Cherokee Nation Cultural and Economic Development LLC

Cherokee Nation Cultural Tourism Offices

591 Main Parkway
Tahlequah OK 74464

PROJECT MANUAL

MARCH 31, 2023

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PROJECT MANUAL **MARCH 31, 2023**

Project: **Cherokee Nation Cultural Tourism Offices**
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Tahlequah OK 74464

Owner: **Cherokee Nation Cultural and Economic Development LLC**

Architect: **CJC Architects, Inc.**
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SECTION 01 1000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Cherokee Nation Cultural Tourism Offices

B. Project Address: 591 Main Pkwy, Tahlequah, Oklahoma74464

C. Owner's Name: Cherokee Nation Cultural and Economic Development LLC.

D. Architect's Name: CJC Architects, Inc..

E. The Project consists of the alteration of an existing one-story building with associated plumbing mechanical and electrical systems and sitework. The Owner desires the project to be constructed in phases, with the completion of the office areas to be prioritized over the completion of the warehouse/storage areas.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 5200 - Agreement Form.

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of alterations work is indicated on drawings.

B. Renovate the following areas, complete including operational mechanical and electrical work and finishes:

1. Existing office areas: The existing office areas have previously been damaged by an overhead water leak. All gypsum board, solid core wood doors, fixtures, ceilings, and floor finishes are to be replaced. Modifications to the existing layout are indicated on the drawings to include patching an opening in the exterior thermal enclosure. Existing fire suppression, HVAC, and electrical systems will be altered to accommodate new construction. Existing plumbing will be capped and removed or altered as indicated on the drawings.
2. Existing production areas under mezzanine: The existing production rooms, toilet rooms, and support areas located below the mezzanine structure will be altered to expand the office area as indicated on the drawings. A portion of the existing mezzanine will be removed to accomodate alterations. Existing fire suppression, HVAC, and electrical systems will be altered to accommodate new construction. Existing plumbing will be capped and removed or altered as indicated in the drawings.
3. Existing warehouse areas: The existing warehouse area will be altered as indicated on the drawings, to include the addition of a new thermal and vapor barrier enclosure at the walls and ceiling of the Art Storage Room which will provide a temperature and humidity stable environment for the storage of artwork. Existing walk-in cooler equipment will be removed and modified where indicated. Wire cage partitions will be installed in the warehouse where indicated. Existing fire suppression and electrical systems will be altered to accommodate new construction in the warehouse area, with a Novec 1230 system installed within the Art Storage Room. The existing unit heater and ventilation system will be removed and replaced with a new HVAC system comprised of ground mounted packaged air conditioning systems at the warehouse and dedicated dehumidification/cooling and ventilation systems in the Art Storage Room. Existing plumbing will be capped and removed or altered as indicated in the drawings.
4. Site work associated with the interior alterations include mechanical and electrical equipment pads for new ground mounted equipment, fence enclosures with gates, and associate site paving. A new ground mounted sign will be provided.

1.04 WORK BY OWNER

A. Owner will supply and install the following:

1. Refrigerators and other non-fixed appliances. The Contractor shall supply and install the undercounter dishwasher and other fixed plumbing fixtures.

2. Communications devices and wiring.
3. Modular storm shelter structure.
4. Office furniture and non-fixed equipment, Warehouse storage shelving and equipment, and Art Storage shelving and storage equipment.

1.05 OWNER OCCUPANCY

A. Owner intends to occupy the Office areas of the Project prior to Substantial Completion of the Warehouse and Art Storage spaces.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Arrange use of site and premises to allow:
1. Owner occupancy after completion of the office area phase.
2. Work by Others.
3. Work by Owner.

B. Provide access to and from site as required by law and by Owner:
1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
2. Do not obstruct roadways, sidewalks, or other public ways without permit.

C. Utility Outages and Shutdown:
1. Limit disruption of utility services to hours the building is unoccupied.
2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
3. Prevent accidental disruption of utility services to other facilities.

1.07 WORK SEQUENCE

A. Construct Work in phases during the construction period:
1. Phase 1: Office areas.
2. Phase 2: Warehouse/Storage Areas.

B. Coordinate construction schedule and operations with Owner.

END OF SECTION

SECTION 01 2000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

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

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

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

1.02 RELATED REQUIREMENTS

A. Section 00 5200 - Agreement Form: Contract Sum, retainages, payment period, monetary values of unit prices.

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

1.03 SCHEDULE OF VALUES

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

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

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

D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

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

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

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

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

B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.

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

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

E. Present required information {CH#10000006}.

F. Form: {CH#10000007} including continuation sheets when required.

G. Execute certification by signature of authorized officer.

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

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

J. Submit one electronic copy of each Application for Payment.

K. When Architect requires substantiating information, submit data justifying dollar amounts in question.

1.05 MODIFICATION PROCEDURES

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

B. Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract by issuing supplemental instructions on AIA Form G710.

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

D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 15 days.

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

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
   3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.

G. Substantiation of Costs: Provide full information required for evaluation.
   1. Provide following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.

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

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

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

K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

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

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2100
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowances.

B. Payment and modification procedures relating to allowances.

1.02 RELATED REQUIREMENTS

A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 CASH ALLOWANCES

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

B. Costs Not Included in Cash Allowances: Product delivery to site and handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing.

C. Architect Responsibilities:
   1. Consult with Contractor for consideration and selection of products, suppliers , and installers.
   2. Select products in consultation with Owner and transmit decision to Contractor.
   3. Prepare Change Order.

D. Contractor Responsibilities:
   1. Assist Architect in selection of products, suppliers , and installers.
   2. Obtain proposals from suppliers and installers and offer recommendations.
   3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
   4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
   5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

E. Differences in costs will be adjusted by Change Order.

1.04 ALLOWANCES SCHEDULE

A. Fire Protection System Design and Installation: Include a stipulated sum of $100,000 for the design, purchase, delivery, and installation of the fire suppression system, to include modifications to the existing wet-pipe system and the addition of a new Novec 1230 fire suppression system at the Art Storage room.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Site mobilization meeting.

D. Progress meetings.

E. Construction progress schedule.

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

G. Number of copies of submittals.

H. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions: Dates for applications for payment.

B. Document 00700 - General Conditions: Duties of the Contractor.

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

D. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 7000 - 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.

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.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.

4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
5. Designation of personnel representing the parties to Contract and Architect.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. 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 SITE MOBILIZATION MEETING

A. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

B. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

C. 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 PROGRESS MEETINGS

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

B. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

C. 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. Coordination of projected progress.
11. Maintenance of quality and work standards.

12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to work.

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.

3.04 CONSTRUCTION PROGRESS SCHEDULE

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

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

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

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

E. Submit updated schedule with each Application for Payment.

3.05 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 3216 - 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.

3.06 SUBMITTALS FOR REVIEW

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

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

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

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.07 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.

3.08 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 7800 - 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.

3.09 NUMBER OF COPIES OF SUBMITTALS

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

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

3.10 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   2. 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.
   3. 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.
   4. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   5. Provide space for Contractor and Architect review stamps.
   6. When revised for resubmission, identify all changes made since previous submission.
   7. Submittals not requested will be recognized, and will be returned "Not Reviewed",

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. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
   1. Transmit related items together as single package.
   2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

E. Deliver submittals to Architect via approved electronic method or at business address.

3.11 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, but will take no other action.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

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.
   2. Not Authorizing fabrication, delivery, and installation:

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

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. References and standards.

C. Testing and inspection agencies and services.

D. Control of installation.

E. Manufacturers' field services.

F. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.

B. Section 01 3000 - Administrative Requirements: Submittal procedures.

C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 SUBMITTALS

A. See Section 01 3000 - 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. Erection Drawings: Submit drawings to Architect.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.04 REFERENCES AND STANDARDS

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

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

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

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

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

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

1.05 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. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
   2. Laboratory: Authorized to operate in the State in which the Project is located.
   3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
   4. 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 TESTING AND INSPECTION

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

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

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

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

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

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

G. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by the Owner. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.03 MANUFACTURERS' FIELD SERVICES

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

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

3.04 DEFECT ASSESSMENT

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

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

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary sanitary facilities.

C. Temporary Controls: Barriers, enclosures, and fencing.

D. Vehicular access and parking.

E. Waste removal facilities and services.

F. Project identification sign.

1.02 TEMPORARY UTILITIES

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

B. Existing facilities may be used.

C. New permanent facilities may be used.

D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. New permanent facilities may not be used during construction operations.

C. Maintain daily in clean and sanitary condition.

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

1.05 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and plywood sheet materials with closed joints and sealed edges at intersections with existing surfaces:

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

F. Existing parking areas may be used for construction parking.

1.07 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.

1.08 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on drawings.

B. Erect on site at location indicated.

C. No other signs are allowed without Owner permission except those required by law.

1.09 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

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

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

E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

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

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Lists of products to be removed from existing building.

B. Section 01 1000 - Summary: Identification of Owner-supplied products.

C. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

D. Section 01 4000 - Quality Requirements: Product quality monitoring.

E. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

F. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

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

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

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

E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

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

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

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

2.02 NEW PRODUCTS

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

B. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 01 6116.
   2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
   3. Are extracted, harvested, and/or manufactured closer to the location of the project.
   4. Have longer documented life span under normal use.
   5. Result in less construction waste. See Section 01 7419

2.03 PRODUCT OPTIONS

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

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

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

2.04 MAINTENANCE MATERIALS

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

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 01 1000 - Summary for identification of Owner-supplied products.

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

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

3.03 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

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

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.

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

C. Store with seals and labels intact and legible.

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

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

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

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

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

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

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

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

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

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

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

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

J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.

F. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

G. Section 02 4100 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.

H. Section 07 8400 - Firestopping.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. 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.

1.04 REGULATORY REQUIREMENTS

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

B. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.

1.05 PROJECT CONDITIONS

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

B. 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.

C. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

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

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

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

1.06 COORDINATION

A. See Section 01 1000 for occupancy-related requirements.

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

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

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

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

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

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

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

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

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

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

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

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

3.05 ALTERATIONS

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

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

2. Relocate items indicated on drawings.
3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
   b. See Section 01 1000 for other limitations on outages and required notifications.
   c. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

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

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

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

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

J. Clean existing systems and equipment.

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

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

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

3.06 CUTTING AND PATCHING

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

B. See Alterations article above for additional requirements.

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

D. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.

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

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

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

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

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

J. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

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

L. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

M. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

3.07 PROGRESS CLEANING

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

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

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

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

3.08 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.

3.09 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.

3.10 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.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.11 ADJUSTING

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

3.12 FINAL CLEANING

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

B. Use cleaning materials that are nonhazardous.

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

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

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

F. Replace filters of operating equipment.

G. Clean debris from area drains and drainage systems.

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

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

3.13 CLOSEOUT PROCEDURES

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

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

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

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

E. Owner will occupy all of the building as specified in Section 01 1000.

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

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

H. Accompany Project Coordinator on Contractor's preliminary final inspection.

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

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

3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Furnish service and maintenance of components indicated in specification sections during the warranty period.

D. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

E. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

F. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.

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

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

1.03 SUBMITTALS

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

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final 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. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

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

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

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

D. Include color coded wiring diagrams as installed.

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

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

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

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

I. Include sequence of operation by controls manufacturer.

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

K. Provide control diagrams by controls manufacturer as installed.

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

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

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

O. Include test and balancing reports.

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

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

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

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

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

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

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

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

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

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

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

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

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

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

M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:

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

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

3.06 WARRANTIES AND BONDS

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

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

C. Co-execute submittals when required.

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

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

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

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

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

END OF SECTION

SECTION 02 4100
DEMOLITION

<<<< UPDATE NOTES

PART 1 GENERAL

2.01 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

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

PART 3 EXECUTION

3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   5. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
   6. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
   7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

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

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

3.02 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

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

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

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

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

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

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.

1. Verify construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

C. Remove existing work as indicated and required to accomplish new work.
1. Remove items indicated on drawings.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
1. Verify that abandoned services serve only abandoned facilities before removal.
2. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.
1. Prevent movement of structure. Provide shoring and bracing as required.
2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch to match new work.

3.04 DEBRIS AND WASTE REMOVAL

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

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

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

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floors and slabs on grade.

B. Concrete reinforcement.

C. Miscellaneous concrete elements, including equipment pads.

D. Vapor Barrier.

E. Concrete Finishing

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

A. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide 2022.

B. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete 1998 (Reapproved 2004).

C. ACI 301 - Specifications for Concrete Construction 2020.

D. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

F. ACI 318 - Building Code Requirements for Structural Concrete 2019 (Reapproved 2022).

G. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.

H. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.

I. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.

J. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

K. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.

L. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2022a.

M. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete 2017a.

N. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2022.

O. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.

P. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.

Q. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Mix Design: Submit proposed concrete mix design.

1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

C. Samples: Submit samples of underslab vapor retarder to be used.

D. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

PART 2 PRODUCTS

2.01 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
1. Type: Deformed billet-steel bars.
2. Finish: Unfinished, unless otherwise indicated.

B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
1. Form: Flat Sheets.

C. Reinforcement Accessories:
1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.

2.02 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C33/C33M.
1. Acquire aggregates for entire project from same source.

C. Lightweight Aggregate: ASTM C330/C330M.

D. Fly Ash: ASTM C618, Class C.

E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.03 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:
1. Installation: Comply with ASTM E1643.
2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
3. Products:
a. Henry Company; Moistop Ultra 15: www.henry.com/#sle.
b. Stego Industries, LLC; Product: Stego Wrap (15 mil): www.stegoindustries.com/#sle.
c. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.
d. W.R. Meadows, Inc.; Product: Sealtight Vapor-Mat (15 mil): www.wrmeadows.com.
e. Substitutions: See Section 01 6000 - Product Requirements.

2.04 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

B. Proportioning Structural Lightweight Concrete: Comply with ACI 211.2 recommendations.
1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

C. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

D. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3500 pounds per square inch.
2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
3. Cement Content: Minimum 470 lb per cubic yard.
4. Water-Cement Ratio: Maximum 44 percent by weight.
5. Maximum Slump: 4 inches.
6. Maximum Aggregate Size: 5/8 inch.

2.05 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.

B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

C. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Architect not less than 24 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

G. Screed toppings level, maintaining surface flatness of maximum 1/4 inch in 10 feet.

3.05 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

F. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.06 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
1. Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

C. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

3.07 DEFECTIVE CONCRETE

A. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

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

3.08 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire retardant treated wood materials.

B. Communications and electrical room mounting boards.

C. Concealed wood blocking, nailers, and supports.

D. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies:

B. Section 10 2800 - Toilet and Bath Accessories

1.03 REFERENCE STANDARDS

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

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

C. AWPA U1 - Use Category System: User Specification for Treated Wood 2022.

D. PS 20 - American Softwood Lumber Standard 2021.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.03 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment:

1. Interior Type A: AWPA Use Category UCFA, Commodity Specification H (Treatment C20 for lumber and C27 for plywood), low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E 84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
   a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
   b. Treat rough carpentry items as indicated .
   c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

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.

END OF SECTION

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Hardware.

D. Factory finishing.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard 2022.

B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications 2022.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

C. Product Data: Provide data for hardware accessories.

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 units from moisture damage.

1.07 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 Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI (AWS) for Custom Grade.

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Cabinets:
   1. Finish - Exposed Exterior Surfaces: Decorative laminate.
   2. Finish - Exposed Interior Surfaces: Decorative laminate.
   3. Finish - Concealed Surfaces: Manufacturer's option.
   4. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
   5. Casework Construction Type: Type A - Frameless.
   6. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
   7. Layout for Cabinet and Door Fronts: Flush panel.
      a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
   8. Adjustable Shelf Loading: 40 psf.

a. Deflection: L/144.

9. Drawers:
   a. Drawer fronts shall be 3/4 inch thick plastic laminate faced to grain match. Exposed edges to be banded with 3M PVC (hot mill glued).
   b. Drawer Construction Technique: Fabericated metal drawer system.
10. Doors: Doors shall be 3/4 inch thick plastic laminate faced with melamine laminate on the inside surface.
11. Backs:
   a. Finished backs shall be 3/4 inch thick plastic laminate faced with melamine laminate on inside surface.
   b. Unexposed backs shall be 1/4 inch thick MDF board core with melamine laminate on inside surface for upper and lower cabinets. Use 3/4 inch thick on full height cabinets.
12. Ends: Finished ends shall be 3/4 inch thick plastic laminate faced with melamine laminate on inside surface. Exposed edges to be banded with 3M PVC (hot mill glued).
13. Partitions: Partitions shall be 3/4 inch thick plastic laminate faced with melamine laminate on inside surface. Exposed face edges to be banded with PVC (hot mill glued).
14. Bottoms and Bases:
   a. Bottoms shall be 3/4 inch thick MDF board core with melamine laminate surface on the top side.
   b. Base, storage and shelving units shall have a separate framed and reinforced base attached to the bottom of the cabinets forming a 4 inch high base that shall be recessed 2 inches in the front (unless noted otherwise on the drawings).
15. Shelves:
   a. All shelves shall be 1 inch thick MDF board core with melamine laminate surface on two sides. Exposed edges to be banded with melamine laminate.
   b. All adjustable shelves to be on metal shelf pegs inserted into shop drilled holes at 2 inches on center vertically.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 PANEL CORE MATERIALS

A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.
   1. Grade: M-2; moisture resistance: MR10.
   2. Panel Thickness: 3/4 inch.

B. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.
   1. Grade: 115; moisture resistance: MR10.
   2. Panel Thickness: 3/4 inch.

2.04 THERMALLY FUSED LAMINATE PANELS

A. Thermally Fused Laminate (TFL): Melamine- or polyester-resin-saturated decorative papers; for fusion to composite wood substrates under heat and pressure.
   1. Test in accordance with NEMA LD 3 Section 3.
   2. Panel Core Substrate: Particleboard.
   3. Color: White.

2.05 LAMINATE MATERIALS

A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

B. Provide specific types as follows:
   1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, color as selected, finish as indicated.
   2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, color as selected, finish as indicated.

3. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, color as selected, finish as indicated.
4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.06 COUNTERTOPS

A. Natural Quartz and Resin Composite Countertops: as indicated on drawings.

2.07 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Color: selected to match panel's decorative laminate finish..
2. Use at all exposed plywood edges.
3. Use at all exposed shelf edges.

C. Fasteners: Size and type to suit application.

D. 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.

E. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.08 HARDWARE

A. Hardware: BHMA A156.9, types as indicated for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.

D. Cabinet Locks: Keyed cylinder, two keys per lock, steel with satin finish.

E. Drawer Slides:
1. Type: Full extension.
2. Static Load Capacity: Commercial grade.
3. Mounting: Side mounted.
4. Stops: Integral type.
5. Features: Provide self closing/stay closed type.

F. Hinges: European style concealed self-closing type with 110 degree range, steel with satin finish.
1. Manufacturers:
a. Hardware Resources: www.hardwareresources.com.
b. Substitutions: See Section 01 6000 - Product Requirements.

2.09 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.

F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

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. 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

3.05 SCHEDULES

A. Typical casework construction unless scheduled otherwise:
   1. Plastic laminate faced cabinets as specified above.
   2. Finish - Concealed Surfaces: Manufacturer's option.
   3. Door and Drawer Front Edge Profiles: Plastic edge banding as specified above.
   4. Countertop: Quartz / Resin composite.

B. Base Cabinets:.
   1. Plastic laminate cabinets.

C. Countertops:
   1. Natural Quartz and Resin Composite Countertops.

END OF SECTION

SECTION 06 8316
FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

B. Trim.

1.02 REFERENCE STANDARDS

A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

1.03 SUBMITTALS

A. See Section 01 3000 - 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.

PART 2 PRODUCTS

2.01 PANEL SYSTEMS

A. Wall Panels:
   1. Panel Size: 4 by 8 feet.
   2. Panel Thickness: 0.10 inch.
   3. Surface Design: Embossed.
   4. Color: White.
   5. Attachment Method: Adhesive only, sealant joints, no trim.

2.02 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

B. Trim: Vinyl; color coordinating with panel.

C. Adhesive: Type recommended by panel manufacturer.

D. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Place trim on panel before fastening edges, as required.

G. Fill channels in trim with sealant before attaching to panel.

H. Install trim with adhesive and screws or nails, as required.

I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation at interior walls and for filling perimeter window and door shim spaces.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

C. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

2.02 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, 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. Thickness: 3.5 and 5.5 inch.
   5. Facing: Unfaced.

PART 3 EXECUTION

3.01 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in wall 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.

END OF SECTION

SECTION 07 2119
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. In exterior ad interior framed walls.
   2. At junctions of dissimilar wall and roof materials.
   3. At underside of roofs.

1.02 REFERENCE STANDARDS

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, insulation properties, and preparation requirements.

C. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

D. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

1.06 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foamed-In-Place Insulation:
   1. BASF Corporation: www.spf.basf.com/#sle.
   2. Carlisle Spray Foam Insulation: www.carlislesfi.com/#sle.
   3. Henry Company: www.henry.com/#sle.
   4. Icynene-Lapolla: www.icynene.com/#sle.
   5. Johns Manville: www.jm.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Foamed-In-Place Insulation (Hybrid System): Foamed on-site using blowing agent of non-ozone-depleting gas.
   1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and overcoat limitations.
   2. Base Layer: Medium-density, semi-rigid, closed-cell, spray polyurethane foam.
      a. Thermal Resistance: R-value of 6.7, minimum, per 1 inch thickness at 140 degrees F mean temperature, at 90 days, when tested in accordance with ASTM C518.
      b. Water Vapor Permeance: 1.05 perms, maximum, when tested at 1-1/2 inch thickness in accordance with ASTM E96/E96M.
      c. Closed Cell Content: At least 98 percent.

d. Density: 2.0 lbs/cu ft, nominal, in accordance with ASTM D1622/D1622M.
e. Compressive Strength: 26 psi, minimum, in accordance with ASTM D1621.
f. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, at 4 inch thick when tested in accordance with ASTM E84.

3. Top Layer (Exposed Surface Layer): Low-density, semi-rigid, two-part, open-cell, spray polyurethane foam.
   a. Thermal Resistance: R-value of 3.5, minimum, per 1 inch thickness at 140 degrees F mean temperature, at 90 days, when tested in accordance with ASTM C518.
   b. Air Permeance: Less than 0.0014 cfm per square foot, when tested at 1-1/4 inch thickness in accordance with ASTM E2178 at 1.57 psf.
   c. Density: 0.5 lbs/cu ft, nominal, in accordance with ASTM D1622/D1622M.
   d. Tensile Strength: 4.7 psi, minimum, in accordance with ASTM D1623.
   e. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, at 4 inch thick when tested in accordance with ASTM E84.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.02 APPLICATION

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

B. Patch damaged areas.

C. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

D. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.03 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

3.04 SCHEDULES

A. For Roof Assembly 'R1': Minimum R30 comprised of two layers; one 3" layer of open cell spray foam insulation applied over 3" of closed cell spray foam insulation.

B. For Wall Assemblies 'W1', 'W2', and 'W3': Minimum R20 comprised of two layers; one 2" layer of open cell spray foam insulation applied over 2" of closed cell spray foam insulaton.

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Thermally insulated hollow metal doors with frames.

D. Sound-rated hollow metal doors and frames.

E. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2022.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.

G. 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.

H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

I. ASTM E413 - Classification for Rating Sound Insulation 2022.

J. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

K. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.

L. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Maintain at project site copies of reference standards relating to installation of products specified.

PART 2 PRODUCTS

2.01 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.

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.

2.02 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 3 - Extra Heavy-duty.
      b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Core Material: Polyurethane, 1.8 lbs/cu ft minimum density.
   3. Door Thermal Resistance: R-Value of 8.7 minimum for installed thickness of polyurethane.
   4. Door Thickness: 1-3/4 inches, nominal.
   5. Top Closures for Outswinging Doors: Flush with top of faces and edges.
   6. Door Face Sheets: Flush.
   7. Weatherstripping: Refer to Section 08 7100.

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: 20 gauge, 0.032 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
   3. Door Thickness: 1-3/4 inches, nominal.
   4. Door Face Sheets: Flush.

D. Sound-Rated Interior 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 1 - Full Flush.
      d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.

2. Sound Transmission Class (STC) Rating of Door and Frame Assembly: STC of 39, minimum, calculated in accordance with ASTM E413, and tested in accordance with ASTM E90.
3. Door Core Material: Manufacturer's standard construction as required to meet acoustic requirements indicated.
4. Door Thickness: As required to meet acoustic requirements indicated.
5. Door Face Sheets: Flush.
6. Sound Seals: Integral, in door and/or frame.
7. Opening Force of Sound-Rated Doors, Non-Fire-Rated: 5 pounds, maximum, in compliance with ADA Standards.

2.03 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Face welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
3. Weatherstripping: Separate, see Section 08 7100.

D. Interior Door Frames, Non-Fire Rated: Face welded type.
1. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch, maximum, above floor at 45 degree angle.
2. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.

E. Sound-Rated Door Frames: Face welded type.
1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.

F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

2.04 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.05 ACCESSORIES

A. Glazing: As specified in Section 08 8000, factory installed.

B. 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.

C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 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 7100.

3.02 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.03 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

3.04 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; non-rated.

1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry: Wood door frames.

B. Section 08 1113 - Hollow Metal Doors and Frames.

C. Section 08 7100 - Door Hardware.

D. Section 08 8000 - Glazing.

E. Section 09 9123 - Interior Painting: Field finishing of doors.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

1.04 SUBMITTALS

A. See Section 01 3000 - 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. Manufacturer's Installation Instructions: Indicate special installation instructions.

E. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience. All doors shall be the product of the same manufacturer to insure uniformity of quality and appearance throughout the project.

B. The top of each door shall bear a label from the manufacturer indicating the door construction, face veneer species, cut and grade. If the doors are factory finished the label shall also have the finishing information.

C. The Door Manufacturer shall provide a letter, signed by an authorized company representative, to the Architect stating that the doors have been manufactured in compliance with this specification.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

D. No doors shall be delivered to the building until weatherproof storage space is available. Store doors in a space having controlled temperature and humidity range between 30 and 60 percent. Stack doors flat and off the floor, supported to prevent warpage. Protect doors from damage and direct exposure to sunlight.

E. Do not walk or place other material on top of stacked doors. Do not drag doors across one another.

F. Contractor shall use all means necessary to protect doors from damage prior to, during, and after installation. All damaged doors shall be repaired or replaced by the contractor at no cost to the owner.

G. Doors shall be palletized at factory in stacks of no more than 30 doors per pallet. Door edges shall be protected with heavy corner guards.

H.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 DOORS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Wood veneer facing for field opaque finish as indicated on drawings.

2.02 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type PC, particleboard core, plies and faces as indicated above.

2.03 DOOR FACINGS

A. Veneer Facing for Opaque Finish: Medium density overlay (MDO), in compliance with indicated quality standard.

B. Facing Adhesive: Type I - waterproof.

2.04 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Vertical Exposed Edge of Stiles - Veneer Faces: Of same species as veneer facing.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings.
   1. Exception: Doors to be field finished.

E. Provide edge clearances in accordance with the quality standard specified.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Use machine tools to cut or drill for hardware.

C. Coordinate installation of doors with installation of frames and hardware.

3.03 INSTALLATION TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall-mounted access units.

B. Ceiling-mounted access units.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM), 100 Bar Harbor Drive,
   1. West Conshocken, PA 19428-2959; (215) 299-5400, fax (215) 977-9679
   2. ASTM A 36-93a: Standard Specification for Structural Steel

1.03 DESIGN REQUIREMENTS

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

1.05 WARRANTY/GUARANTEE

A. Manufacturer’s standard warranty: Materials shall be free of defects in material and workmanship for a period of (5) five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units with Return Air Grille:
   1. Panel Material: Aluminum extrusions with gypsum board inlay.
   2. Size: 12 by 12 inches.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.

B. Ceiling-Mounted Units with Return Air Grille:
   1. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
   2. Size - Other Ceilings: 12 by 12 inches.

2.02 ACCESS DOOR UNITS - WALLS AND CEILINGS

2.03 WALL-MOUNTED ACCESS UNITS WITH RETURN AIR GRILLES

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings for door and frame are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 3323
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior non-fire-rated coiling doors.

B. Electric operators and control stations.

C. Wiring from electric circuit disconnect to operators and control stations.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

B. ITS (DIR) - Directory of Listed Products Current Edition.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).

E. UL (DIR) - Online Certifications Directory Current Edition.

F. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide general construction and component connections and details.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

1.04 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified and indicated.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 COILING DOORS

A. Interior Non-Fire-Rated Coiling Doors: Steel slat curtain.
   1. Single Thickness Slats: Manufacturer's standard.
   2. Nominal Slat Size: 2 inches wide by required length.
   3. Finish: Factory painted, color as selected.
   4. Guides, Angles: Primed steel.
   5. Hood Enclosure: Manufacturer's standard; primed steel.
   6. Electric operation.
   7. Mounting: Within framed opening.
   8. Locking Devices: Lock and latch handle on outside.

2.02 MATERIALS AND COMPONENTS

A. Metal Curtain Construction: Interlocking slats.
   1. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.

B. Guide Construction: Continuous, of profile to retain door in place, mounting brackets of same metal.

C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
   1. Prime painted.

D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

2.03 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
   1. Provide interlock switches on motor operated units.

B. Electric Operators:
   1. Mounting: Side mounted.
   2. Motor Enclosure:
   3. Motor Rating: 1/3 HP; continuous duty.
   4. Motor Voltage: 120 volts, single phase, 60 Hz.
   5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
   6. Controller Enclosure: NEMA 250, Type 4.
   7. Opening Speed: 12 inches per second.
   8. Brake: Manufacturer's standard type, activated by motor controller.
   9. Manual override in case of power failure.
   10. See Section 26 0583 for electrical connections.

C. Control Station: Provide standard three button, 'Open-Close-Stop' momentary-contact control device for each operator complying with UL 325.
   1. 24 volt circuit.
   2. Surface mounted, at interior door jamb.
   3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
      a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Section 26 0583.

F. Complete wiring from disconnect to unit components.

G. Install enclosure and perimeter trim.

3.02 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

END OF SECTION

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront for new window openings, with vision glass.

1.02 RELATED REQUIREMENTS

A. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AA DAF-45 - Designation System for Aluminum Finishes; The Aluminum Association, Inc.; 2003.

B. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

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

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

G. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.

H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).

I. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

1.05 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.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide 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 five 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. Center-Set Style, Thermally-Broken:
   1. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

2.02 COMPONENTS

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch insulating glazing at exterior installations. Glazing to be installed from inside at all canted/sloped storefront.
   2. Air Infiltration Test Pressure Differential: 1.57 psf.
   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 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. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
   3. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
   4. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at specified differential pressure across assembly in accordance with ASTM E283.
   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 over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

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. Framing members for interior applications need not be thermally broken.

2. Glazing stops: Flush.
3. Cross-Section: 2" x 4 1/2" and 1 3/4" x 4" as indicated on drawings. Refer schedule at end of this section.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

C. Fasteners: Stainless steel.

D. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.

E. Glass: As specified in Section 08 8000.

F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

G. Glazing Accessories: See Section 08 8000.

H. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

A. Comply with AA DAF-45 for aluminum finishes required.

B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 8000.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

END OF SECTION

SECTION 08 7100
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood and hollow metal doors.

B. Thresholds.

C. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 1416 - Flush Wood Doors.

C. Section 08 4313 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.

D. Section 28 1000 - Access Control: Electronic access control devices.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. BHMA A156.1 - Standard for Butts and Hinges 2021.

C. BHMA A156.2 - Bored and Preassembled Locks and Latches 2017.

D. BHMA A156.3 - Exit Devices 2020.

E. BHMA A156.4 - Door Controls - Closers 2019.

F. BHMA A156.5 - Cylinders and Input Devices for Locks 2020.

G. BHMA A156.6 - Standard for Architectural Door Trim 2021.

H. BHMA A156.7 - Template Hinge Dimensions 2016.

I. BHMA A156.16 - Auxiliary Hardware 2018.

J. BHMA A156.17 - Self Closing Hinges & Pivots 2019.

K. BHMA A156.18 - Materials and Finishes 2020.

L. BHMA A156.21 - Thresholds 2019.

M. BHMA A156.22 - Standard for Gasketing 2021.

N. BHMA A156.26 - Standard for Continuous Hinges 2021.

O. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames 2016.

P. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.

Q. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.

R. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.

S. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors 1993; also in WDHS-1/WDHS-5 Series, 1996.

T. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

U. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

V. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

C. Keying Requirements Meeting:
   1. Schedule meeting at project site prior to Contractor occupancy.
   2. Attendance Required:
      a. Contractor.
      b. Owner.
      c. Architect.
      d. Installer's Architectural Hardware Consultant (AHC).
      e. Hardware Installer.
   3. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.
      d. Establish keying submittal schedule and update requirements.
   4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
   5. 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.
   6. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
   3. List groups and suffixes in proper sequence.
   4. Provide complete description for each door listed.
   5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.

D. Keying Schedule:
   1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

E. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Lock Cylinders: Ten for each master keyed group.
   3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
   1. Locksets and Cylinders: Three years, minimum.
   2. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   4. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   5. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

D. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See shop drawing submittal of Door Hardware Schedule.

E. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      a. Aluminum fasteners are not permitted.
      b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   2. Fire-Rated Applications: Comply with NFPA 80.
      a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
      b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.
   3. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

2.02 HINGES

A. Hinges: Comply with BHMA A156.1, Grade 1.
   1. Self Closing Hinges: Comply with BHMA A156.17.
   2. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
      a. Provide hinge width required to clear surrounding trim.
   3. Continuous Hinges: Comply with BHMA A156.26.
   4. Provide hinges on every swinging door.
   5. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
   6. Provide ball-bearing hinges at each door with closer.
   7. Provide following quantity of butt hinges for each door:
      a. Doors up to 60 inches High: Two hinges.
      b. Doors From 60 inches High up to 90 inches High: Three hinges.
      c. Doors 90 inches High up to 120 inches High: Four hinges.

d. Doors over 120 inches High: One additional hinge per each additional 30 inches in height.
e. Dutch Doors: Two hinges each leaf.

2.03 FLUSH BOLTS

A. Flush Bolts: Comply with BHMA A156.16, Grade 1.
1. Flush Bolt Throw: 3/4 inch, minimum.
2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
3. Provide dustproof floor strike for bolt into floor, except at metal thresholds.

2.04 EXIT DEVICES

A. Exit Devices: Comply with BHMA A156.3, Grade 1.
1. Lever design to match lockset trim.
2. Provide cylinder with cylinder dogging or locking trim.
3. Provide exit devices properly sized for door width and height.
4. Provide strike as recommended by manufacturer for application indicated.
5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.05 LOCK CYLINDERS

A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
1. Provide standard type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
2. Provide cylinders from same manufacturer as locking device.
3. Provide cams and/or tailpieces as required for locking devices.

2.06 CYLINDRICAL LOCKS

A. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
1. Bored Hole: 2-1/8 inch diameter.
2. Latchbolt Throw: 1/2 inch, minimum.
3. Backset: 2-3/4 inch unless otherwise indicated.
4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
a. Finish: To match lock or latch.
b. Flat-Lip Strikes: Provide for locks with three piece antifriction latchbolts as recommended by manufacturer.
c. Extra-Long-Lip Strikes: Provide for locks used on frames with applied wood casing trim.
5. Provide a lock for each door, unless otherwise indicated that lock is not required.
6. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.

2.07 DOOR PULLS AND PUSH PLATES

A. Door Pulls and Push Plates: Comply with BHMA A156.6.
1. Pull Type: Straight, unless otherwise indicated.
2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
a. Edges: Beveled, unless otherwise indicated.
3. Material: Stainless steel, unless otherwise indicated.
4. Provide door pulls and push plates on doors without a lockset, latchset, exit device, or auxiliary lock unless otherwise indicated.
5. On solid doors, provide matching door pull and push plate on opposite faces.

2.08 CLOSERS

A. Closers: Comply with BHMA A156.4, Grade 1.
1. Type: Surface mounted to door.

2. Provide door closer on each exterior door.
3. Provide door closer on each fire-rated and smoke-rated door.
4. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
5. At corridor entry doors, mount closer on room side of door.
6. At outswinging exterior doors, mount closer on interior side of door.

2.09 PROTECTION PLATES

A. Protection Plates: Comply with BHMA A156.6.

B. Metal Properties: Stainless steel.
1. Metal, Standard Duty: Thickness 0.050 inch, minimum.

C. Edges: Beveled, on four sides unless otherwise indicated.

D. Fasteners: Countersunk screw fasteners.

E. Drip Guard: Provide at head of exterior doors unless covered by roof or canopy.

2.10 KICK PLATES

A. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
1. Size: 8 inch high by 2 inch less door width (LDW) on push side of door.

2.11 FLOOR STOPS

A. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Provide floor stops when wall surface is not available; be cautious not to create a tripping hazard.
2. Material: Aluminum housing with rubber insert.

2.12 WALL STOPS

A. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Provide wall stops to prevent damage to wall surface upon opening door.
2. Type: Bumper, concave, wall stop.
3. Material: Aluminum housing with rubber insert.

2.13 THRESHOLDS

A. Thresholds: Comply with BHMA A156.21.
1. Provide threshold at each exterior door, unless otherwise indicated.
2. Type: Flat surface.
3. Material: Aluminum.
4. Threshold Surface: Fluted horizontal grooves across full width.
5. Field cut threshold to profile of frame and width of door sill for tight fit.
6. Provide non-corroding fasteners at exterior locations.

2.14 WEATHERSTRIPPING AND GASKETING

A. Weatherstripping and Gasketing: Comply with BHMA A156.22.
1. Head and Jamb Type: Adjustable.
2. Door Sweep Type: Encased in retainer.
3. Material: Aluminum, with brush weatherstripping.
4. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
5. Provide door bottom sweep on each exterior door, unless otherwise indicated.
6. Provide sound-rated gasketing and automatic door bottom on doors indicated as "Sound-Rated", "Acoustical", or with "Sound Transmission Class (STC) rating"; fabricate as continuous gasketing, do not cut or notch gasketing material.

2.15 SILENCERS

A. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
   1. Single Door: Provide three on strike jamb of frame.
   2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
   3. Material: Rubber, gray color.

2.16 FIRE DEPARTMENT LOCK BOX

A. Fire Department Lock Box:
   1. Heavy-duty, recessed, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers.
   2. Capacity: Holds 2 keys.
   3. Finish: Manufacturer's standard dark bronze.

2.17 KEY PAD

A. Key Pad: Indoor or outdoor use, 12-key digital keypad with silicone rubber keys, and compatible with access control systems using standard Wiegand output.
   1. Power: 12 VDC; 35mA Active and 7mA at Rest.
   2. Mounts on narrow mullion, 1-1/2 inch wide by 7 inch high by 1 inch deep.
   3. Operating Temperature: Minus 22 to 158 degrees F.
   4. Finish: Black.

2.18 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
   1. Primary Finish: 625; bright chromium plated over nickel, with brass or bronze base material (former US equivalent US26); BHMA A156.18.
   2. Secondary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
      a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.
   3. Exceptions:
      a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
      b. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
      c. Hardware for Aluminum Entrance Doors: Finished to match door panel finish, except at hand contact surfaces provide stainless steel with satin finish, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
   2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
   3. Mounting heights in compliance with ADA Standards:
      a. Locksets: 40-5/16 inch.

b. Push Plates/Pull Bars: 42 inch.
c. Deadlocks (Deadbolts): 48 inch.
d. Exit Devices: 40-5/16 inch.

D. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 ADJUSTING

A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

B. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

C. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

D. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Mirrors.

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 2015 (Reaffirmed 2020).

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).

D. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.

E. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.

F. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2019.

G. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2020.

H. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2020.

I. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2023.

1.04 SUBMITTALS

A. See Section 01 3000 - 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, and identify available colors.

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. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. In conjunction with weather barrier related materials described in other sections, as follows:

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 otherwise indicated.
   1. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

2.03 INSULATING GLASS UNITS

A. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Metal-Edge Spacers: Aluminum, bent and soldered corners.
   4. Spacer Color: Aluminum.
   5. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
   6. Color: Black.
   7. Purge interpane space with dry air, hermetically sealed.

B. 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 thick, minimum.
      a. Tint: Clear.
   4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
      a. Tint: Black, to match existing exterior glazing..
   5. Total Thickness: 1 inch.

2.04 GLAZING UNITS

A. Monolithic Interior Vision Glazing:
   1. Applications: Interior glazing unless otherwise indicated.
   2. Glass Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch, nominal.

2.05 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 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.

3.02 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.03 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

E. Place glazing tape on free perimeter of glazing in same manner described above.

F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

G. Carefully trim protruding tape with knife.

3.04 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent 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.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Metal channel ceiling framing.

C. Acoustic insulation.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data 2017.

B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing 2020.

C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing 2015, with Errata (2020).

D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.

E. ASTM C 79/C 79M - Standard Specification for Treated Core and Nontreated Core Gypsum Sheathing Board; 2001.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.

H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.

I. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

J. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.

K. GA-216 - Application and Finishing of Gypsum Panel Products 2021.

L. GA-253 - Recommended Specifications for the Application of Gypsum Sheathing; Gypsum Association; 1999.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. 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 FRAMING MATERIALS

A. Material and Product Requirements Criteria: AISI S201.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
   1. Structural Grade: As required to meet design criteria.
   2. Corrosion Protection Coating Designation: G40 in accordance with AISI S220.

C. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 at 16 inches on center, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Framing Schedule is as follows:
      a. 25 gauge studs.
         1) 3-5/8 inches wide @ 16 inches on center, allowable deflection of L/240: Used for interior partitions and other assemblies with heights up to but not exceeding 13' - 4" that use this stud dimension.
      b. 22 gauge studs.
         1) 3-5/8 inches wide @ 16 inches on center, allowable deflection of L/240: Used for interior partitions and other assemblies with heights greater than 13' - 4" but not exceeding 15' - 6" that use this stud dimension.
         2) 6 inches wide @ 16 inches on center, allowable deflection of L/240: Used for interior partitions and other assemblies with heights up to but not exceeding 23 feet that use this stud dimension.
      c. 20 gauge studs.
         1) 3-5/8 inches wide @ 16 inches on center, allowable deflection of L/240: Used for interior partitions and other assemblies with heights greater than 15' - 6" but not exceeding 16' - 6" that use this stud dimension.
         2) 6 inches wide @ 16 inches on center, allowable deflection of L/240: Used for interior partitions and other assemblies with heights greater than 23 feet but not exceeding 24'-8" that use this stud dimension.
   2. Furring Members: U-shaped sections, minimum depth of 2 1/2 inch.

D. 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.

2.03 BOARD MATERIALS

A. 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 at all locations.
   3. At all assemblies with or without 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.
      b. Ceilings: 1/2 inch.

B. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Ceilings, unless otherwise indicated.
   2. Thickness: 1/2 inch.
   3. Edges: Tapered.

2.04 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness 3 1/2 inch.

B. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
   1. Corner Beads: Low profile, for 90 degree outside corners.
   2. L-Trim: Sized to fit 5/8-inch thick gypsum wallboard.
   3. Expansion Joints:
      a. Type: V-shaped PVC with tear away fins.

C. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center.
   1. Laterally brace entire suspension system.

B. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure in all locations.
   2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

C. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

D. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.

E. Blocking: Install wood blocking for support of:
   1. Wall-mounted cabinets.
   2. Plumbing fixtures.
   3. Toilet partitions.
   4. Toilet accessories.
   5. Wall-mounted door hardware.
   6. Wall mounted display boards.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 25 feet apart on walls and ceilings over 30 feet long.
   2. Align control joints with a window or door jamb.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.

B. 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.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 3000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Transition Strips.

D. Edge Protection

1.02 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.
   1. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.
   2. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
   3. ANSI A108.1c - Contractor's 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 Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).
   4. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship 2019.
   5. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive 2019.
   6. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2021.
   7. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy 1999 (Reaffirmed 2019).
   8. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).
   9. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).
   10. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.
   11. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).
   12. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2021).
   13. 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 2020.
   14. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs 2020.

B. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2022.

1.03 SUBMITTALS

A. See Section 01 3000 - 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.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.05 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE - REFER DRAWINGS FOR TILE AND GROUT SCHEDULED.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

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 cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.

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 A108.20, 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. Sound tile after setting. Replace hollow sounding units.

G. Keep control and expansion joints free of mortar, grout, and adhesive.

H. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

I. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

J. 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.

3.05 INSTALLATION - WALL TILE

A. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

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.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.

B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
   2. Size: 24 by 48 inches.
   3. Thickness: 3/4 inch.
   4. Panel Edge: Reveal.
   5. Color: White.
   6. Suspension System: Exposed grid.
   7. Products:
      a. Refer Room Finish Schedule on Drawings.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, clips, and splices as required.

B. Exposed Suspension System: Hot-dipped galvanized steel grid with steel cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 15/16 inch face width.
   3. Finish: Baked enamel.
   4. Color: White.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.

D. 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. Locate system on room axis according to reflected plan.

C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

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 of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

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 acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

END OF SECTION

SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).

B. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile 2020.

C. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.

1.03 SUBMITTALS

A. See Section 01 3000 - 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. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 MATERIALS - TILE FLOORING

A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
   1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   2. Size: 12 by 12 inch.
   3. Thickness: 0.125 inch.
   4. Color: As indicated on drawings.

B. Luxury Vinyl Tile: Solid vinyl with color and pattern throughout thickness.
   1. Minimum Requirements: Comply with ASTM F 1700, of Class 1, type A.
   2. Total Thickness: 0.125 inch.
   3. Pattern and Size: As indicated on the drawings.
   4. Color: As indicated on drawings.

2.02 MATERIALS - BASE

A. Resilient Base: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.
   1. Height: 4 inches.
   2. Thickness: 0.125 inch.
   3. Finish: Satin.
   4. Length: Roll.
   5. Color: To be selected by Architect from manufacturer's full range.
   6. Accessories: Premolded external corners and internal corners.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers and Adhesives: 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. Verify that sub-floor surfaces are smooth and flat within tolerances specified in Section 03300 and are ready to receive resilient flooring.

C. Verify that concrete sub-floor surfaces are ready for resilient flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:

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.

C. Clean substrate.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed.

B. Spread only enough adhesive to permit installation of materials before initial set.

C. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

D. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Secure metal strips before installation of flooring with stainless steel screws.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.05 INSTALLATION - BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 6813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

C. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

1.03 SUBMITTALS

A. See Section 01 3000 - 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.

1.04 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Tile Carpeting: Tufted, manufactured in one color dye lot.
   1. Product: As indicated on the drawings.
   2. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
   3. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").

2.02 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Rubber, color as selected by Architect.

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. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Trim carpet tile neatly at walls and around interruptions.

G. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 9123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Mechanical and Electrical:
      a. At Art Storage #124, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   6. Glass.
   7. Concrete masonry units in utility, mechanical, and electrical spaces.
   8. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. MPI product number (e.g., MPI #47).
   3. Cross-reference to specified paint system products to be used in project; include description of each system.

PART 2 PRODUCTS

2.01 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

C. Colors: As indicated on drawings.
   1. At Art Storage #124, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.02 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board and gypsum board.
   1. Two top coats and one coat primer.
   2. Top Coat Sheen:
      a. Eggshell: MPI gloss level 3; use this sheen at all locations.
   3. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
   1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
   2. Two top coats and one coat primer.
   3. Top Coat Sheen:
      a. Satin: MPI gloss level 4; use this sheen at all locations.
   4. Primer: As recommended by top coat manufacturer for specific substrate.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or 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. Masonry:

F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

G. 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.

H. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

I. 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. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

END OF SECTION

SECTION 10 1423
PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panel signage.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.

C. Shop Drawings:
   1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.02 PANEL SIGNAGE

A. Panel Signage:
   1. Application: Room and door signs.
   2. Description: Flat signs with engraved panel media, tactile characters.
   3. Sign Size: As indicated on drawings.
   4. Total Thickness: 1/8 inch.
   5. Color and Font, unless otherwise indicated:
      a. Character Font: Helvetica, Arial, or other sans serif font.
      b. Character Case: Upper and lower case (title case).
      c. Background Color: As scheduled.
      d. Character Color: Contrasting color.
   6. Material: Laminated colored plastic engraved through face to expose core as background color.
   7. Profile: Flat panel without frame.
   8. Tactile Letters: Raised 1/32 inch minimum.
   9. Braille: Grade II, ADA-compliant.
   10. One-Sided Wall Mounting: Tape adhesive.

2.03 SIGNAGE APPLICATIONS

A. Room and Door Signs:
   1. Office Doors: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section for replaceable occupant name.
   2. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
   3. Toilet Rooms: Identify with pictograms, the names "MEN" and "WOMEN", and braille.
   4. Exit Doors: Identify with "EXIT" and braille.

2.04 ACCESSORIES

A. Tape Adhesive: Double-sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

END OF SECTION

SECTION 10 2113.13
METAL TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal toilet compartments.

1.02 RELATED REQUIREMENTS

A. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

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 2022.

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

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 PROJECT CONDITIONS

A. Coordinate the work with placement of support framing and anchors in wall.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

B. Stainless Steel Sheet: ASTM A666, Type 304.

2.02 COMPONENTS

A. Toilet Compartments: Baked enamelled or powder coated steel, floor-mounted headrail-braced.

B. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound deadening core, formed and closed edges; corners made with corner clips or mitered, welded, and ground smooth.
   1. Panel Faces: 20 gauge, 0.0359 inch.
   2. Door Faces: 22 gauge, 0.0299 inch.
   3. Pilaster Faces: 20 gauge, 0.0359 inch.
   4. Reinforcement: 12 gage.
   5. Internal Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.

C. Door and Panel Dimensions:
   1. Thickness: 1 inch.
   2. Door Width: 24 inch.
   3. Door Width for Handicapped Use: 36 inch , out-swinging.
   4. Height: 58 inch.

D. Pilasters: 1-1/4 inch thick, of sizes required to suit compartment width and spacing.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.

1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Brackets: Polished chrome-plated non-ferrous cast metal.

C. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.

D. Hardware: Polished stainless steel:
1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
2. Thumb turn or sliding door latch with exterior emergency access feature.
3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
4. Coat hook with rubber bumper; one per compartment, mounted on door.
5. Provide door pull for outswinging doors.

2.04 FINISHING

A. Powder Coated Steel Compartments: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat and two finish coats powder coat enamel.

B. Baked Enamel Steel Compartments: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat and two finish coats baked enamel.

C. Color: To be selected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that field measurements are as indicated.

C. Verify correct spacing of and between plumbing fixtures.

D. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged enamel finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2213
WIRE MESH PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wire mesh systems for walls.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.

C. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel 2020.

D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.

E. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for mesh materials, finishes.

C. Shop Drawings: Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Provide component details and anchorage.

PART 2 PRODUCTS

2.01 WIRE MESH PARTITIONS

A. Wire Mesh Partitions: Factory-fabricated modular assemblies of panels, doors, anchors, hardware, and accessories as required to provide a complete system.
   1. Design Criteria:
      a. Design partition system to provide for movement of components without damage, undue stress on fasteners or other detrimental effects, when subject to design loads.
      b. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
      c. Comply with applicable code for wire mesh opening size.

2.02 COMPONENTS

A. Woven Wire Mesh: Standard duty.
   1. Material: ASTM A510/A510M uncoated crimped steel wire.
   2. Wire Size: 10 gauge, 0.135 inch.
   3. Mesh Opening Size: 1-1/2 inch diamond shape.
   4. Mesh Weave: Plain weave, inter-crimped.

B. Framing and Support Members:
   1. Material: ASTM A36/A36M steel shapes and ASTM A500/A500M cold-formed steel tubing.
   2. Framing, Corner Posts, and Intermediate Support Members: Manufacturer's standard sizes for system specified and as indicated on drawings.

C. Doors: Same material as partitions, fully framed; manufacturer's standard construction and hardware for swing operation.
   1. Locking: Integrated padlock hasps for padlocks provided by Owner.

D. Sheet Metal Base Panel: ASTM A1008/A1008M, cold rolled steel sheet.

E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.03 FASTENERS

A. Bolts, Nuts and Washers: Hot dip galvanized.

B. Anchorage Devices: Provide power driven, powder actuated, and drilled expansion bolts.

2.04 ACCESSORIES

A. Bracing: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

B. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

C. Post Caps: Manufacturer's standard.

D. Floor Pilaster Shoe: Manufacturer's standard.

E. Floor Base: Manufacturer's standard.

2.05 FABRICATION

A. Fit and assemble in largest practical sections for delivery to site, ready for installation.

B. Make exposed joints flush or tight.

2.06 FINISHES

A. Painted Finish: Manufacturer's standard powder coat finish.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install items plumb and level, accurately fitted, free from distortion or defects.

END OF SECTION

SECTION 10 2800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000-Rough Carpentry: Concealed supports for accessories, including in wall framing and plates.

B. Section 08 8300 - Mirrors: Other mirrors.

C. Section 10 2113 - Toilet Compartments

1.03 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2022.

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

C. ASTM C1036 - Standard Specification for Flat Glass 2021.

D. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 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.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Provide 2 keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Adhesive: Two component epoxy type, waterproof.

G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.02 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Back paint components where contact is made with building finishes to prevent electrolysis.

2.03 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser TP-P1: Dual jumbo roll, surface mounted type, satin stainless steel finish.
   1. Substitutions: Section 01 6000 - Product Requirements.

B. Paper Towel Dispenser TP-P3: Folded paper type, stainless steel, surface-mounted, and tumbler lock.

1. Capacity: 8" diameter roll.
2. Mounting: Recessed 9 3/4", Projects 2 3/4".
3. Product: Model 2A02 manufactured by Bradley.
4. Substitutions: Section 01 6000 - Product Requirements.

C. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
2. Size: As indicated on drawings.
3. Frame: 0.05 inchangle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
4. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.

D. Grab Bars: Stainless steel, smooth surface.
1. Standard Duty Grab Bars:
a. Products:

E. Sanitary Napkin Disposal Unit SD-P1: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Product: Model 4721-15 manufactured by Bradley.
2. Substitutions: Section 01 6000 - Product Requirements.

2.04 UTILITY ROOM ACCESSORIES

A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
1. Holders: 4 spring-loaded rubber cam holders.
2. Product: Model 9954 manufactured by Bradley.
3. Substitutions: 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 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.

END OF SECTION

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers 2022.

1.03 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, and color and finish.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers, Cabinets and Accessories:
   1. JL Industries, Inc: www.jlindustries.com.
   2. Larsen's Manufacturing Co: www.larsensmfg.com.
   3. Potter-Roemer: www.potterroemer.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Size: 10 pound.
   3. Finish: Baked polyester powder coat, red color.
   4. Temperature range: Minus 40 degrees F to 120 degrees F.

C. Dry Chemical Type Fire Extinguishers: Heavy duty steel tank, with pressure gage.
   1. Class A,B,C.
   2. Size 10.
   3. Finish: Baked enamel, RED color.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Configuration: Recessed type.
   1. Sized to accommodate specified fire extinguishers.
   2. Depth to be verified for fit in wall thickness.
   3. Exterior nominal dimensions of 9-1/2 inches wide x 24 inches high x 6 deep.
   4. Trim: Rolled edge, Face width - Manufacturers Standard.

5. Trim: Returned to wall surface, with 4 inch projection, face width - Manufacturers standard.

B. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

C. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

E. Fabrication: Weld, fill, and grind components smooth.

F. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

G. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

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, Maximum of 48 inches from finished floor to center of door handle or latch but not more than 60 inches to the top of the cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

END OF SECTION

SECTION 32 1313
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks and integral curbs.

1.02 REFERENCE STANDARDS

A. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide 2022.

B. ACI 301 - Specifications for Concrete Construction 2020.

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

D. ACI 305R - Guide to Hot Weather Concreting 2020.

E. ACI 306R - Guide to Cold Weather Concreting 2016.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.

H. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

I. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.

J. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2022a.

K. ASTM C150/C150M - Standard Specification for Portland Cement 2022.

L. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method 2016.

M. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

N. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing 2017.

O. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) 2018.

P. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction 2018.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Wood form material, profiled to suit conditions.

B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
   1. Thickness: 1/2 inch.

2.02 REINFORCEMENT

A. Steel Welded Wire Reinforcement: Plain type, ASTM A1064/A1064M; in flat sheets; unfinished.

B. Dowels: ASTM A615/A615M, Grade 40 - 40,000 psi yield strength; deformed billet steel bars; unfinished finish.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Normal - Type I Portland cement, gray color.

B. Fine and Coarse Mix Aggregates: ASTM C33/C33M.

C. Water: Clean, and not detrimental to concrete.

D. Air-Entraining Admixtures: ASTM C260/C260M.

2.04 ACCESSORIES

2.05 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Concrete Properties:
   1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; 3,000 psi.
   2. Water-Cement Ratio: Maximum 40 percent by weight.
   3. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
   4. Maximum Slump: 4 inches.

2.06 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

B. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.02 REINFORCEMENT

A. Place reinforcement at top of slabs-on-grade.

B. Interrupt reinforcement at contraction joints.

C. Place dowels to achieve pavement and curb alignment as detailed.

3.03 COLD AND HOT WEATHER CONCRETING

A. Follow recommendations of ACI 305R when concreting during hot weather.

B. Follow recommendations of ACI 306R when concreting during cold weather.

C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.05 JOINTS

A. Align curb, gutter, and sidewalk joints.

B. Place 3/8 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.

1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.

C. Provide sawn joints.
   1. At 5 feet intervals.

D. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.06 FINISHING

A. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.

B. Curbs and Gutters: Light broom, texture parallel to pavement direction.

3.07 PROTECTION

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

END OF SECTION

SECTION 32 3119
DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative steel fences.

1.02 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

D. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact) 1993 (Reapproved 2019).

E. ASTM D3359 - Standard Test Methods for Rating Adhesion by Tape Test 2022.

F. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets 2016 (Reapproved 2023).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit 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.

PART 2 PRODUCTS

2.01 FENCES

A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:

B. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
   1. Total Coating Thickness: 2 mils, minimum.
   2. Coating Performance: Comply with general requirements of ASTM F2408.
      a. Adhesion: ASTM D3359 (Method B); Class 3B with 90 percent or more of coating remaining in tested area.
      b. Impact Resistance: ASTM D2794; 60 inch pounds.

C. Steel: ASTM A653/A653M; tensile strength 45,000 psi, minimum.
   1. Hot-dip galvanized; ASTM A653/A653M, G60.
   2. 62 percent recycled steel, minimum.

D. Aluminum: ASTM B221.
   1. Tubular Pickets, Rails and Posts: 6005-T5 alloy.
   2. Extrusions for Posts and Rails (Outer Channel): 6005-T5 alloy.
   3. Extrusions for Pickets and Rail (Inner Slide Channels): 6063-T5 alloy.

E. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.
   1. Tamper-proof security bolts.

2.02 MECHANICALLY FASTENED STEEL FENCE

A. Provide fence meeting requirements for Industrial class as defined by ASTM F2408.

B. Fence Panels: Mechanically fastened with internal reinforcement and tamperproof fasteners; 6 feet high by 6 feet long.

1. Panel Strength: Capable of supporting 600 pound load applied at midspan without deflection.
2. Attach panels to posts with manufacturer's standard panel brackets.

C. Posts: Steel tube.
1. Size: 2-1/2 inches square by 12 gauge, 0.1094 inch, with manufacturer's standard cap.
2. Post Cap: Flush plate.

D. Rails: Manufacturer's standard, double-wall steel channel; 1-3/4 inch square by 14 gauge, 0.0747 inch with pre-punched picket holes.
1. Picket Retaining Rods: 1/8 inch galvanized steel.
2. Picket-to-Rail Intersection Seals: PVC grommets.

E. Pickets: Steel tube.
1. Spacing: 4.175 inch on center.
2. Size: 1 inch square by 14 gauge, 0.0747 inch
3. Style: Pickets with finial extend above top rail.
4. Finial: Spear point.

F. Flexibility: Capable of following variable slope of up to 1:4.

G. Color: Black.

2.03 SPECIALITY HARDWARE

A. Hinges: Finished to match fence components.
1. Closing: Manual.
2. Material: Steel.

B. Latches: Finished to match fence components.
1. Mechanism: Gravity.
2. Locking: Mechanical.
3. Material: Steel.

PART 3 EXECUTION

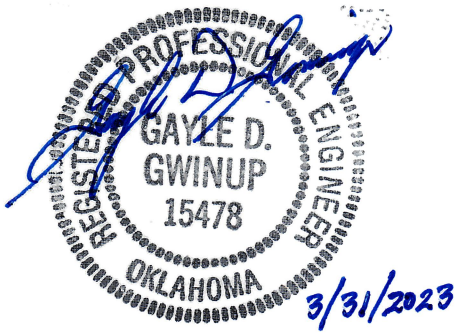
3.01 INSTALLATION

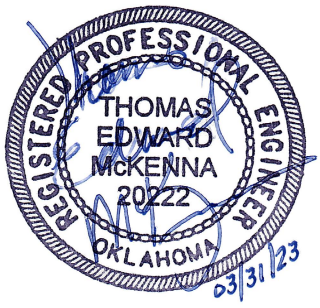
A. Install in accordance with manufacturer's instructions.

B. Set fence posts in accordance with the manufacturer recommended spacing.

END OF SECTION

END OF TABLE OF CONTENTS





SECTION 220400
PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Work Included: Provide plumbing where shown on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:
   1. Domestic hot and cold water piping system.
   2. Drain, waste, and vent systems.
   3. Gas piping system.
   4. Plumbing fixtures and trim as shown on the Drawings.
   5. Existing concrete floor cuts, trenching, and backfilling. Refer to Architectural drawings and specifications for patching of concrete floor.

B. Related Work: Documents affecting Work of this Section include, but are not necessarily limited to: General Conditions, Supplementary, and Sections in Division 1 of these Specifications.

C. Drawings: The plumbing drawings show the general arrangement of piping, equipment, and appurtenances and shall be followed as closely as actual building construction, site conditions, and the work of other trades will permit. The mechanical work shall conform to the requirements shown on all of the drawings. General and structural drawings shall take precedence over mechanical drawings. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly.

1.2 QUALITY ASSURANCE:

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

B. Codes and Regulations:
   1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction, all applicable laws, codes, and ordinances including those of the state, county and city.
   2. The Work shall also comply with all applicable requirements of the National Fire Protection Association, International Building, Plumbing and Mechanical Codes, and all locally accepted amendments to these codes.
   3. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.
   4. Non-compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local

ordinances, industry standards, and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

C. Install all utility connections to water, sewer, and gas per requirements of Governing Agencies. Pay all fees and permits for inspection and certification for the execution of this Work.
   1. Temporary Utility Service: All required utility services such as water, and sanitary shall be obtained and paid for by the contractor under the section of the specifications for which they are required. The contractor shall be responsible for utilities used during construction.

