nominal Length: 7-feet, 9-inches, or as indicated on the drawings

2-03 PERFORMANCE

A. Provide separator designed for intermittent and variable flows of water, oil, or any combination of non-emulsified oil-water mixtures ranging from zero to 55 gal/min. Nominal separator retention time shall be 10 minutes, based on total unit volume. (Actual retention time will be less due to air space above fluid level).

B. Typical operating temperature range of the influent oil in water mixture: 40º F to 80º F.

C. Typical specific gravity range of the oils at operating temperatures: 0.71 to 0.92.

D. Typical specific gravity range of the fresh water at operating temperatures: 1.00 to 1.03.

E. The free oil and grease concentration in the effluent from the separator shall not exceed 10 mg/l (10 PPM) to satisfy requirements of the NPDES stormwater discharge permit. To achieve this goal, it will be necessary to remove all free oil droplets equal to and greater than 20 microns.

2-04 DESIGN CRITERIA

A. Separator shall be designed in accordance with Stokes Law and the American Petroleum Institute Publication 421, "Monographs on Refinery Environmental Control - Management of Water Discharges; Design and Operation of Oil/Water Separators." The total effective surface area of the parallel-corrugated plate coalescer shall be determined by OWS manufacturer for the flow, temperature, and oil specific gravity conditions specified above. The total effective surface area of the polypropylene impingement coalescer shall be determined by OWS manufacturer for the flow, temperature, and oil specific gravity conditions specified above. Calculations, signed and stamped by a Registered Professional Engineer shall be submitted to document specified effluent

quality based on complete removal of the specified oil globule. A separator with lower effective surface areas is not permissible.

B. Separator capacities, dimensions, construction, and thickness shall be in strict accordance with Underwriters Laboratories, Subject UL-58 Standard for Safety, Steel Underground Tanks for Flammable and Combustible Liquids, Single-wall construction. Separator shall comply with National Fire Protection Association NFPA 30 Flammable and Combustible Liquids Code.

C. Separator shall be the standard patented product of a steel tank manufacturer regularly engaged in the production of such equipment. Manufacturer shall have at least 20-years experience in manufacturing similar units for identical applications. No subcontracting of tank fabrication shall be permitted.

D. Separator shall be fabricated, inspected, and tested for leakage before shipment from the factory by manufacturer as a completely assembled vessel (to the greatest extend possible with consideration to shipping requirements) ready for installation.

E. Separator shall be cylindrical, horizontal, atmospheric-type steel vessel intended for the separation and storage of flammable and combustible liquids. The separator shall have the structural strength to withstand static and dynamic hydraulic loading while empty and during operating conditions. The Oil/Water Separator's dimensions and thickness shall be in strict compliance with Roark's Formulas for Stress and Strain as presented in UL 58. Calculations, signed and stamped by a Registered Professional Engineer shall be submitted to document structural strength under specified overbearing or external pressure. A separator with a reduced shell thickness is not permissible.

F. Separator shall have the following oil storage capacities:
   a. High oil level (warning), equal to about 20% of the static vessel volume
   b. High-high oil (alarm), equal to about 43% of the static vessel volume
   c. Emergency oil spill capacity equal to about 80% of the static vessel volume

G. Separator shall consist of inlet and outlet connections, non-clogging flow distributor and energy dissipater device, stationary under flow baffle, pre-settling area for solids, sludge baffle, oil coalescing chamber with removable parallel corrugated plates and sectionalized removable polypropylene impingement coalescers to optimize separation of free oil from water, effluent downcomer positioned to prevent discharge of free oil that has been separated from the water, access manways for coalescers and each chamber, fittings for vent, oil pump-out, sampling, gauging, leak detection, and lifting lugs.

H. Separator Corrosion Control System shall be in strict accordance with Underwriters Laboratories Inc. Subject UL-1746 Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks and HighGuard External Corrosion Protection Specifications.

2-05 DESCRIPTION

The separator shall be a pre-packaged, pre-engineered, ready to install unit consisting of:

A. A 4-inch flanged influent connection with an internal influent nozzle at the inlet end of the separator. Nozzle discharge point will be located at the furthest diagonal point from the effluent discharge opening.

B. A velocity head diffusion baffle at the inlet to:
   a. reduce horizontal velocity and flow turbulence.
   b. distribute the flow equally over the separators cross sectional area.
   c. direct the flow in a serpentine path in order to enhance hydraulic characteristics and fully utilize all separator volume.
   d. completely isolate all inlet turbulence from the separation chamber.