D. Certificate of Final Inspection: Under each applicable section of the specifications, the contractor shall, upon completion of the work under that section, furnish a certificate of final inspection from the department having jurisdiction.

1.3 EXAMINATION OF SITE:

A. Visit the site, inspect the existing Conditions and check the Drawings and Specifications so as to be fully informed of the requirements for completion of the Work.

B. Lack of such information shall not justify a request for extra compensation to the contract price.

1.4 TEMPORARY WATER SUPPLY:

A. Provide, where directed by the Owner, two (2) 3/4" water hydrants to be used during construction. Remove from the job site upon completion of the Work.

1.5 MATERIAL AND EQUIPMENT:

A. All materials and equipment shall be new, those of the same type shall be by the same Manufacturer, and shall be of the best quality and design and free from defects.

B. A Manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer's name, address and catalog number.

C. Manufacturer's name and model numbers used herein and on the Drawings establish type and quality required. Equal products may be considered if submitted in writing to the Owner for approval 10 days prior to bid date. The Contractor shall be responsible for assuring the items and equipment substituted for those shown on the Drawings will physically fit in the space allocated.

D. Delivery and Storage: Equipment and materials shall be delivered to the site and stored in original containers, suitably sheltered from the elements, but readily accessible for inspection until installed. All items subject to moisture damage (such as controls) shall be stored in dry, conditioned spaces.

E. Protection: Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury. Damage or defects developing before acceptance of the work shall be made good at the contractor's expense.

F. Dimensions: It shall be the responsibility of the contractor to insure that items to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install sizes and shapes of equipment so that the final installation shall suit the true intent and meanings of the drawings and specifications.

G. Manufacturer's Directions: Shall be followed completely in delivery, storage, protection and installation of all equipment and materials. The contractor shall promptly give notice in writing of any conflict between any requirement of the Contract Documents and the manufacturer's directions and shall obtain written instructions before proceeding with the work. Should the contractor perform any work that does not comply with the manufacturer's directions or such written instructions, he shall bear all costs arising in correcting the deficiencies.

1.6 SUBMITTALS:

A. Comply with pertinent provisions of Division 1.

B. Product Data: After the Contractor has received the Owner's Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's Specifications, catalog cuts, and other data needed to prove compliance with the specified requirements.
3. Shop Drawings and other data as required to indicate method of installing and attaching equipment, except where such details are fully shown on the Drawings.
4. All sheets of the submittal shall have the job name stamped or permanently written neatly on them and shall be assembled in an indexed brochure. The descriptive material shall be arranged in the brochure in the same order as found in the specifications. Each brochure shall be submitted in a hardback, 3-ring binder. The leading sheet of the descriptive material for each item shall be full size, of heavy paper, with a numbered outside tab, and an index sheet showing the location in the brochure.
5. Manufacturer's regular catalog sheets will not be acceptable under these requirements unless they indicate completely all of the specification requirements. Where drawings cover several sizes or types of construction, they shall clearly indicate the size or type of construction to be used on the project. In cases where several sizes of the same type of equipment are required to be furnished, the submittal shall include a schedule identifying each piece of equipment, complete with all capacity information needed to compare every submittal item with its respective specified item. Special features shall be listed on a separate typewritten sheet.
6. Brochures shall contain a certification by the Contractor that the equipment or materials are suitable for conditions shown and specified; that the equipment or materials are believed to be in conformity with the plans and specifications, except as may be specifically described; be signed by the Contractor. Brochures received not in conformity with these requirements will be returned for required action.

7. Finding "APPROVED" or "APPROVED AS NOTED" shall not eliminate responsibility for compliance with the plans and specifications, unless specific attention has been called, in writing, to the proposed deviations at the time of transmittal of the brochures and such deviations have been found acceptable, nor shall it eliminate the responsibility for freedom from errors of any sort in the data submitted. Discovery of such deviations at or after installation shall be cause for immediate replacement at no additional cost to the Owner.
8. No material or equipment so governed shall be ordered until found acceptable by the Owner.

C. Sterilization Certificate: Upon completion of water line sterilization, deliver to the Owner two copies of an acceptable "Certificate of Performance" for that activity.

D. Record Drawings:
1. Comply with pertinent provisions of Division 1.
   a. Record Drawings- The contractor shall furnish to the owner CAD record drawings consisting of three (3) sets of 11" x 17" prints (To be bound in O&M Manuals), one (1) full size set of prints and one (1) disk, showing the piping and ductwork for the HVAC and plumbing systems. Piping sizes, rerouting, etc., for both under floor and above ceiling piping shall be shown. Also, provide a blue-line of the site plan, clearly marked, to indicate any and all changes in sanitary sewer, storm sewer, domestic cold water and natural gas piping to the building. In addition to these drawings, a complete set of approved ductwork shop drawings and temperature control shop drawings shall be included in this set of drawings.
      1) CAD Record drawings shall incorporate all change and field orders. (No separate or supplemental drawings).
      2) All equipment schedules to be revised to reflect installed manufacturer model numbers and capabilities.

2. Include a copy of the Record Drawings in each copy of the operation and maintenance manual as described below. (Original document shall be reproducible paper.)

E. Manuals: Upon completion of the Work of this Section, deliver to the Owner two copies of an operation and maintenance manual compiled in accordance with the provisions of Division 1 of these Specifications. Include within each manual:
1. Copy of the approved record documents for this portion of the Work.
2. Copies of all warranties and guarantees.
3. Description of equipment control and seasonal operation, including schedule of required maintenance.

1.7 INSPECTION:

A. Make written notice to the Owner adequately in advance of each of the following stages of construction:
1. In the underground Condition prior to placing concrete floor slab, when all associated Work is in place.
2. When all rough-in is complete, but not covered.
3. At completion of the Work of this Section.

B. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance, remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.

1.8 PRODUCT HANDLING:

A. Comply with pertinent provisions of Division 1.

1.9 CLEANING, TESTING AND PLACING IN SERVICE:

A. Immediately prior to final inspection, the Contractor shall make a final cleanup of dirt and refuse resulting from his Work and shall assist in keeping the premises clean at all times.

B. Immediately prior to final inspection, the Contractor shall clean all material and equipment installed under this Contract. Dirt, dust, plaster, stains and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched up and restored to their original Condition.

C. Mechanism of all equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required to produce the intended performance.

1.10 ADJUSTMENT AND INSTRUCTION:

A. Energize all systems, equipment and fixtures and check for proper operation. Make corrections and adjustments to systems, equipment, and fixtures required for proper operation.

B. The Contractor's service personnel shall instruct the Owner's Representative in the proper operation of all systems.

1.11 GUARANTEE:

A. The Contractor guarantees all Work against any defects due to faulty workmanship or material and that all raceways, ducts, and piping are free from foreign material, obstructions, holes, or breaks of any nature.

B. Upon written notice from the Owner, the Contractor shall promptly remedy without cost to the Owner any defects occurring within a period of one (1) year from the date of final acceptance.

1.12 WARRANTY:

A. The Contractor shall properly execute in the Owner's name all Manufacturer's standard warranty certificates applying to equipment installed on the project and shall deliver

said certificates to the Owner at completion of the job. All warranty cards shall also be properly executed and delivered to the supplier or Manufacturer's records. Standard warranties for equipment shall not be less than one (1) year.

PART 2 - PRODUCTS

2.1 PIPE SCHEDULE:

A. Drain, Waste, and Vent System:
   1. For sanitary Work below the floor and outside underground:
      a. Provide service weight cast iron pipe and fittings or Schedule 40 PVC or ABS DWV pipe if allowed by local codes.
      b. Soil lines 5'-0" or more away from the structures may be Schedule 40 PVC.
   2. Above ground:
      a. Provide service weight cast iron pipe and fittings with No-Hub joints. Schedule 40 PVC or ABS DWV pipe may be used in lieu of cast iron if allowed by local codes.

B. Water System (domestic piping):
   1. Above ground, provide Type "L" copper with sweated connections. (Non-lead bearing solder)
   2. Below grade, provide Type "K" copper with sil-fossed connections. Schedule 40 PVC may be used for water service, if allowed by local codes.

C. Gas Piping:
   1. Underground piping equal to Republic X-Tru-Coat plastic coated black steel pipe with protective wrap over joints.
   2. Above ground piping shall be black steel.
      a. Piping 2" and smaller: Threaded fittings.
      b. Piping 2-1/2" and larger: Welding fittings.
   3. Gas service piping up to the building: Refer to Civil drawings and specifications for water service pipe requirements.

2.2 MATERIALS:

A. Cast Iron Soil Pipe and Fittings:
   1. Provide service weight cast iron conforming to ASTM A74 and CISPI 30l, or provide hubless type per above standards. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International.

B. Galvanized:
   1. Provide standard weight complying with ASTM A53 and A120 for above ground piping. (Galvanized not allowed underground or under slab floors.)

C. Copper Pipe:

1. Provide copper pipe conforming to ASTM B42 and B302. (Type "M" copper not allowed underground or under slab floors.)

D. Copper Tube:
1. Provide copper tube conforming to ASTM B75, B88, and B251. (Type "M" copper not allowed underground or under slab.)

E. Polyvinyl Chloride Pipe:
1. Provide PVC pipe conforming to ASTM D2665 for waste, vent, and drainage pipe above and underground within 5'-0" of the building.
2. Provide PVC pipe conforming to ASTM D2265 for building sewer pipe.
3. Provide PVC pipe conforming to ASTM D1785 for water service pipe.

F. Black Steel Pipe:
1. Provide black steel pipe conforming to ASTM A53 and A120..

G. Fittings:
1. 2" and smaller provide standard cast iron threaded fittings.
2. 2-1/2" and larger provide standard Butt Welding fittings.

H. Unions:
1. For copper lines, provide copper unions.
2. For connections in iron pipe lines:
   a. 2" and smaller provide ground joint brass-to-iron fittings.
   b. 2-1/2" and larger provide standard cast iron with flanged ends and gaskets.

2.3 VALVES:

A. All valves of the same type shall be by the same Manufacturer.

B. Globe Valves: Provide replaceable composition disc suitable for 200°F water.
1. 2" and smaller: Provide Hammond #IB-413T, bronze, screwed, mallable iron hand wheel.
2. 2-1/2" and larger: Provide Hammond #IR-116, iron body, flanged, 200# WOG.

C. Ball Valves: Provide large port ball of chrome plated, bronze or stainless steel construction, screwed ends, quarter turn operation, lever or C-handle operator. Valve shall be rated for 150 psi steam, 600 psi WOG. Valve shall have blow out proof stem and adjustable packing nut.
1. 2" and smaller: Hammond #8501 Series or approved equal.

D. Gas Cocks:
1. 2” and smaller: Provide bronze, screwed, lubricated square head valve equal to Resun #R-1430.
2. 2-1/2” and larger: Provide Nordstrom #142 or #143.

E. Check Valves:
1. 2" and smaller: Provide Hammond #IB-940, bronze, screwed, Y-pattern, 200# WOG, swing check type.
2. 2-1/2" and larger: Provide Hammond #IR-1124, IBBM, flanged, 200# WOG.

F. Strainers: Provide Y-pattern, 200# WOG, 20 mesh stainless perforated screen free area, equal to 4 times pipe area.
   1. 2" and smaller: Provide Wilkins #YSBR Series, screwed.
   2. 2-1/2" and larger: Provide Wilkins #FS Series, flanged.

G. Plumbing Fixture Service Valves:
   1. 1/2" angle valve with wheel handle stop, 1/2" I.P.S. female inlet, 3/8" tube compression fitting outlet, 3/8" chrome plated flexible riser and chrome plated escutcheon plate. Chicago Faucet #1015 or equal.

2.4 FLASHING:

A. Where pipes of this Section pass through the roof, flash with Semco, #1100-4 seamless 4 lb. flashing, with steel reinforced "Vari-Pitch" boot and cast iron counterflashing sleeve or equal method approved by the Architect.

2.5 PIPE HANGERS:

A. Water Piping:
   1. Provide Fee and Mason #212 split ring hangers with supporting rods.
   2. Copper plated hangers or hangers with dielectric isolators to be installed for copper pipe.

B. Soil and Waste Piping:
   1. Provide Fee and Mason #212 adjustable ring hangers with supporting rods.
   2. Use Fee and Mason #241 riser clamps at each floor and as required.

C. Gas Piping:
   1. Provide Fee and Mason #241 split ring hangers with supporting rods.

2.6 CLEANOUTS:

A. Exterior:
   1. Provide Wade W-6030-Z, or Smith #4253 with XH cast iron top in concrete areas.

B. Floors:
   1. Provide Wade W-6030-1 or Smith #4023 with round nickle bronze top in finished room floors.
   2. Provide Wade W-6030-Z or Smith #4223 with round cast iron top in unfinished room floors.
   3. Provide "flush-with-floor" type cleanouts, with adjustable watertight covers and integral anchoring flange with clamping collar where waterproofing membrane is used.

C. Finished Walls:
   1. Provide Wade W-8460-R6 or Smith #4532 with round chrome plate or stainless steel access plate and screw.

D. Provide cleanout plugs of extra heavy bronze.

2.7 ACCESS BOXES:

A. Walls:
   1. Provide Wade W-8480-ST or Smith #4730 with polished chrome plate face in tile walls.
   2. Provide Wade W-8490-AKL, Smith #4760-AKL or #4765-AKL with bonderized prime-coated steel face and with Allen locks in walls of other finished rooms.

B. Ceilings:
   1. Provide Acorn DW Series bonderized prime-coated steel face with Allen lock.

2.8 TRAPS:

A. For lavatories and sinks, except service sinks, provide chrome plated cast brass traps with brass nuts. Provide deep seal traps where required and/or shown on the Drawings.

B. For handicap lavatories, provide off-set tailpiece ahead of P-trap.

2.9 WATER HAMMER ARRESTORS:

A. Provide Smith #5000 series or Precision Plumbing Products, Inc. stainless steel.

2.10 INSULATION:

A. Insulate hot water, cold water, and condensate piping with ½" thick glass fiber preformed pipe insulation with factory applied all purpose glass fiber reinforced flame retardant kraft paper and aluminum foil self sealing lap.

B. Elbows and fittings to be insulated with factory preformed PVC jacketed insulation material to match thickness of pipe insulation.

C. Valve bodies shall be insulated with Armstrong Armaflex type "FR" or equal insulation with vapor barrier. Factory preformed insulation enclosures may be substituted for field applied insulation.

D. Insalate waste traps receiving cooling coil condensate and piping for a minimum of 10 feet after trap with ½ inch Armstrong Armaflex type "FR" or equal insulation with vapor barrier.

E. Where shown on the Drawings or required by governmental agencies having jurisdiction, at lavatories for handicapped persons provide TRUEBRO Inc. Handi Lav-Guard model #102W and #105W white finish insulation on hot water supply, cold water supply, tailpiece, and trap.

2.11 FIXTURES AND EQUIPMENT:

A. Provide plumbing fixture, trim, (exposed trim to be chrome plated) and equipment as shown on the "Plumbing Fixture Schedule" in the Drawings. China fixture shall be of the best grade vitreous ware without pit holes and blemishes. The Owner reserves the right to reject any pieces which, in his opinion, are faulty.
   1. For the purpose of identification only one Manufacturer's model numbers are used throughout the schedule shown on the Drawings.
   2. Approved Manufacturers: American Standard, Crane, Kohler, or Eljer.

B. Non-Freeze Hose Bibbs (FPHB):
   1. Provide 3/4" non-freeze type of cast bronze construction with lock shield cap and loose key operator to suit wall size.
   2. Hose bibb to have integral backflow preventer, pressure relief valve and vacuum breaker.
   3. Approved equal by Wade (W-8620), Zurn or Woodford.

C. Cover Plates (Escutcheons):
   1. Provide chrome plated brass equal to Beaton Corbin Company style 2-BC for copper tube and 13-BC for standard pipe.

D. Floor Drains:
   1. Provide floor drains where indicated on the Drawings complete with deep seal P-trap as listed below for various floor conditions:
      a. Linoleum or asphalt tile floor - Wade W-1100-STD-1 with nickle bronze raised lip strainer.
      b. Quarry tile or Terrazzo floor - Wade W-1100-G-1 with nickle bronze square strainer.
      c. General - Wade W-1100 with type B nickle bronze strainer:
         1) 2" drain to have 5" strainer;
         2) 3" drain to have 6" strainer;
         3) 4" drain to have 8" strainer.
      d. Heavy duty - Wade W-1200-13-5 with 12" diameter secured coated iron grate.
      e. Manufacturers - Zurn, Wade, or J.R. Smith.

2.12 INSULATION:

A. Insulate hot water, cold water, condensate, and refrigerant suction lines with 1/2" thick IMCOA Polyolefin Insulation or Armstrong Armaflex type "FR" with vapor barrier.

B. Also see requirements specified for "Handicap Fixture Insulation."

2.13 SLEEVES:

A. Where pipes pass through concrete, masonry, or stud walls, or pass through ceilings, provide 20-gauge galvanized sheet metal sleeve large enough to allow for free movement of the pipes with expansion.
   1.

2.14 OTHER MATERIALS:

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Examine the areas and Conditions under which Work of this Section will be performed. Correct Conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory Conditions are corrected.

3.2 PLUMBING SYSTEM LAYOUT:

A. Lay out the plumbing system in careful coordination with the Drawings, determining proper elevations for all components of the system and using only the minimum number of bends to produce a satisfactorily functioning system.

B. Follow the general layout shown on the Drawings in all cases except where other Work may interfere.

C. Lay out pipes to fall within partition, wall, or roof cavities, and do not require furring other than as shown on the Drawings. Do not install domestic water lines in exterior walls without proper considerations of required insulation and routing.

D. Slots, Chases, Openings, and Recesses: Through floors, walls, ceilings, and roofs as specified in new structure will be provided by the various trades in their respective materials, but the trade requiring them shall see that they are properly located and shall do any cutting and patching caused by the neglect to do so. No cuts shall be made into any structural element, beam or column, without written approval. Opening in existing structures will be provided by the trade requiring same.

E. Locations: Of pipes, ducts, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The contractor shall determine the exact route and location of each pipe, duct and electrical raceway prior to fabrication.
   1. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example, plumbing drains shall normally have right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.
   2. Offsets, transitions and changes in direction in pipes and ducts shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The contractor shall furnish and install all traps and sanitary vents, etc., as required to effect these offsets, transitions and changes in direction.

3.3 TRENCHING AND BACKFILLING:

A. Perform trenching and backfilling associated with the Work of this Section in strict accordance with the provisions of Division 2 of these Specifications.

B. Cut bottom of trenches to grade. Make trenches 12" wider than the greatest dimension of the pipe.

C. Bedding and Backfilling:
   1. Install piping promptly after trenching. Keep trenches open as short a time as practicable.
   2. Under the building, install pipes on a 6" bed of damp sand. Backfill to bottom of slab with damp sand.
   3. Outside the building, install underground piping on a 6" bed of damp sand. Backfill to within 12" of finish grade with damp sand. Backfill remainder with native soil.
   4. Do not backfill until installation has been approved and Project Record Documents have been properly annotated.
   5. Provide bare copper trace wire 6 inches above all buried plastic pipe.
   6. Provide continuous plastic banner labeled CAUTION-GAS PIPING 12 inches above all buried gas piping.

3.4 INSTALLATION OF PIPING AND EQUIPMENT, GENERAL:

A. General:
   1. Proceed as rapidly as the building construction will permit. Install piping parallel and perpendicular to building walls and partitions.
   2. Thoroughly clean items before installation. Cap pipe openings to exclude dirt until fixtures are installed and final connections have been made.
   3. Cut pipe accurately, and work into place without springing or forcing, properly clearing windows, doors, and other openings. Excessive cutting or other weakening of the building will not be permitted.
   4. Show no tool marks or threads on the exposed plated, polished, or enameled connections from fixtures. Tape all finished surfaces to prevent damage during construction.
   5. Make changes in directions with fittings; make changes in main size with eccentric reducing fittings. Unless otherwise noted, install water supply and return piping with straight side of eccentric fittings at top of the pipe.
   6. Run horizontal sanitary piping at a uniform grade of 1/4" per ft., unless otherwise noted. Branch connections and changes in direction to be made with 45 degree "Y" fittings or long sweep ells.
   7. Run horizontal water piping with an adequate pitch upward in direction of flow to allow complete drainage.
   8. Install vent connections on all fixtures, traps, and equipment connected to the soil and waste system and extend not less than 3'-6" above floor before turning horizontal. Extend vent through roof minimum 1'-0" above roof or adjacent wall within 18" of roof penetration.
   9. Provide sufficient swing joint, ball joints, expansion loops, and devices necessary for a flexible piping system, whether or not shown on the Drawings. Make branch connections with offsets to provide for pipe movement.

10. Support piping independently at pumps, coils, tanks, and similar locations, so that weight of pipe will not be supported by the equipment.
11. Pipe drain lines from drip pans, air vents, relief valves and similar locations, to spill over an open sight drain, floor drain, or other acceptable discharge point, and terminate with a plain end, unthreaded pipe 2" above the drain.
12. Securely bolt all equipment, isolators, hangers, and similar items in place.
13. Support each item independently from other pipes. Do not use wire for hanging or strapping pipes.
14. Provide complete dielectric isolators between ferrous and non-ferrous metals.
15. Provide union and shut-off valves suitably located to facilitate maintenance and removal of equipment and apparatus.
16. Valves, strainers, check valves, and fittings shall be full size of the line they serve unless noted otherwise.
17. Make change in pipe size noted on the plans after last fitting of larger pipe. When supply pipes are larger than equipment tappings, reduce size immediately prior to entry.

B. Equipment Access:
1. Install piping, equipment, and accessories to permit access for maintenance. Reroute pipe and/or relocate items as necessary to provide such access, and without additional cost to the Owner.
2. Provide access doors where valves, motors, or equipment requiring access for maintenance are located in walls or chases or above ceilings. Coordinate location of access doors with other trades as required.

3.5 PIPE JOINTS:

A. Copper Tubing:
1. Cut square, remove burrs, and clean inside of female fitting to a bright finish.
   a. Apply solder flux with brush to tubing.
   b. Remove internal parts of solder-end valves prior to soldering.
2. Provide dielectric unions at points of connection of copper tubing to ferrous piping and equipment.
3. For joining copper tubing, use:
   a. Water piping 3" and smaller : 95-5 solder.
   b. Water piping larger than 3" : "Sil-fos" brazing.
   c. Underground : "Sil-fos" brazing.

B. Plastic Piping:
1. Mechanical joints shall be made with an Elastomeric thread seal on male thread. Joint shall be clean and free of dirt and made in accordance with Manufacturer's instructions. (DWV piping to conform to ASTM D3212.)
2. Solvent Cementing:
   a. Clean joint surfaces free of dirt and moisture.
   b. Prime joint with colored primer past extend of joint.
   c. Apply cement to all joint surfaces and make joint while cement is still wet.
   d. Use Solvent Cement for particular pipe material and make joint in accordance with Manufacturer's instructions.

3. Threaded joints shall be made in using lubricant or tape approved for pipe material applied to male thread. Threads of joints shall conform to ANSI B2.1 and shall be clean of dirt immediately prior to making joint.

C. Leaky Joints:
1. Remake with new material.
2. Remove leaking section and/or fitting as directed.
3. Do not use thread cement or sealant to tighten joint.

3.6 PIPE SUPPORTS:

A. Support suspended piping with clevis or trapeze hangers and rods.

B. Space hangers and support for horizontal steel pipes according to the following schedule:

Pipe Size		Maximum Spacing on Centers
1-1/4" and smaller	:	8'-0"
1-1/2" to 3"	:	10'-0"
4" to 5"	:	14'-0"

C. Space hangers and supports for horizontal copper tubing according to the following schedule:

Tube Size		Maximum Spacing on Centers
1" and smaller	:	6'-0"
1-1/2"	:	7'-0"
2"	:	8'-0"
2-1/2"	:	9'-0"
3" and larger	:	10'-0"

D. Space hangers and supports for horizontal cast iron soil pipe 5'-0" on center.

E. Space hangers and supports for horizontal PVC and ABS plastic pipe 4'-0" on center.

F. Provide sway bracing on hangers longer than 18".

G. Support vertical piping with riser clamps secured to the piping and resting on the building structure. Provide at each floor unless otherwise noted.

H. Provide insulation continuous through hangers and rollers. Protect insulation by galvanized steel shields.

I. Arrange pipe supports to prevent excessive deflection, and to avoid excessive bending stress.

J. Support piping from inserts or anchors in concrete slabs. Provide the inserts under this Section and arrange for the placing under Section 03300 of these Specifications. Use expansions inserts only where approved by the Owner.

K. Hubless Piping:

1. Provide hangers on the piping at each side of, and within 6" of, hubless pipe coupling so the coupling will bear no weight.
2. Do not provide hangers on couplings.
3. Provide hangers adequate to maintain alignment and to prevent sagging of the pipe.
4. Make adequate provisions to prevent shearing and twisting of the pipe and the joint.

3.7 SLEEVES AND OPENINGS:

A. Provide sleeves for each pipe passing through walls, partitions, floors, roofs, and ceilings.
   1. Set pipe sleeves in place before concrete is poured.
   2. For uninsulated pipe, provide sleeves two pipe sizes larger than the pipe passing through, or provide a minimum of 1/2" clearance between inside and outside of the pipe.
   3. For insulated pipe, provide sleeves of adequate size to accommodate the full thickness of pipe covering, with clearance of packing and caulking.

B. Caulk the space between sleeve and pipe or pipe covering, using a noncombustible, permanently plastic, waterproof, non-staining compound which leaves a smooth finished appearance, or pack with noncombustible cotton, rope, or fiberglass to within 1/2" of both wall faces, and provide the waterproof compound described above.

C. Finish and Escutcheons:
   1. Smooth any rough edges around sleeves with plaster or spackling compound.
   2. Provide 1" wide chrome or nickle plated escutcheons in all pipes exposed to view where passing through walls, floors, partitions, ceilings, and similar locations.
      a. Size the escutcheons to fit pipe and covering.
      b. Hold escutcheons in place with set screw.

3.8 CLEANOUTS:

A. Accessible cleanouts shall be installed in all horizontal waste lines at no greater than 100 ft. intervals and at the base of all vertical stacks.

B. Secure the Owner approval of locations for cleanouts in finished areas prior to installation.

C. Exterior cleanouts shall be installed in site sanitary lines at no greater than 75 ft. intervals. Cleanout piping shall be brought to finished grade and cleanout set in 6 inch thick concrete base extending a minimum of 6 inches on all sides of grade cleanout.

D. Provide cleanouts of same nominal size as the pipes they serve; except where cleanouts are required in pipes 4" and larger, provide 4" cleanouts.

E. Make cleanouts accessible. After pressure tests are made and approved, thoroughly graphite the cleanout threads.

3.9 VALVES:

A. Provide valves in water, systems. Locate and arrange so as to give complete regulation of apparatus, equipment, and fixtures.

B. Provide valves in at least the following locations:
   1. In branches and/or headers of water piping serving a group of fixtures.
   2. On both sides of apparatus and equipment.
   3. For shutoff of risers and branch mains.
   4. For flushing and sterilizing the system.
   5. Where shown on the Drawings.

C. Locate valves for easy accessibility and maintenance.

3.10 WATER HAMMER ARRESTORS:

A. Provide water hammer arrestors on hot water lines and cold water lines.
   1. Install in upright position at all quick closing valves, solenoids, isolated plumbing fixtures, and supply headers at plumbing fixture groups.
   2. Locate and size as specified or as shown on the Drawings and, where not shown, locate in accordance with Plumbing and Drainage Institute Standard WH-201.
   3. Install water hammer arrestors behind access panels.

B. Where fixtures are not protected by water hammer arrestors, provide air compression chambers equal to twelve (12) pipe diameters, 18" minimum on all water supply connections.

3.11 BACKFLOW PREVENTION:

A. Protect plumbing fixtures, faucets with hose connections, yard hydrants, lawn irrigation, and other equipment having plumbing connection, against possible back-siphonage.

3.12 PLUMBING FIXTURE INSTALLATION:

A. Installation:
   1. Set fixtures level and in proper alignment with respect to walls and floors, and with fixtures equally spaced.
   2. Provide supplies in proper alignment with fixtures and with each other.
   3. Provide flush valves in alignment with the fixture, without vertical or horizontal offsets.
   4. Install all fixture supports before wall finish is applied.

B. Grout wall and floor mounted fixtures watertight where the fixtures are in contact with walls and floors.

C. Caulk deck-mounted trim at the time of assembly, including fixture and casework mountings. Caulk self-rimming sinks installed in casework.

D. All fixtures shall be cleaned before setting and the installation shall be left ready for use.
1.

3.13 DISINFECTION OF WATER SYSTEMS:

A. Sterilize domestic hot and cold water systems to meet Health Department requirements.
1. Prior to treatment, flush the system of all dirt and foreign matter.
2. Fill system with water treated with 50 ppm of chlorine. Leave treated water in the systems for 24 hours.
3. Open all valves and faucets several times during flushing and treatment filling to insure full circulation.
4. Test the chlorine content at the end of treatment period and if chlorine content is greater than 10 ppm, flush the system. If chlorine content is found to be less than 10 ppm, repeat the sterilization process. Take samples from several points in the system.
5. After sterilization, flush the system with clean water until the chlorine is less than 0.1 ppm.

B. After final flushing, obtain Health Department Certificate of Approval on samples of water taken from the systems. (Use a testing agency approved by the Health Department.) Test shall show negative for coli-aerosene organisms.

C. If analysis results are not satisfactory, repeat the disinfection procedures and retest until specified standards are achieved.

3.14 OTHER TESTING AND ADJUSTING:

A. Provide personnel and equipment, and arrange for and pay the costs of, all required tests and inspections required by governmental agencies having jurisdiction.

B. Test the following systems at the pressures listed:
1. Domestic water: Test under 130 psi hydrostatic pressure.
2. Soil and waste:
   a. Above ground test with 12 ft. water head;
   b. Underground test with 8 ft. water head.

C. Where tests show materials or workmanship to be deficient, replace or repair as necessary, and repeat the tests until the specified standards are achieved.

D. Adjust the piping systems to optimum standards of operation.

END OF SECTION

SECTION 230600
HEATING, VENTILATING, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Work Included: Provide heating, ventilating, and air conditioning systems where shown on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:
   1. Rooftop packaged air-cooled, gas/electric conditioning systems, complete with direct-expansion cooling section, burner gas valve and heat exchanger, dampers, damper operators, mounting frame, operating and safety controls, blowers, motors, compressors, condensers, filters, and related items.
   2. Mini-Split system direct expansion heat pump heating and cooling system with controls, safety controls, blowers, motors, electric strip heaters, compressors, coils, filters, and related items.
   3. Air conditioning supply and return ductwork system with grilles, diffusers, registers, dampers, sheet metal hardware, and related items.
   4. Exhaust systems including, motors, ductwork, grilles, registers, controls and related items.
   5. Temperature control system.
   6. Air systems balance for air quantities shown on the plans.
   7. Acoustical and thermal insulation of ducts, piping, and equipment.

B. Related Work: Documents affecting Work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of this Specification.

C. Drawings: The mechanical drawings show the general arrangement of all piping, equipment, and appurtenances and shall be followed as closely as actual building construction, site conditions, and the work of other trades will permit. The mechanical work shall conform to the requirements shown on all of the drawings. General and structural drawings shall take precedence over mechanical drawings. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly.

1.2 QUALITY ASSURANCE:

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

B. Codes and Regulations:

1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction, all applicable laws, codes, ordinances including those of the state, county and city.
2. The Work shall also comply with all applicable requirements of the National Fire Protection Association, International Building, Plumbing and Mechanical codes, and all locally accepted amendments to these codes.
3. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.
4. Pay all fees, taxes, licenses and permits for inspection and certification for the execution of this Work.
5. Non-compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

C. Certificate of Final Inspection: Under each applicable section of the specifications, the contractor shall, upon completion of the work under that section, furnish a certificate of final inspection from the department having jurisdiction.

1.3 EXAMINATION OF SITE:

A. Visit the site, inspect the existing Conditions and check the Drawings and Specifications so as to be fully informed of the requirements for completion of the Work.

B. Lack of such information shall not justify a request for extra compensation to the contract price.

1.4 MATERIAL AND EQUIPMENT:

A. All materials and equipment shall be new, of the same type and Manufacturer, and shall be of the best quality and design and free from defects.

B. A Manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer's name, address and catalog number.

C. Manufacturer's name and model number used herein and on the Drawings establish type and quality required. Equal products may be considered if submitted in writing to the Owner for approval 10 days prior to bid date. The Contractor shall be responsible for assuring the items and equipment substituted for those shown on the Drawings will physically fit in the space allocated.

D. Delivery and Storage: Equipment and materials shall be delivered to the site and stored in original containers, suitably sheltered from the elements, but readily accessible for inspection until installed. All items subject to moisture damage (such as controls) shall be stored in dry, conditioned spaces.

E. Protection: Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury. Damage or defects developing before acceptance of the work shall be made good at the contractor's expense.

F. Dimensions: It shall be the responsibility of the contractor to insure that items to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install sizes and shapes of equipment so that the final installation shall suit the true intent and meanings of the drawings and specifications.

G. Manufacturer's Directions: Shall be followed completely in delivery, storage, protection and installation of all equipment and materials. The contractor shall promptly give notice in writing of any conflict between any requirement of the Contract Documents and the manufacturer's directions and shall obtain written instructions before proceeding with the work. Should the contractor perform any work that does not comply with the manufacturer's directions or such written instructions, he shall bear all costs arising in correcting the deficiencies.

1.5 SUBMITTALS:

A. Comply with pertinent provisions of Division 1.

B. Product Data: Within 35 calendar days after the Contractor has received the Owner’s Notice to Proceed, submit:
   1. Materials list of items proposed to be provided under this Section.
   2. Manufacturer’s Specifications, catalog cuts, and other data needed to prove compliance with the specified requirements.
   3. Shop Drawings and other data as required to indicate method of installing and attaching equipment, except where such details are fully shown on the Drawings.
   4. All sheets of the submittal shall have the job name stamped or permanently written neatly on them and shall be assembled in an indexed brochure. The descriptive material shall be arranged in the brochure in the same order as found in the specifications. Each brochure shall be submitted in a hardback, 3-ring binder. The leading sheet of the descriptive material for each item shall be full size, of heavy paper, with a numbered outside tab, and an index sheet showing the location in the brochure.
   5. Manufacturer's regular catalog sheets will not be acceptable under these requirements unless they indicate completely all of the specification requirements. Where drawings cover several sizes or types of construction, they shall clearly indicate the size or type of construction to be used on the project. In cases where several sizes of the same type of equipment are required to be furnished, the submittal shall include a schedule identifying each piece of equipment, complete with all capacity information needed to compare every submittal item with its respective specified item. Special features shall be listed on a separate typewritten sheet.
   6. Brochures shall contain a certification by the Contractor that the equipment or materials are suitable for conditions shown and specified; that the equipment or materials are believed to be in conformity with the plans and specifications, except as may be specifically described; be signed by the Contractor. Brochures

received not in conformity with these requirements will be returned for required action.

7. Finding "APPROVED EQUAL" or "NO EXCEPTION TAKEN" shall not eliminate responsibility for compliance with the plans and specifications, unless specific attention has been called, in writing, to the proposed deviations at the time of transmittal of the brochures and such deviations have been found acceptable, nor shall it eliminate the responsibility for freedom from errors of any sort in the data submitted. Discovery of such deviations at or after installation shall be cause for immediate replacement at no additional cost to the Owner.
8. No material or equipment so governed shall be ordered until found acceptable by the Architect/Engineer/Owner.

C. Record Drawings:
   1. Comply with pertinent provisions of Division 1.
      a. Record Drawings- The contractor shall furnish to the owner CAD record drawings consisting of three (3) sets of 11" x 17" prints (To be bound in O&M Manuals), one (1) full size set of prints and one (1) disk, showing the piping and ductwork for the HVAC and plumbing systems. Piping sizes, rerouting, etc., for both under floor and above ceiling piping shall be shown. Also, provide a blue-line of the site plan, clearly marked, to indicate any and all changes in sanitary sewer, storm sewer, domestic cold water and natural gas piping to the building. In addition to these drawings, a complete set of approved ductwork shop drawings and temperature control shop drawings shall be included in this set of drawings.
         1) CAD Record drawings shall incorporate all change and field orders. (No separate or supplemental drawings).
         2) All equipment schedules to be revised to reflect installed manufacturer model numbers and capabilities.
   2. Include a copy of the Record Drawings in each copy of the operation and maintenance manual described below. (Original document shall be reproducible paper.)

D. Manuals: Upon completion of this portion of the Work, and as a Condition of its acceptance, deliver to the Owner two copies of an operation and maintenance manual compiled in accordance with the provisions of Division 1 of these Specifications. Include within each manual:
   1. Copy of the approved record documents for this portion of the Work.
   2. Copies of all warranties and guarantees.
   3. Description of HVAC equipment control and seasonal operation, including schedule of required maintenance.

1.6 PRODUCT HANDLING:

A. Comply with pertinent provisions of Division 1.

1.7 INSPECTION:

A. Make written notice to the Owner adequately in advance of each of the following stages of construction:

1. In the underground condition prior to placing concrete floor slab, when all associated Work is in place.
2. When all rough-in is complete, but not covered.
3. At completion of the Work of this Section.

B. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance, remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.

1.8 CLEANING, TESTING AND PLACING IN SERVICE:

A. Immediately prior to final inspection, the Contractor shall make a final cleanup of dirt and refuse resulting from his Work and shall assist in keeping the premises clean at all times.

B. Immediately prior to final inspection, the Contractor shall clean all material and equipment installed under this Contract. Dirt, dust, plaster, stains and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched up and restored to their original Condition.

C. Mechanism of all equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required to produce the intended performance.

1.9 ADJUSTMENT AND INSTRUCTION:

A. Energize all systems, equipment and fixtures and check for proper operation.

B. HVAC system shall be placed in operation and balanced to provide air and water flow as indicated on the Drawings.

C. The Contractor’s service personnel shall instruct the Owner’s Representative in the proper operation of all systems.

1.10 GUARANTEE:

A. The Contractor guarantees all work against any defects due to faulty workmanship or material and that all raceways, ducts and piping are free from foreign material, obstructions, holes or breaks of any nature.

B. Upon written notice from the Architect or Owner, the Contractor shall promptly remedy without cost to the Owner any defects occurring within a period of one (1) year from the date of final acceptance.

1.11 WARRANTY:

A. The Contractor shall properly execute in the Owner's name all Manufacturer's standard warranty certificates applying to equipment installed on the project and shall deliver said certificates to the Architect at completion of the job. All warranty cards shall also be properly executed and delivered to the supplier or Manufacturer's representative for Manufacturer's records. Standard warranties for equipment shall not be less than one (1) year.

PART 2 - PRODUCTS

2.1 SHEET METAL DUCTWORK:

A. For interior heating, ventilating, and air conditioning systems, provide best grade, prime, open hearth, galvanized sheet metal ducts fabricated and installed to pertinent ASHRAE and SMACNA standards, or to the requirements of governmental agencies having jurisdiction, whichever requirement is more stringent.

B. Round ductwork to be constructed of best grade prime, open hearth galvanized steel with spiral seams. For systems with less than .75" W.G. pressure, round duct with longitudinal snap lock seams and beaded sleeve transverse joints may be installed.

2.2 FLEXIBLE DUCT:

A. Provide factory fabricated insulated low pressure flexible duct with the following attributes as manufactured by Thermaflex, Wire Mold, Metalflex, or Flexmaster.
   1. Helix wire flexible core.
   2. 2" fiberglass blanket insulation of 3/4 lb. density with continuous sealed vapor barrier jacket.
   3. Accessories shall include strap clamps, spin-in duct taps, air scoops and dampers as required.
   4. Composite assembly, including insulation and vapor barrier, shall meet all requirements of UL 181, including flame spread of 25 or less and smoke developed rating of 50 or less as set forth in NFPA Bulletin 90-A, and bearing UL label as a Class 1 air duct.
   5. Flexible duct only allowed above accessible ceilings.

2.3 FABRIC DUCTWORK:

A. Provide fabric air diffuser constructed of a woven fire retardant fabric with the following characteristics:
   1. Minimum 10 year warranty.
   2. 100% flame retardant.
   3. 8.20 oz/sq yd. per ASTM D3776.
   4. Air Permeability: 2 cfm per sf per ASTM D737 at 0.5 static pressure.
   5. Minimum "high" operating temperature 176 deg. F.
   6. Holes spaced per manufacturer's recommendations for the dispersion of the total design CFM in single or multiple rows for the length of the duct at the angles noted on the drawings.

7. Single or parallel stainless steel cable support or track type support. Means and methods of support anchors and attachments to be coordinated with building conditions of construction.
8. Color selected by the Architect.

2.4 DUCTWORK FABRICATION:

A. All interior ductwork and fittings shall be fabricated in accordance with recommendations as outlined in current ASHRAE and SMACNA Standards.

B. Gauges and reinforcing in accordance with current SMACNA Standards for greatest dimensions of duct or housing.

C. Lap metal ducts in direction of air flow. Hammer down edges and slip joints to leave smooth duct interior.

D. Cross break all rectangular ducts 18" and larger. Omit cross breaking if two gauge heavier metal is used in duct construction.

E. Transverse Joints: Ductwork up to 24", use s-drive, pocket, or bar slip. Ductwork 25" to 40", use joints forming outside ribs. Other joint connections of equivalent mechanical strength and air tightness may be used if approved by the Engineer.

F. Construct elbows with radius of not less than 1-1/2 times width of duct on center line or square elbows with air foil turning vanes. Round duct elbows shall be of the smooth radius type. For round duct systems with less than .75" W.G. pressure, jointed elbows may be installed.

G. Branch ducts shall be tied to main trunk duct through radius take-off and splitter damper, or 45 degree branch and curved blade extractor. Round branch duct tappings to be of the conical or spin-in type with air scoop and volume damper for supply air on 12" round and smaller. Flanged or bellmouth taps used for larger ducts as noted on the Drawings.