C. A sediment area to disperse flow and collect oily solids and sediments.

D. A sludge baffle to retain settleable solids and sediment and prevent them from entering the separation chamber.

E. An oil/water separation chamber containing removable inclined, parallel, flat/corrugated coalescer plates, sloped downward toward the sediment chamber, to:

   a. shorten the vertical distance than an oil globule has to rise for effective removal. Minimum plate gap to be 1-1/4".
   b. enhance coalescence by generating a slight sinusoidal (wave like) flow pattern thereby causing smaller, slow rising, oil globules to coalesce together on the undersides of the plates forming larger, rapidly rising sheets of oil.
   c. direct the paths of the separated oil to the surface of the separator.

F. A sectionalized removable "Petro-Screen" polypropylene impingement coalescer designed to intercept oil globules of less than 20 microns in diameter. Heavy, one-piece impingement coalescers are not permissible.

G. An internal effluent downcomer pipe, located at the outlet end of the separator, to allow for effluent discharge from the bottom of the separation chamber only.

H. A 4-inch flanged effluent connection.

I. Fittings for vent, interface/level sensor, leak detection, waste oil pump-out, sampling, and gauge.

J. Two (2) 18-inch diameter manholes, UL approved, complete with 48-inch extensions (length based on burial depth), covers, gaskets, and bolts. One manway shall be placed between the inlet and the parallel-flat/corrugated plate coalescer to facilitate access into sediment chamber for solids removal. One manway shall be placed between the parallel flat/corrugated plate coalescer and outlet to facilitate access into the oil water separation chamber for oil removal.

K. Lifting lugs at balancing points for handling and installation.

L. Identification plates: Plates to be affixed in prominent location and be durable and legible throughout equipment life.

M. HighGuard Corrosion Protection System consisting of:
   a. External surfaces commercial grit blasted and coated with 75 mils DFT HighGuard self-reinforcing polyurethane.
   b. 10-year limited warranty

2-06 ACCESSORIES & OPTIONS

A. Internal surfaces commercial grit blasted and coated with 15 mils DFT heavy duty polyurethane.

B. Grade Level Manways for vehicle traffic loading (H20 or H25)

2-07 WARRANTY

A. The manufacturer shall warrant its products to be free from defects in material and workmanship for a period of one year from the date of shipment. The warranty shall be limited to repair or replacement of the defective part(s).

B. Highland Tank 10-year limited warranty for external corrosion and structural defects.

PART 3 - EXECUTION

3-01 GENERAL

A. The Contractor shall complete final assembly of equipment and accessories necessary for proper functioning of such equipment.

B. The Contractor shall furnish shop drawings and manufacturer's catalog sheets as requested by the Engineer.

3-02 ASSEMBLY

A. The Contractor shall complete final assembly of equipment delivered to the job site unassembled. Included in the work shall be the interconnection of equipment with electric wiring and piping, as required for an operable installation (if applicable)

3-03 EQUIPMENT SETTING

A. No tank shall be set into any excavation until written excavation and installation procedures by the Contractor have been reviewed and approved by the Engineer.

Tank shall be installed on suitable bedding material compacted to a density of at least ninety-eight percent (95%) of standard Proctor maximum dry density or as directed by the Engineer.

B. Once installed, the bottom of the access hatches/ports shall be four (4) to six (6) inches above finished grade.

C. Finished grade shall slope away from the access hatches/ports.

D. Equipment shall be set plumb, level and true in elevation, alignment and dimensions. The Contractor shall check dimensions necessary for installation of equipment and be responsible for the correctness and proper fitting of his work.

E. Upon completion of equipment installation, the Contractor shall thoroughly clean lubrication reservoirs and install lubricants recommended by the manufacturer at no extra cost to the Owner.

3-04 CLEAN-UP AND RESTORATION OF SITE

A. After the work has been completed, the Contractor will dispose of surplus materials, dirt and rubbish from the site at an offsite location determined by the Owner.

B. The Contractor will further remove tools and other equipment used by him, leaving the site clean, clear and in good condition.

3-05 GUARANTEE

A. In addition to the Contractor's one (1) year guarantee, the manufacturer of the entire oil/water separator, shall guarantee for one (1) full year from the date of acceptance by the Owner that all equipment will be free from defects in design, material and workmanship.

Whether of his own manufacture or not, the Contractor will furnish replacement parts of any component which is proved defective during the guarantee period.

B. Manufacturing or operating defects found during the warranty period will be reported to the Contractor by the Owner/Engineer and will be corrected by the Contractor at no cost to the Owner.

3-06 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall be responsible for the condition of excavations made by him. Slides and cave-ins shall be removed without extra compensation, at whatever time and under whatever circumstances they may occur.

B. Installation of sheeting and shoring shall be the responsibility of the Contractor. Shoring left in place by the Contractor shall not entitle the Contractor to any claim for extra compensation.

3-07 TESTING

A. Contractor shall demonstrate a fully functional oil/water separator system prior to final acceptance.

END OF SECTION
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