H. Transitions shall be constructed per SMACNA Standards and shall not exceed 20 degrees for diverging air flows or 30 degrees for contracting air flows.

I. Plenums shall be fabricated in accordance to duct gauges and shall be reinforced per SMACNA standards.

J. Exterior duct joints to be hard cast and sealed water tight.

2.5 DUCT HANGERS AND SUPPORTS:

A. Hangers shall be galvanized steel band iron or angle iron and galvanized threaded rod. Wall supports shall be galvanized steel band iron or fabricated angle bracket.

2.6 DUCT INSULATION:

A. General:
   1. Provide materials complying with NFPA Bulletin 90-A, as determined by UL method NFPA 225-ASTM E84, and complying with the governing code, with flame spread rating less than 25 and smoke developed rating less than 50.
   2. Where vapor barriers are used, provide intact and continuous throughout with all joints sealed.
   3. Manufacturer of duct liners shall print density and thickness on face of duct liner.
   4. Acceptable Manufacturers:
      a. Owens/Corning Fiberglass
      b. Johns-Manville
      c. Certainteed
      d. Armstrong

B. Ductliner (Interior Rectangular Duct): Insulate internal supply, return and exhaust ducts with 1" glass fiber with a minimum density of 1.5 pounds per cubic foot. Liner to be coated to prevent fiber erosion at air velocities up to 4000 f.p.m.

C. Ductwrap (Round Duct): Insulate externally all round ducts and fresh air ducts with 2" thick, 1 pound density, fiberglass ductwrap with factory applied reinforced aluminum foil vapor barrier.

D. Exterior Duct Liner: All ductwork exposed to weather to be internally insulated with 2" glass fiber with a minimum density of 3.0 pounds per cubic foot. Liner to be coated to prevent fiber erosion at air velocities up to 4000 f.p.m.

2.7 DUCTWORK ACCESSORIES:

A. Acceptable Manufacturers:
   1. Air Balance, Inc.
   2. Ruskin
   3. Carnes
   4. Pottorff
   5. Krueger
   6. United Enertech
   7. Nailor Industries

B. Flexible Connections: Duct connections to fans and where noted elsewhere on plans shall be sound isolation of fire resistant, water proof, and mildew-resistant canvas. Connections shall not be less than 4" long, shall have suitable metal collar frame on each end, and shall be made with at least 1" slack material.

2.8 ROOF HOODS:

A. Provide and install all aluminum roof hoods with bird screens as sized and noted on the Drawings. Backdraft dampers and other accessories to be furnished and installed as noted on the Drawings.

B. Acceptable Manufacturers:
   1. Penn

2. Greenheck
3. Cook
4. Carnes
5. Twin City
6. Or as provided by fan Manufacturer when installed in conjunction with exhaust or supply fan systems.

2.9 VIBRATION ISOLATION:

A. Vibration isolation shall be of the type and deflection for the duty indicated on the Drawings. The vibration isolator supplier shall confirm equipment weights and revolutions (Frequency) with actual products approved and installed by Division 15 Contractor.

B. All vibration isolators and bases shall be treated for resistance to corrosion.

C. Size type and deflection of isolators shall conform to recommendations set forth in ASHRAE standards.

D. Approved Manufacturers:
1. Amber Booth
2. Mason Industries, Inc.
3. Consolidated Kinetic Corporation

2.10 EXHAUST FANS:

A. Exhaust fans shall be of the type and capacity as scheduled on the Drawings. All fans bear seal of ratings certified by A.M.C.A. Fans shall be furnished and installed with accessories, special coatings, special materials and construction, and controls as noted on the Drawings.

B. Approved Manufacturers:
1. Penn
2. Greenheck
3. Cook
4. Carnes

2.11 SPLIT SYSTEM HEAT PUMP:

A. Provide heating and cooling split system fan coil air handling unit, evaporator/condenser coil in fan unit, air cooled outdoor heat pump unit with reversing valve, of the capacities and voltage as scheduled on the Drawings.

B. Fan coil outdoor heat pump unit shall be of the same Manufacturer and matched for the capacities scheduled on the Drawings. Performance ratings shall comply with those scheduled for the outdoor and coil entering air design data listed on the Drawings.

C. Fan Coil Features:

1. Cabinet: Constructed of cold-rolled steel finished with baked enamel and fully insulated; duct connection flanges; filter frame and access door; and removable access panels for servicing.
2. Fan: Direct drive, multi-speed blower, dynamically and statically balanced; fan motor overload protection; resilient mounting.
3. DX Coil: Copper tube and mechanically bonded aluminum fins; refrigerant metering device; refrigerant line fittings; condensate drain pan with primary and secondary drain line fittings.
4. Electric Heater: Factory installed; heaters greater than 10 KW shall have current overload protection by fuses or circuit breaker in accordance with N.E.C. Article 424-22; heater over 10 KW shall be wired for 2 stage operation and sequenced off and on in 5 KW increments; all heaters shall have thermal overload protection; 60 VA control circuit; 24 volt transformer and voltage terminal board.

D. Heat Pump Features: Galvanized heavy gauge steel with enamel finish housing; hermetic spring isolated compressor with crankcase heater and noise shield; thermal and current-sensitive overload protection; compressor internal high pressure protection; outdoor coil construction of copper tube with mechanically bonded aluminum fins; coil refrigerant metering device mounted at liquid service valve; direct drive, propeller condenser fan with factory lubricated, inherently protected, and resiliently mounted motor; low pressure switch; suction line accumulator; pressure relief device; automatic defrost control; liquid line solenoid valve; charging valves; liquid line filter dryer; compressor and condenser fan starters; EER and C.O.P. ratings to meet local code requirements for unit performance.

E. Accessories: Extra set of throwaway filters to install after final acceptance; relays; transformers for control wiring; unit thermostat control as described in Temperature Control Section; precharged refrigerant lines when applicable for distance and routing.

F. Acceptable Manufacturers:
1. Lennox, no exceptions

2.12 REFRIGERANT PIPING:

A. Precharged and factory insulated refrigerant lines shall be installed for distances less than 50 feet and direct, unconcealed pipe routing. Refrigerant piping shall be type “L” copper, refrigerant grade with wrought copper fittings and insulated per Section 15400, item 2.12.

B. Pipe sizes shown on the Drawings are for estimating purposes only. Equipment Manufacturer shall verify size of refrigerant piping for system installation.

C. Refrigerant system shall include liquid filter dryer, strainer, charging valves, relief valves, check valves, sight glass, solenoid valves, and thermostatic expansion valves.

2.13 ROOF TOP UNITS (GAS HEAT AND ELECTRIC DX COOLING):

A. Provide package air cooled, electric DX cooling, single zone, gas fired heating unit with capacities and voltage as scheduled on the Drawings.

B. Unit Features: Insulated galvanized steel cabinet with baked enamel finish, aluminized steel with heat exchanger with end shot burners, redundant gas valve, intermittent pilot ignition, A.G.A. approved for outdoor application, evaporator and condenser coils with aluminum plate fins mechanically bonded to seamless copper tubes, hermetic compressors with motor overload protection, crankcase heater and vibration isolators, centrifugal forward curve indoor fan with motor and drive, condensing propeller fans with direct drive motor, low temperature operation to 0° F, short cycling protection, freezestat.

C. Approved Manufacturers:
1. Lennox
2. Trane
3. Carrier

2.14 TEMPERATURE CONTROL:

A. Contractor to furnish and install low voltage, adjustable thermostat to control burner operation, heater stages in sequence with delay between stages and cooling stages in sequence of compressor and condenser fan and supply fan to maintain temperature setting. RTU thermostat shall be Provided by the factory.

2.15 PIPE INSULATION

A. Glass Fiber Insulation: Inorganic glass fibers, bonded with a thermosetting resin. (Hydronic piping).
1. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.
2. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, jacketed.
3. Thermal Conductivity: 0.26 average maximum at 75 deg F mean temperature. Density: 10 average maximum.

B. Jackets:
1. Foil and Paper Jacket: Laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil, vapor barrier type for all hydronic piping applications.
2. PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-thick, high-impact, ultra-violet-resistant PVC. Adhesive: As recommended by insulation manufacturer.

C. Manufacturer:
1. Owens Corning Fiberglass Corporation
2. CertainTeed Manson
3. Schuller International, Inc.
4. Knauf Fiberglass

2.16 OTHER MATERIALS:

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect/Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Examine the areas and Conditions under which Work of this Section will be performed. Correct Conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory Conditions are corrected.

3.2 COORDINATION:

A. Coordinate as required with other trades to assure proper and adequate provision in the Work of those trades for interface with the Work of this Section.

B. Slots, Chases, Openings, and Recesses: Through floors, walls, ceilings, and roofs as specified in new structure will be provided by the various trades in their respective materials, but the trade requiring them shall see that they are properly located and shall do any cutting and patching caused by the neglect to do so. No cuts shall be made into any structural element, beam or column, without written approval. Opening in existing structures will be provided by the trade requiring same.

C. Locations: Of pipes, ducts, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The contractor shall determine the exact route and location of each pipe, duct and electrical raceway prior to fabrication.
   1. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example, plumbing drains shall normally have right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.
   2. Offsets, transitions and changes in direction in pipes and ducts shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The contractor shall furnish and install all traps and sanitary vents, etc., as required to affect these offsets, transitions and changes in direction.

3.3 PREPARATION:

A. Holes in Concrete:
   1. Provide sleeves, accurately dimensioned and shaped to permit passage of items of this Section.
   2. Deliver all such sleeves, with accurate setting Drawings and setting information, to the trades providing the surfaces through which such items must penetrate, and in a timely manner to assure inclusion in the Work.

B. Flashing:
   1. Where items of this Section penetrate the roof, outer walls or waterproofing of any kind, provide under this Section all base flashing and counterflashing required at such penetration.
   2. Provide on each pipe passing through the roof a 4 lb. seamless lead flashing and counterflashing assembly. Penetrations through sheet metal roofs shall be installed per roofing Manufacturer's recommendations.

3.4 EQUIPMENT INTERFACE:

A. Provide all required shutoff valves, unions, and final connections of piping to the Work of this Section.

B. For electrically operated equipment, verify the electrical characteristics actually available for the Work of this Section and provide equipment meeting those characteristics.

3.5 DUCTWORK INSTALLATION:

A. Rigidly support all interior ductwork using angle iron and galvanized threaded rods or galvanized strap hangers spaced to carry the load but not less than 5'-0" on centers and secured to the building structure in a method approved by the Architect. All hangers shall be installed truly vertical. Ductwork shall be hung level except where Architectural or structural Conditions dictate otherwise.

B. Flexible ductwork shall not exceed 8'-0" runout total length from tapping to diffuser connection. Make smooth radius bends and secure duct at each end using a method of mechanical fastening with air tight seal. Support duct from resting on ceiling using strap hangers.

C. Fabric ductwork to be secured to metal duct via strap band secured behind beaded duct collar or manufacturer’s standard means and methods of attachment. Secure suspension system to duct reinforced connectors to support duct. Suspension system to be installed in accordance with manufacturer’s installation requirements and recommendations and in compliance with Architect and Structural Engineer directives for installation and support of duct systems.

D. Clean duct system of dirt and debris prior to operating any fan connected to the duct system. Cap all floor outlets and open ductwork during construction until final connections are made.

E. Duct sizes shown on the Drawings are internal clear dimensions. The Contractor shall adjust for thickness of duct liner required.

3.6 DUCT HANGER AND SUPPORT INSTALLATION:

A. Duct hangers and supports to be secured to the building structure via a method approved by the Architect.

B. Hanger Minimum Sizes:
   1. Up to 30" wide: 1" x 16 ga. at 5 feet spacing.
   2. 31" to 48" wide: 1-1/2" x 16 ga. at 5 feet spacing.
   3. Over 48" wide: 1-1/2" x 16 ga. at 8 feet spacing.

C. Horizontal Duct on Wall Supports Minimum Sizes:
   1. Up to 18" wide: 1-1/2" x 16 ga. galvanized steel strap or 1" x 1" x 1/8" angles at 8 feet spacing.
   2. 19" to 40" wide: 1-1/2" x 1-1/2" x 1/8" angles at 4 feet spacing.

D. Vertical Duct on Wall Supports Minimum Sizes:
   1. At 6'-0" spacing:
      a. Up to 24" wide: 1-1/2" x 16 ga.
      b. 25" to 36" wide: 1" x 1" x 1/8"
      c. 37" to 48" wide: 1-1/4" x 1-1/4" x 1/8"

3.7 INSULATION:

A. Duct liner shall be adhered to interior sides of ductwork with minimum 50% coverage of fire-retardant adhesive. Coat all exposed edges with adhesive. Use mechanical fasteners, (12-gauge impale anchor tabs or equal) maximum 16" on centers. Cut off excess fastener length and cover with brush coat of mastic. Liner shall be cut to fit and be without gaps at all joints. Just before sections of ductwork are hung, coat end butt joints of duct liner with adhesive and hang immediately.

B. Ductwrap shall be firmly secured to ductwork with adhesive applied in 6" widths on 16" centers. Securely fasten insulation in place with 16-gauge annealed tie wire spirals wound 16" on center for straight duct runs and half hitched around duct on 4" centers for elbows and fittings OR tape longitudinal seams on straight duct runs with 2" tape. Butt insulation and seal joints and breaks with 2" tape or foil adhered to vapor barrier. Do not stretch or compress insulation excessively during application.

3.8 DUCTWORK ACCESSORIES:

A. Install items in accordance with Manufacturer's instructions and accepted methods.

3.9 AIR OUTLETS:

A. Install all grilles, registers, and diffusers and their accessories in accordance with Manufacturer's instructions and accepted methods.

B. Paint interior of all ductwork visible behind air outlets matt black.

C. Review requirements of outlet sizes, finish, mounting, and air patterns prior to installation. Coordinate location of outlets and make necessary adjustments to conform with Architectural features, symmetry, and light locations. Refer to grille, register and diffuser list for additional requirements.

3.10 ROOF HOODS:

A. Set roof hoods on factory or field-built curbs and connect to ductwork as shown on the Drawings. Flash, caulk, and seal weather tight per Manufacturer's instructions and Architectural details.

3.11 VIBRATION ISOLATION:

A. Install vibration isolators in accordance with Manufacturer's instructions.

3.12 EXHAUST FANS:

A. Install fans in accordance with Manufacturer's instructions and accepted methods.

B. Set roof mounted fans on factory or field-built curbs and connect to ductwork as shown on the Drawings. Fans manufactured for sloped roofs to be flashed into roofing per Manufacturer's instructions. Flash, counterflash, caulk, and seal water tight per Manufacturer's instructions and Architectural details.

C. Vibration isolation shall be included in all fan mounting methods as required in the "Vibration Isolation" Section of these Specifications above and as detailed on the Drawings.

3.13 SPLIT SYSTEM HEAT PUMP:

A. Install in accordance with code requirements and Manufacturer's instruction, adhering to required clearances for operation and servicing. Division 23 Contractor to complete ductwork, refrigerant piping, mounting and condensate connections for a fully functional system. Division 26 Contractor to rough-in and make final connections of required electrical power wiring. Owner shall secure control contractor under separate contract to perform installation of unit control interface with building HVAC systems controls.

B. Refrigerant system to be tested and fully charged and complete for a fully functional system.

3.14 REFRIGERANT PIPING:

A. Install refrigerant piping parallel and perpendicular to building structure. Route piping as directly between equipment as possible, using only the minimum number of bends required. Support and hang piping as described in Section 15400, Item 2.05 A and 3.06 C. Joints and fittings to be sweat with SIL-FOS or equivalent silver bearing solder.

B. Test refrigerant system with Nitrogen at 300 psi.

3.15 ROOF TOP UNITS:

A. Install in accordance with code requirements and Manufacturer's instructions adhering to required clearances for operation and servicing. Division 15 Contractor to complete ductwork, gas piping, and condensate connections for a fully functional system. Division 16 Contractor to rough-in and make final connections of required electrical and control wiring.

B. Set roof mounted unit on factory curb or rails as noted on the Drawings. Flash, counterflash, caulk and seal weather tight per Manufacturer's instructions and Architectural details.

C. Ground mounted units shall be set on reinforced concrete pads or elevated pipe columns and support beams as noted on the Drawings.

D. Vibration isolation shall be included as specified in 3.14 above and detailed on the Drawings.

3.16 TEMPERATURE CONTROL:

A. Division 26 Contractor shall furnish and install all control wiring. Coordinate and verify control requirements with unit Manufacturer and description of control shown on the Drawings. Locate thermostats as shown on the Drawings.

3.17 TESTING AND ADJUSTING:

A. Test and adjust each piece of equipment and each system as required to assure proper air balance and operation.
   1. Test and regulate ventilation and air conditioning systems to conform to the air volumes shown on the design Drawings.
   2. Make tests and adjustments in apparatus and ducts for securing the proper volume and face distribution of air for each grille and ceiling outlet.
   3. Where required, provide pulleys for fans at no additional cost to the Owner, and set to drive the fan at the speed to give the indicated volume.
   4. For each system, take the following data in tabulated form:
      a. Air volumes at all supply, return, and exhaust outlets
      b. Total cfm supplied
      c. Total cfm returned
      d. Total outdoor air cfm supplied
      e. Total cfm exhausted

B. Submit two sets of test and balance reports to the Architect for approval.

C. Eliminate noise and vibration, and assure proper function of all controls, maintenance of temperature, and operation in accordance with the approved design.

3.18 INSTRUCTIONS:

A. Upon completion of this portion of the Work, and prior to its acceptance by the Owner, provide a qualified representative and fully instruct the Owner's maintenance personnel in the proper operation and maintenance of items provided under this Section.

B. Demonstrate the contents of the approved operation and maintenance manual required in the "Submittals" Section of these Specifications.

END OF SECTION

SECTION 260400 – ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Provide complete electrical service entrance, systems and components as shown on the Drawings and as specified herein, along with proper installation of materials and equipment including, but not necessarily limited to:

2.01 Basic Materials and Methods

2.02 Low-Voltage Electrical Power Conductors and Cables

2.03 Grounding and Bonding for Electrical Systems

2.04 Hangers and Supports for Electrical Systems

2.05 Raceways and Boxes for Electrical Systems

2.06 Sleeve-Seal Systems for Electrical Raceways

2.07 Lighting and Control Devices

2.08 Wiring Devices

2.09 Fuses

2.10 Enclosed Switches and Circuit Breakers

2.11 Interior LED Lighting

2.12 Surge Protection for Electrical Power Circuits

2.13 Other Materials

B. Drawings:

1. These Specifications are accompanied by floor plans of the building showing the location of the outlets. Exact locations shall be subject to the approval of the Architect who reserves the right to make any reasonable changes in locations indicated, prior to rough-in, without cost to the Owner. While the general run of feeders, branches, and conduits are indicated on the Drawings, it is not intended that the exact routing of circuits or locations of conduits be determined by said Drawings. Detailed arrangements of all Work shall be subject to the Owner and Architect's approval. Contractor shall coordinate all

materials, equipment, devices and routing pathways with all Trades affected by this Scope of Work prior to bidding. Provide written documentation of identified systems which shall require any deviation from the drawings and issue to the Architect prior to bid.

C. Related Work:

1. Documents affecting Work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of the Specifications. Coordinate all requirements for the electrical service entrance with utility company. Deviations identified or discovered during the initial site investigation shall be documented and submitted to the Architect for equivalent Scope-of-Work prior to bid.

D. Temporary Power:
1. Arrange, provide and pay for the costs of installing temporary power to the site in accordance with the requirements of Division 1.

E. Errors in Bid Documents:
1. The documents provided for bidding shall be defined as the Contract Documents inclusive of each Division and defined as all Drawings, Specifications, Addendums, Sketches and documented Request for Information (RFI). The Bidder shall promptly notify the Owner's Representative and the Architect/Engineer of Record upon discovery of any inconsistencies in the Contract Documents and be reported prior to the submitted Bid for proper correction utilizing the Addendum process listed in Division 1. Identified inconsistencies published by the Architect prior to bid shall be the contractor's responsibility for any and all incurred costs.

1.2 QUALITY ASSURANCE

A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section. Provide all warning signage and barriers required and as directed by the Owner to maintain the highest quality installation including safety of the overall site conditions.

B. CODES AND ORDINANCES:
1. The installation shall comply with requirements of all applicable laws, codes and ordinances including those of the state, county and city.
   a. NFPA 70 - 2014.
   b. NFPA 72 – 2015 (including Fire Marshal Directives)
   c. NFPA 101 – 2014.
2. Where these Drawings, Design Guidelines and Specifications show more stringent requirements than required codes, the more stringent shall prevail.
3. The Work shall comply with current standards of the serving utility companies and the Contractor shall support the Owner in efforts to coordinate trenches

and pathways in unison as to not burden the site with multiple efforts. Provide all necessary materials to match or exceed existing standards of installations from the previous Work.

4. System grounding per ANSI/NFPA70: National Electrode Code. Performance requirement of grounding system resistance shall be 10 ohms. Furnish products listed and classified by Underwriters Laboratories Inc. to obtain the results listed.

C. PERMITS, FEES AND LICENSES:

1. The Contractor shall obtain and pay for all permits, fees and licenses, for Work required under these Specifications.

D. UTILITY COMPANY FEES:

1. Determine the amount of fees and reimbursable construction costs from the utility companies and include that amount as a part of the proposal by line-item qualifiers. The contractor shall pay the utility company directly for all Work required for a complete and operable system.
2. Coordination of existing utilities: Comply with the requirements of the authorities having jurisdiction, and of the utility companies providing electrical power and other services. The existing utilities shall be clearly marked by the Contractor and all parameters that affect the Work shall be submitted to each Division's Contractor for a complete coordinated installation. Failure to notify Division 1 through 26 Contractors of conditions that will cause monetary or construction delays shall be the direct responsibility of the Contractor.

E. Without additional cost to the Owner, provide such other labor and materials as required to complete the Work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

F. Contractor shall coordinate all sub-contractors sequence/phasing of work and proposed equipment installation pathways through the existing building with all other Divisions listed in Specifications prior to final connection.

1.3 EXAMINATION OF SITE

A. All Contractors and Sub-Contractor shall be required to visit the site and inspect the existing Conditions with the Drawings and Specifications so as to be fully informed of the requirements for completion of the Work.

B. Contractors shall provide contact information on a Pre-construction sign-in sheet. Lack of such information shall constitute the Owner's right of refusal.

1.4 MATERIAL AND EQUIPMENT

A. All materials and equipment shall be new, of the same type and Manufacturer of the existing facility and shall be of the best quality and design, free from defects and meet the requirements of UL and NFPA where standards are established for those items.

B. A Manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer's name, address, ratings, capacity and catalog number.

C. Manufacturer's name and model number used herein and on the Drawings establish type and quality required. Equal products may be considered if submitted in writing to the Engineer/Architect for approval 10 (ten) days prior to bid date. The Contractor shall be responsible for assuring the items and equipment substituted for those shown on the Drawings will physically fit in the space allocated. If substitutions are not submitted as defined, the Contractor shall be responsible for all costs incurred for installation or re-installation of systems.

D. Firestopping material shall be 3M Fire Seal Caulking, or approved substitution.

1.5 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings and Submittal Data:
   1. Contractor shall process shop drawings and submittal data to insure that the proposed materials, equipment and devices conform to the requirements of the Contract Documents, all local code requirements and that there are no omissions or duplications in the various Divisions of Work. Contractor shall coordinate with each Division for the proposed submittal data or shop drawings and note on the Submittals Contractor requirements for these coordinated trades prior to sending to Architect. Provide layouts, fabrication information and data for systems, materials, equipment and devices proposed for the project.
      a. Shop drawings shall be drawn on a scale not less than ¼ inch equals 1 foot showing actual dimensions. Shop drawings shall include, but not be limited to:
         1) Exterior Equipment Pads and Clearances.
      b. Grounding of Electrical Systems Connections and Diagrams.
      c. Gaseous Duel-Fuel Emergency Engine Generators.
      d. Transfer Switches.
      e. Dry-type Low-Voltage Transformers.
      f. Enclosed Switches and Circuit Breakers.
      g. Wiring Devices and all equipment specified as an Assembly.
   2. Submittal data (manufacturer's catalog data) shall include Manufacturer's Specifications, product literature and other data needed to demonstrate compliance with the specified requirements, to include but not be limited to the following:
      a. Equipment: Generators, Transfer Switches, Transformers, Disconnect switches, Circuit Breakers, Fuses, etc.
      b. Materials: conduit, conductors, connectors, supports, etc.

c. Wiring devices.
d. Grounding System: Test report and record of location.

3. Manufacturer's recommended installation procedure which, when approved by the Architect or Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
4. The submittal data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered and clearly indicating UL Listed ratings.
5. Do not submit detailed quantitative listings of materials, equipment and devices. It is the Contractor's responsibility to provide proper sizes and quantities to conform to Contract Documents.
6. Assemble submittals on related items procured from a single manufacturer in brochures or other suitable package form, rather than submitting a multiplicity of loose sheets.
7. The Contractor shall submit shop drawings whenever equipment proposed varies in physical size and arrangement from that indicated thus causing rearrangement of equipment space, where tight spaces require extreme coordination between this work and other work, where called for elsewhere in these Specifications and where specifically requested by the Architect/ Engineer. Shop drawings shall be prepared at a scale of not less than ¼ inch equals 1 foot.
8. Contractor shall only submit proposed equipment; materials and devices that are coordinated between all trades of Work listed in the Contract Documents and shall be identified as so on the inside cover of the Submittal packages indicating the affected Divisions. Coordination of Divisions shall be the sole responsibility of the Contractor and lack of coordination resulting in additional service costs shall be paid by the Contractor in addition to any consultant fees incurred by the Owner.

C. SUBSTITUTIONS

1. Where a single manufacturer is mentioned by trade name or manufacturer's name, it has been done in order to establish a standard rather than to discriminate against an equal product made by another manufacturer.
2. Where multiple manufacturers are listed, none other than those manufacturers will be accepted.
3. Substitute manufacturers will be considered (10) ten-days prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum ten (10) business days prior to bid with each sub-paragraph noted with the comment, "COMPLIANCE", "DEVIATION" or "ALTERNATE". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated along with indicated Divisions affected.
4. The term "COMPLIANCE" shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.

5. By noting the term "DEVIATION" shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
6. By noting the term "ALTERNATE" shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.
7. Where a single manufacturer is mentioned by trade name or manufacturer's name in addition to listing acceptable substitute manufacturers, it has been previously determined that, although the equipment by these manufacturers may include some philosophical design differences from that specified their overall design philosophy and equipment quality are acceptable for the intended application.
8. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of equipment or devices of a particular manufacturer whether indicated or not. If any item of equipment or device is offered in substitution which differs substantially in dimension or configuration from that indicated on the Drawings or specifications, provide as part of the submittal ¼ inch equals 1 foot scaled drawings showing that the substitute can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.
9. Where substitute equipment or devices requiring different arrangement or connections from that indicated is accepted by the Architect/Engineer, install the equipment or devices to operate properly and in harmony with the intent of the Contract Documents, making all incidental changes in piping, ductwork or wiring resulting from the equipment or device selection without any additional cost to the Owner. The Contractor shall pay all additional costs incurred by other portions of the work in connection with the substituted equipment or device.
10. The Architect/Engineer reserves the right to call for samples of any item of material, equipment or device offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.
11. When any request for a substitution of material, equipment or device is submitted and rejected, the item named in the Contract Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

D. SAMPLES:
1. When requested by the Architect/Engineer, promptly provide samples of items scheduled to be exposed in the final structure.
2. When specifically so requested by the Contractor and approved by the Architect/Engineer, approved samples will be returned to the Contractor for installation on the Work.

E. RECORD DRAWINGS:

1. Comply with provisions of Division 1.
2. Include a copy of the Record Drawings and Shop Drawings in each copy of the operation and maintenance manual described below.

F. MANUAL:

1. Upon completion of this portion of the Work, and as a Condition of its acceptance, deliver the operation and maintenance manual to the Architect compiled in accordance with the provisions of Division 1 of these specifications. Include within each manual.
   a. Copy of the approved Record Shop Documents for this portion of the Work.
   b. Copy of each circuit directory.
   c. Copy of Testing and Commissioning worksheets indicating parameters.
   d. Copy of each warranty and guaranty.
   e. Copy of Training Manuals for complex equipment.

1.6 PRODUCT HANDLING:

A. Comply with pertinent provisions of Division 1. Provide all offloading, logging, verification of conditions and setting of equipment as directed by the manufacturer.

B. Contractor shall provide the Owner all equipment Training Manuals and any associated software provided by the manufacturer upon receiving products.

1.7 GUARANTEE:

A. The Contractor guarantees all Work against any defects due to faulty workmanship or material and that all raceways, ducts and piping are free from foreign material, obstructions, holes or breaks of any nature.

B. Upon written notice from the Architect or Owner, the Contractor shall promptly remedy without cost to the Owner any defects occurring within a period of one (1) year from the date of final acceptance.

1.8 WARRANTY:

A. The Contractor shall properly execute in the Owner's name all Manufacturers' standard warranty certificates applying to equipment installed on the project and shall deliver said certificates to the Architect at completion of the job. All warranty cards shall also be properly executed and delivered to the supplier or Manufacturer's representative for Manufacturer's records. Standard warranties for equipment shall be not less than one (1) year.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS AND METHODS

A. Provide only materials that are new and of the type and quality specified. Where Underwriter's Laboratories, Inc. have established standards for such materials, provide only materials bearing the UL label and marked for intended location and application.

B. All terminals and enclosures shall be marked for 75° C operation or conductor size shall be increased as required at no cost to the Owner.

C. Firestopping material shall be 3M Fire Seal Caulking, or approved substitute.

D. Terminals and enclosures shall be marked for 75° C operation or conductor size shall be increased as required at no cost to the Owner.

E. Steel Pipe Wall Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends. Comply with NECA 1.

F. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work and roof manufacturer’s requirements.

G. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

H. Provide sleeves and chases where conduits pass through rated floors and walls, fire stopped in accordance with UL Listed assembly.

I. When boring, cutting or drilling structural wood or wall members, drill only in locations as approved by the Owner.

J. Immediately prior to final inspection, the Contractor shall make a final cleanup of dirt and refuse resulting from his Work and shall assist in keeping the premises clean at all times.

K. Immediately prior to final inspection, the Contractor shall clean all material and equipment installed under this Contract. Dirt, dust, plaster, stains and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched up and restored to their original Condition.

L. Mechanism of all equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required to produce the intended performance.

M. Service voltage and color codes for 480Y/277V: Phase A - Brown, Phase B - Orange, Phase C – Yellow, Neutral – White, and Ground - Green.

N. Service voltage and color codes for 208/120V: Phase A - Black, Phase B - Red, Phase C – Blue, Neutral – White, and Ground - Green.

2.2 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

A. Section Includes:
   1. Copper building wire rated 600 V or less.
   2. Metal-clad cable, Type MC, rated 600 V or less.
   3. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:
   1. Section 260400 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
   2. Section 270400 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

C. Submittals:
   1. Product Data: For each type of product.
   2. Product Schedule: Indicate type, use, location, and termination locations.

D. Copper Building Wire: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

E. Basis-of-Design Product: Subject to compliance with requirements, provide Southwire Company or comparable product by one of the following:
   1. Alpha Wire Company.
   2. Cerro Wire LLC.
   3. Encore Wire Corporation.
   4. General Cable Technologies Corporation.
   5. Southwire Company.

F. Standards:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
   2. RoHS compliant.
   3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

G. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

H. Conductor Insulation:
   1. Type NM: Comply with UL 83 and UL 719.
   2. Type RHH and Type RHW-2: Comply with UL 44.
   3. Type USE-2 and Type SE: Comply with UL 854.
   4. Type THHN and Type THWN-2: Comply with UL 83.
   5. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
   6. Type XHHW-2: Comply with UL 44.

2.3 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Circuits:

1. Single circuit.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Ground Conductor: Bare.

F. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

G. Armor: Steel, interlocked.

H. Jacket: PVC applied over armor.

I. Connectors and Splices: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and UL Listed and marked for intended location and use.

2.4 GROUNDING AND BONDING FOR ELECTRICAL SYSTEM

A. Submittals:
1. Product Data: For each type of product.
2. Product Schedule: Indicate type, use, location, and termination locations.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.

3. TE Connectivity Ltd.
4. ILSCO.
5. O-Z/Gedney; a brand of Emerson Industrial Automation.

C. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

D. Bare Copper Conductors:
1. Stranded Conductors: ASTM B 8.
2. Tinned Conductors: ASTM B 33.
3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

E. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

F. Connectors: Listed and labeled by an NRTL as complying with NFPA 70, acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 467.
1. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
2. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
3. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
4. Cable-to-Cable Connectors: Compression type, copper or electroplated tinned copper, C and H shaped.
5. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
6. Conduit Hubs: Mechanical type, terminal with threaded hub.
7. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
8. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
9. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
10. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.
11. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
12. Water Pipe Clamps: Tin-plated aluminum or Silicon Bronze. Mechanical type, two pieces with zinc-plated bolts.

G. Make ground rods accessible for inspection and testing.

H. Ground Rods: Copper-clad steel, sectional type; 5/8 by 96 inches.

I. Bond all water piping systems per local codes. Do not bond to gas piping systems within the building.

2.5 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allied Tube & Conduit; a part of Atkore International.
      b. B-line, an Eaton business.
      c. Thomas & Betts Corporation; A Member of the ABB Group; Metal Framing Channels.
      d. Unistrut; Part of Atkore International.
   2. Material: Pre-galvanized steel.
   3. Channel Width: 1-5/8 inches.
   4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4 for interior non-wet locations.
   6. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel, Stainless Steel and malleable-iron hangers, clamps, and associated fittings, designed for environment, types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hilti, Inc.
2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) B-line, an Eaton business.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti, Inc.
      4) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

G. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter. Wire-ties and zip-ties shall not be an acceptable means of support to structure(s).

H. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

I. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

J. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and

junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

K. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

L. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2.6 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

A. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.

B. Raceways and Fittings:
1. Steel Electrical Intermediate Metal Conduit (IMC) - UL 1242 and UL Category Control Number DYBY: Exterior - Zinc coated; Interior - Zinc with organic top coated. Fittings: Steel, compression coupling.
2. Steel Electrical Metal Tubing (EMT) and Elbows: UL 797 and UL Category Control Number FJMX: Exterior - Zinc coated; Interior - Zinc with organic top coated. Fittings: Steel, compression coupling.
3. Aluminum Electrical Metal Tubing (EMT) and Elbows: UL 797A and UL Category Control Number FJMX: Exterior - Zinc coated; Interior - Zinc with organic top coated. Fittings: Steel, compression coupling.
4. Flexible Metal Conduit (FMC): Steel_Aluminum. UL 1 and UL Category Control Number DXUZ. Fitting: UL 514B and UL Category Control Number ILNR.
5. Liquidtight Flexible Metal Conduit (LFMC): Steel_Aluminum. UL 360 and UL Category Control Number DXHR. UL 514B and UL Category Control Number DXAS.
6. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings: UL 651 and UL Category Control Number DZYR. For use with maximum 90 deg C wire.
7. Minimum raceway size: 3/4” raceway for power circuits and 1” raceways for low-voltage communication cable raceways.

C. Surface mounted raceways: Wiremold or Owner approved equal, steel 500 or 700 Series with matching surface mount box and mounting accessories. Color as directed by Owner. EMT conduit is not an allowable method for surface raceways. Submit to Owner prior to installation.

D. Steel Tele-Power Poles: Legrand Wiremold ALTP-2S or architect approved equal - Satin anodized extruded aluminum pole. Nominal material thickness .060'' (1.5mm). Length: 10'5'' (3.2m). Two compartments (power and communication channels). Factory wired with four 15A125V NEMA5-15R devices. Provided with one 1/2'' (12.7mm) trade size KO in cover at base for communications. T-bar mounting hardware, ceiling trim kit,

and feed box furnished. NOTE: There is no method provided for mounting data in this pole. Provide poles with data outlet or cabling capabilities.

E. Boxes, Enclosures and Cabinets:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crouse-Hinds, an Eaton business.
      b. Hubbell Incorporated.
      c. RACO; Hubbell.
      d. Thomas & Betts Corporation; A Member of the ABB Group.
      e. Wiremold / Legrand.
   2. General Requirements for Boxes, Enclosures, and Cabinets: Comply with NFPA 70 for intended location and use. UL 514A and UL CCN QCIT.
   3. Wireways and Auxiliary Gutters:
      a. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system. Manufacturer's standard enamel finish.
      b. Wireway Covers: Hinged, Screw-cover and Flanged-gasketed as indicated in drawings.
   4. Metallic Outlet, Device Boxes, Rings, Covers and Conduit Bodies:
      a. Description: 4" square outlet box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
      b. Material: Sheet steel and Cast metal.
      c. Sheet Metal Depth: 2-1/8" deep minimum to accommodate 1” knockout.
      d. Cast-Metal Depth: 2.4 inch deep.
      e. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing 50 lb.
      f. Paddle Fan and Large Luminaire Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb.
      g. Conduit Bodies: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point.
   5. Metallic Floor Boxes and Floor Box Covers: RFB4 series with (4) independent compartments, stamped steel, and shallow steel for concrete 2 7/16" depths accepting 3/4" and 1" conduit.
      a. Coverplates shall be scrub-proof with carpet in-lay and easy open handle. Activate all compartments with specified and approved wiring devices.
   6. Nonmetallic Outlet, Conduit Bodies and Device Boxes: UL 514C and UL CCN QCMZ.

F. Termination Boxes: UL 1773 and UL Category Control Number XCKT.
   1. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.

2. Listed and labeled for installation on line or load side of service equipment.

G. Cabinets, Cutout Boxes, Junction Boxes and Pull Boxes: UL 50 and 50E.
   1. Sheet Metal Cabinets:
      a. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung. UL Category Control Number CYIV.
   2. Sheet Metal Cutout Boxes:
      a. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
   3. Sheet Metal, Cast-Metal, and Polymeric Junction and Pull Boxes:
      a. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable. UL Category Control Number BGUZ.

H. Cover Plates for Devices Boxes: UL 514D and UL Category Control Numbers QCIT and QCMZ.
   1. Wallplate-Securing Screws: Metal with head color to match wallplate finish.
   2. Cover Plates for Device Boxes:
      a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
      b. Metallic Wallplate Material: 0.032-inch-thick Type 302/304 non-magnetic stainless steel with brushed finish.
      c. Nonmetallic Wallplate Material: 0.060 inch thick high-impact thermoplastic (nylon) with smooth finish and color matching wiring device.
      d. Color: As indicated on architectural drawings or selected by Owner/Architect.
   3. Hoods for Outlet Boxes:
      a. Reference Standards:
         1) UL 514D and UL Category Control Numbers QCIT and QCMZ.
         2) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
      b. Mounts to box using fasteners different from wiring device.
   4. provide galvanized code-gauge sheet steel units with screwed-on covers, of size and shape required to accommodate wires without crowding, and to suit the location. Mark with permanent ink circuit designations on cover plate. If box is to be painted provide permanent ink marking on inside of box cover.
   5. For exterior pull boxes, provide fiberglass quazite box with sealed lid identified “ELECTRICAL” at size required to accommodate wires at 40% fill.
   6. Provide sleeves and chases where conduits pass through floors and walls, fire-stopped in accordance with NEC Article 300.21.
   7. For switches and receptacles, provide standard ganged switch boxes with plastic or stainless-steel covers as required by Architect; except for exposed Work, provide pressed steel boxes with galvanized or cadmium plated steel covers.

a. For telephone/communication outlets, provide 4" square boxes with single device cover. Route conduit to accessible ceiling cavity with end bushings and nylon pullstring.

I. Junction boxes may not be installed back-to-back in walls and partitions. Consult with Owner for proper separation of boxes (typically, 12" in non-rated walls, 24" in rated walls).

J. Securely and rigidly support boxes to super structure throughout the Work.

2.7 SLEEVE-SEAL SYSTEMS FOR ELECTRICAL RACEWAYS

A. Wall Sleeves:
1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

A. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

B. Sleeves for Rectangular Openings:
1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

C. SLEEVE-SEAL SYSTEMS
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

D. SLEEVE-SEAL FITTINGS
1. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1) HOLDRITE.
   2) Presealed Systems.

E. GROUT
1. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000-psi, 28-day compressive strength.

F. SILICONE SEALANTS
1. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
   a. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. A Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

2.8 LIGHTING CONTROL DEVICES:

A. Occupancy Sensors and Presence Detection:
1. Ceiling mounted in Large Area: Greengate VAC-DT-2000-R Model, MicroSet Dual Tech Low Voltage Vacancy Ceiling Sensor with power pack SP200-RD4.
2. Ceiling mounted in Small Area/Restrooms: Greengate OAC-DT-1000-MV Model, MicroSet Dual Tech Line Voltage Ceiling Sensor.
3. Power Packs to control sensors: Greengate SP200-RD4 Heavy-Duty Switchpack.
4. Manufacturer part numbers change and must be verified prior to work. Equal products - Engineer approved per submittals or requested within 10-days of bid.

B. SWITCHBOX-MOUNTED OCCUPANCY SENSORS

C. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
4. Switch Rating: Not less than 800-VA ballast or LED load at 120 V, 1200-VA ballast or LED load at 277 V, and 800-W incandescent.

D. Wall-Switch Sensor Tag WS:

1. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft..
2. Sensing Technology: PIR.
3. Switch Type: SP, field-selectable automatic "on," or manual "on," automatic "off."
4. Capable of controlling load in three-way application.
5. Voltage: Match the circuit voltage.
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
10. Color: White.
11. Faceplate: Color matched to switch.

E. Wall Dimmers:
   1. Greengate WBSD-010DEC – Decorator 0-10V, Locations may vary, final by Owner.

F. Photocells: Integral with egress exterior fixtures.

G. Provide and install time clocks for automatic operation of lighting and equipment loads in accordance with the Time Clock Schedule shown on the Drawings, and as follows:
   1. Equipment Control:
      a. Tork W-220-L, SPST, reserve power, 40 AMP contacts, NEMA 1 surface mounted enclosure.
      b. Lighting Control:
         1) Tork 7200ZL, DPST, reserve power, 40 AMP contacts, astronomic dial, NEMA 1 surface mounted enclosure.
      c. Photocell:
         1) Tork 2101, SPST, 2000 Watt rating, 120 Volt.

2.9 WIRING DEVICES

A. SUBMITTALS

B. Product Data: For each type of product.

C. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

E. GENERAL WIRING-DEVICE REQUIREMENTS

F. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Provide ARC Fault circuit interrupter at required areas.

G. Comply with NFPA 70.

H. Devices for Owner-Furnished Equipment:
   1. Receptacles: Match plug configurations.

I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

J. STRAIGHT-BLADE RECEPTACLES
   1. Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Incorporated; Wiring Device-Kellems; BR20 or comparable product by one of the following:
         1) Eaton (Arrow Hart).
         2) Leviton Manufacturing Co., Inc.
         3) Pass & Seymour/Legrand (Pass & Seymour).
   2. Industrial Heavy Duty, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement SD, and FS W-C-596.
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Incorporated; Wiring Device-Kellems; HBL8300H or comparable product by one of the following:
         1) Eaton (Arrow Hart).
         2) Leviton Manufacturing Co., Inc.
         3) Pass & Seymour/Legrand (Pass & Seymour).

K. GFCI RECEPTACLES
   1. General Description:
      a. 125 V, 20 A, straight blade, 20 A feed-through type.
      b. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
      c. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
      d. Self-testing technology with indicators including disconnecting power if damaged.
      e. Provide ARC Fault circuit interrupter at required areas.
   2. Duplex GFCI Convenience Receptacles:
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Incorporated; Wiring Device-Kellems GFST20 or comparable product by one of the following:
         1) Eaton (Arrow Hart).

2) Leviton Manufacturing Co., Inc.
3) Pass & Seymour/Legrand (Pass & Seymour).

L. Tamper-Resistant Duplex Straight-Blade Receptacle: 125 V, 20 A: Comply with NFPA 70, Heavy-duty NEMA 5-20R, UL CCN RTRT and UL 498, and FS W-C-596. For all patient care areas.

M. Tamper-Resistant Duplex Straight-Blade Receptacle with USB Outlet to Power Class 2 Equipment: 125 V, 20 A: Comply with NFPA 70, Heavy-duty NEMA 5-20R, UL CCN RTRT and UL 498, and FS W-C-596.

N. TWIST-LOCKING RECEPTACLES
1. Twist-Lock, Single Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1) Hubbell Incorporated; Wiring Device-Kellems; HBL2310.
2) Leviton Manufacturing Co., Inc; 2310.
3) Pass & Seymour/Legrand (Pass & Seymour); L520-R.

O. SERVICE POLES - Description:

1. Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
2. Poles: Nominal 2.5-inch-square cross section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
3. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
4. Finishes: Satin-anodized aluminum.
5. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, four-pair, Category 6 voice and data communication cables.
6. Power Receptacles: Two duplex, 20-A, straight-blade receptacles complying with requirements in this Section.
7. Data Communication Outlets: Four RJ-45 jacks complying with requirements in Section 271513 "Communications Copper Horizontal Cabling."

P. TOGGLE SWITCHES

Q. Comply with NEMA WD 1, UL 20, and FS W-S-896.

R. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Single Pole:

1) Cooper; AH1221.
2) Hubbell; HBL1221.
3) Leviton; 1221-2.
4) Pass & Seymour; CSB20AC1.

b. Two Pole:

1) Cooper; AH1222.
2) Hubbell; HBL1222.
3) Leviton; 1222-2.
4) Pass & Seymour; CSB20AC2.

c. Three Way:

1) Cooper; AH1223.
2) Hubbell; HBL1223.
3) Leviton; 1223-2.
4) Pass & Seymour; CSB20AC3.

d. Four Way:

1) Cooper; AH1224.
2) Hubbell; HBL1224.
3) Leviton; 1224-2.
4) Pass & Seymour; CSB20AC4.

S. WALL PLATES

T. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: [Steel with white baked enamel, suitable for field painting] [Smooth, high-impact thermoplastic] [0.035-inch-thick, satin-finished, Type 302 stainless steel] [0.04-inch-thick, brushed brass with factory polymer finish] [0.05-inch-thick, anodized aluminum] [0.04-inch-thick steel with chrome-plated finish].
3. Material for Unfinished Spaces: [Galvanized steel] [Smooth, high-impact thermoplastic].
4. Material for Damp Locations: [Thermoplastic] [Cast aluminum] with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

U. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant[, die-cast aluminum] [thermoplastic] with lockable cover.

V. FINISHES

W. Device Color:
1. Wiring Devices Connected to Normal Power System: [Almond] [Black] [Brown] [Gray] [Ivory] [White] [As selected by Architect] <Insert color> unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: [Red] <Insert color>.
3. SPD Devices: Blue.

4. Isolated-Ground Receptacles: [Orange] [As specified above, with orange triangle on face].

X. Wall Plate Color: For plastic covers, match device color.

2.10 FUSES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bussmann, an Eaton business.
2. Edison; a brand of Bussmann by Eaton.
3. Littelfuse, Inc

B. CARTRIDGE FUSES
1. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
   a. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
   b. Type RK-5: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
   c. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, fast acting, time delay.
   d. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Comply with NEMA FU 1 for cartridge fuses.
4. Comply with NFPA 70.
5. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.11 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

A. Shop Drawings: For enclosed switches and circuit breakers.
1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Two year(s) from date of Substantial Completion.

C. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

F. Comply with NFPA 70.

G. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

H. Enclosure Finish: The enclosure shall be [finished with] [gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1)] [gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (NEMA 250 Types 3R, 12)] [a brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel)] [copper-free cast aluminum alloy (NEMA 250 Types 7, 9)].

I. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

J. FUSIBLE SWITCHES
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eaton.
      b. General Electric Company.
      c. Square D; by Schneider Electric.
   2. Type HD, Heavy Duty:
      a. Single throw.
      b. Three pole.
      c. [240] [600]-V ac.
      d. [1200 A and smaller] [200 A and smaller].
      e. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
      f. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
   3. Accessories:
      a. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
      b. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
      c. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
      d. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
      e. Service-Rated Switches: Labeled for use as service equipment.

K. NONFUSIBLE SWITCHES
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eaton.

b. General Electric Company.
c. Square D; by Schneider Electric.

2. Type GD, General Duty, Three Pole, Single Throw, 240-V ac, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
3. Type HD, Heavy Duty, Three Pole, Single Throw, [240] [600]-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
4. Accessories:
   a. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   b. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   c. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
   d. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
   e. Service-Rated Switches: Labeled for use as service equipment.

L. DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

M. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long and short time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. MCCB Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
f. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."

2.12 INTERIOR LED LIGHTING

A. SUBMITTALS

1. Product Data: For each type of product, arranged by designation.
   a. Include highlighted rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
   b. Photometric calculations on floorplans indicating footcandle values for luminaires requesting substitution or deviations.
2. Shop Drawings: For non-standard or custom luminaires.
   a. Indicate dimensions, weights, loads, required clearances, method of assembly, components, location and size of field connections.
   b. Diagrams for power, signal and control wiring.
   c. Photometric calculations on floorplans indicating footcandle values for luminaires requesting substitution or deviations.
3. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

B. LED TROFFER MANUFACTURERS

1. Pre-Approved Manufacturers Listed: Products of firms regularly engaged in the manufacture of recessed LED lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years. The manufacturer of the lighting fixtures shall comply with the provisions of the appropriate code and standards. All fixtures shall be pretested before shipping. Provisions for a single fixture shipped to the project site shall become property of the Owner to test and evaluate the construction meets or exceeds the original fixture approved by the Owner and listed in the fixture schedule.
2. Conformance: Fixtures shall be manufactured in strict accordance with the Contract Drawings and Specifications.
3. Codes: Materials and installation shall be in accordance with the latest revision of the National Electrical Code and any applicable Federal, State, and local codes and regulations.
4. UL or CSA US Listing: All fixtures shall be manufactured in strict accordance with the appropriate and current requirements of the “Standards for Safety" to UL 8750 or others as they may be applicable. A listing shall be provided for each fixture type, and the appropriate label or labels shall be affixed to each fixture in a position concealing it from normal view.

5. Luminaire Flat Panel Edge Lit shall be DLC Premium Certified (Design Lights Consortium).
6. Specifications and scale drawings are intended to convey the salient features, function and character of the fixtures only, and do not undertake to illustrate or set forth every item or detail necessary for the work.
7. Base Bid Manufacturers: Are listed on fixture schedule and specification. Manufacturers listed without accompanying catalog numbers are responsible for meeting the quality standards and photometric distribution set by the specified product.
8. Alternate Manufacturers: Identification by means of manufacturers names and catalog numbers is to establish basic features, quality and performance standards. Any substitutions must meet or exceed these standards. The three listed manufacturers are pre-approved Owner's standard fixtures and substitution request may not be allowed prior to bid.

C. LED LUMINAIRE SOURCE REQUIREMENTS
1. LED's shall be manufactured by, Nichia, Cree, Samsung or Osram.
2. Lumen Output – minimum initial lumen output of the luminaire shall be as follows for the lumens exiting the luminaire in the 0-90-degree zone - as measured by IESNA Standard LM-79-08 in an accredited lab. Exact tested lumen output shall be clearly noted on the shop drawings.
   a. Type 2x4: 40-Watt, Efficacy (lm/W) >123 @ 4000K for ceilings up to 10'-0".
   b. Type 2x4: 48-Watt, Efficacy (lm/W) >124 @ 4000K for ceilings 10'-1" to 12'-0".
   c. Type 2x2: 30-Watt, Efficacy (lm/W) >121 @ 4000K for ceilings up to 10'-0".
   d. Type 2x2: 40-Watt, Efficacy (lm/W) >119 @ 4000K for ceilings 10'-1" to 12'-0".
   e. 4-Ft Strip: 45-Watt, Efficacy (lm/W) >128 @ 4000K.
3. Recessed Fixtures: Comply with NEMA LE 4.
4. Rated lamp life of 50,000 hours. Lumen output shall not decrease by more than 20% over the minimum operational life of 50,000 hours.
5. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
6. LED Boards shall be suitable for field maintenance or replacement with plug-in connectors at power supply/drive.
7. Light Color/Quality:
   a. Correlated Color temperature (CCT) range as per specification, luminaire sources and 5000K shall be correlated to chromaticity as defined by the absolute (X, Y) coordinates on the 2- D CIE chromaticity chart.
   b. The color rendition index (CRI) shall be 82 or greater.
   c. Chromaticity shift over 6,000 hours shall be <0.007 change in delta-u'v' average as demonstrated data set in IESNA LM-80-08 report.
   d. Lumen Maintenance Factor: >0.84 at 25°C, 50,000 hours and reported in TM-21 L70 Lifetime >60,000 hours.
   e. Binning: Per ANSI, 3-step MacAdam ellipse with abilities to produce uniform color across copious quantities of fixtures.

D. LED LUMINAIRE POWER SUPPLY AND DRIVE REQUIREMENTS

1. Driver: Instant start. 120 – 277 Volt, UL Listed, CSA Certified, Sound Rated A+. Driver shall be > 80% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.
    a. Flat Panel Edge-lit LED: The electronics/power supply enclosure shall be external to the SSL luminaire and be accessible per UL requirements.
2. Dimming: Driver shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100% to 5% of rated lumen output with a smooth shut off function. Dimming shall be controlled by a 0-10V signal. Signal wires shall be 22 AWG solid copper minimum.
3. Compatible with Leviton dimming device(s): DS710-10Z or equal.
4. Electrical Characteristics:
    a. Power Factor: >0.93.
    b. Input Power: 120-277V, 50/60 Hz.
    c. Total Harmonic Distortion (THD): <20%.
    d. The surge protection which resides within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 2002 for Location Category A, where failure does not mean a momentary loss of light during the transient event.
5. Material Usage: Drivers shall be (ROHS)-compliant.

E. LED EDGE-LIT FLAT PANEL CONSTRUCTION

1. Frame: LED strips mounted on edges enclosed in solid extruded aluminum frame, painted after formed with UV-stabilized acrylic optical lens with a full aluminum back. Construction seals conditioned air from the plenum or non-conditioned air. Housing shall be designed rigid to eliminate warping or bending for level installation. Frame corners conformed for seamless appearance.
2. Optical Lens/Diffusers:
    a. Acrylic: One hundred percent virgin UV-stabilized acrylic (PMMA) optical panel, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply) and integral controls as per this specification.
4. Each luminaire shall be designed to operate at an average operating temperature -4°F to 104°F.
5. Humidity: 20% – 85% RH, Lighting Facts.
6. Luminaire housing to have no visible welding, screws, springs, hooks, rivets, bare LED’s or plastic supports in viewing angles at floor to ceiling placement.
7. The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply and circuit board for the luminaire shall be fundamental to the unit.
8. Driver disconnect shall be provided where required to comply with codes.
9. Finish: Polyester white powder coat painted with 92% high-reflective paint after fabrication.

10. Integral Grid Clips required on recessed mounted luminaires along with integral tie wire mounting points. Compatible with standard 15/16” and 9/16” T-Bar ceilings.
11. Luminaire to have air removal capability where specified.

F. LED LUMINAIRE CONSTRUCTION (KITCHENS)
1. Construction:
   a. Shallow 3-1/4” deep extruded aluminum housing with internal high angled distribution.
   b. Injection molded composite end plates securely attached with screws without gaps.
   c. Four suspension mounted points.
   d. Durable frame with high reflectance baked enamel finish.
2. Optics/Shielding: High optical grade acrylic lens.
3. Electrical System: Integral, high-efficiency driver. 120-277V 50/60 Hz. 0.9 Power Factor at full load. <20% THD at full load. Operating temperature -40°F - +104°F.
4. Efficacy: Less than 10’ ceiling heights (LPW): >125 at 43W. Greater than 10’ ceiling heights (LPW): >147 at 57W.
5. Color Temperature: 5000K minimum.
6. CRI: 80.
7. Options: Provide Wet Location/Wipe Down where located in dishwasher areas with hose-bibb.

G. LED SUSPENDED DIRECT/INDIRECT LUMINAIRE CONSTRUCTION
1. Frame: Housing is one piece die-formed cold rolled steel, forming 9”x2-1/2” curved profile. Modular 4’-0” and 8’-0” sections combined for continuous runs. Standard straight and optional beveled endcaps, die-cast aluminum mechanically attached without exposed fasteners.
2. Optics/Shielding: Precision formed optical assembly with One hundred percent virgin UV-stabilized acrylic (PMMA) optical panel, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation for direct/indirect optical distributions.
3. Direct/Indirect LED Source: Field replaceable LED sources for maintaining minimum 61% downlight, 39% up-light.
4. Efficacy (LPW): >101 Lumens at 46W.
5. Color Temperature: 4000K minimum.
6. CRI: <85.

H. LED LUMINAIRE SUPPORT COMPONENTS
1. Comply with requirements in Section 260400 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
2. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
3. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
4. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

5. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.
6. Drywall Grid Adapter: Provide adapter frame for recessed fixture installation into drywall ceilings.
7. Surface or cable mounting capabilities with accessory kits.
8. Pendant Kits: Joiners to accept stems, single aircraft cable and power cords with optional design types.

I. DOWNLIGHTING

1. Compact and efficient shallow recessed remodel housing optimized and listed for EISA compliant LED lamps.
    a. Housing:
        1) Single wall die-formed shallow aluminum housing.
        2) Interlocking collar to maintain aperture geometry.
        3) Integral air-tight gasket between fixture and finished ceilings.
        4) Removable from plaster frame to provide access.
        5) Suitable for light commercial shallow ceiling applications. For installation in insulated ceilings and non-insulated ceilings with airtight code compliant construction.
        6) Available with a variety of trims and finishes.
    b. Socket Plate:
        1) Rigid socket plate adjusts to locks without tools for lamp sizes indicated.
        2) Removeable socket plate and bracket for trims.
    c. Plaster Frame:
        1) Galvanized steel frame. Housing adjust to 3/8” to 1” ceiling thickness.
        2) (2) regressed locking screws for securing hangar bars.
        3) Integral air-tight gasket housing.
    d. Socket:
        1) Porcelain socket with nickel plated brass screws shell.
        2) Snap-on springs secure socket in plate, and detachable when using trims.
    e. Compliance:
        1) cULus Listed Damp Location.
        2) cULus Listed for Wet Location, covered ceiling, with select trims.
        3) cULus Listed for direct contact with insulation and combustible material other than spray foam insulation.
        4) Air-Tite code compliant. Certified under ASTM E283; not exceeding 2.0 cfm (0.944 L/s) air leakage rate tested at a 1.57 psf (75 Pa) pressure differential.
        5) RoHS compliant.
        6) Ligature acceptable or high-abuse listings in patient areas only.
    f. Lamp: Cree or Satco LED luminaire.

J. EXIT SIGNS

1. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction. Ligature acceptable or high-abuse listings in patient areas only.
2. INTERNALLY LIGHTED SIGNS:
3. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
4. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
    g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
5. Master/Remote Sign Configurations:
    a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
    b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

K. EMERGENCY LIGHTING UNITS
1. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
    a. Battery: Sealed, maintenance-free, lead-acid type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
g. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
h. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red

2.13 SURGE PROTECTION FOR ELECTRICAL POWER CIRCUITS

A. SUBMITTALS
1. Product Data: For each type of product.
a. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
b. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.
2. Operation and maintenance data.
3. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
a. Warranty Period: Five years from date of Substantial Completion.

B. GENERAL SPD REQUIREMENTS
1. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NFPA 70.
3. Comply with UL 1449.
4. MCOV of the SPD shall be the nominal system voltage.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advanced Protection Technologies Inc. (APT).
2. Current Technology Inc.
3. Eaton.
4. Northern Technologies, Inc.
5. Square D; by Schneider Electric.
6. SSI, an Ilsco Company.

D. SERVICE ENTRANCE AND TRANSFER SWITCH SUPPRESSOR
1. SPDs: Comply with UL 1449.

a. Type 1 for service equipment where the device is ahead of the service disconnect.
b. Type 2 for panelboards on the load side of the service disconnect.
c. SPDs with the following features and accessories:
1) Integral disconnect switch.
2) Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3) Indicator light display for protection status.
4) Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
5) Surge counter.

E. PANEL SUPPRESSORS
1. SPDs: Comply with UL 1449.
a. Type 1 for service equipment where the device is ahead of the service disconnect.
b. Type 2 for panelboards on the load side of the service disconnect.
c. Include LED indicator lights for power and protection status.
d. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

F. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

G. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:
1. Line to Neutral: 1200 V for 480Y/277 V.
2. Line to Ground: 1200 V for 480Y/277 V.
3. Line to Line: 2000 V for 480Y/277 V.

H. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
1. Line to Neutral: 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 208Y/120 V.
3. Line to Line: 1000 V for 208Y/120 V.

I. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:
1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Neutral to Ground: 700 V.
4. Line to Line: 1200 V.

J. SCCR: Equal or exceed 200 kA.

K. Inominal Rating: 20 kA.

L. ENCLOSURES
1. Indoor Enclosures: NEMA 250, Type 1.
2. Outdoor Enclosures: NEMA 250, Type 3R.

2.14 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect/Engineer.

B. Provide required equipment interlocking were 110 voltages provide a complete operable system for all Work by other Trades and coordinate requirements prior to final rough-in. These systems include, but shall not be limited to:
1. Wiring and supply of control transformers for other control systems stepped down from 110 volts. Coordinate with Division's 13 and 15.

PART 3 - EXECUTION

3.1 ELECTRICAL SITE COORDINATION AND PREPARATION

A. Examine the areas and the Conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of this work. Do not proceed until unsatisfactory conditions are corrected.

B. Coordinate with local utility company temporary and permanent power requirements for the project. Provide a request for all utilities to be located and marked at project site prior to the start of Work. Prepare site easements for saw-cutting, trenching and backfill. Coordinate power outages with Owner and utility company 10-days prior to outage.

C. Coordination with Division Trades:
1. Coordinate as necessary with other trades to assure proper and adequate provision in this Work of those trades for interface with the Work of this Section.
2. Coordinate the installation of electrical items with the schedule for Work of other trades to prevent unnecessary delays in the total Work.
3. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear the encroachment.
4. Provide 110-volt temperature control, control transformers in enclosures and interlock wiring. Coordinate all requirements with mechanical contractor prior to rough-in and installation.
5. Provide weatherproof ground-fault receptacles within 25'-0" of devices and equipment to be readily-accessible for maintenance.

D. Coordinate arrangement, mounting and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. Provide for ease of disconnecting the equipment with minimum interference to other equipment installations.
   3. Allow right-of-way for piping and conduit installed at required slope.
   4. Connecting raceways, cables, wireways, cable trays and busways to be clear of obstructions and allow working clearances of other equipment.

E. Where outlets are not specifically located on the Drawings, locate as determined in the field by the Architect. Where outlets are installed without such specific direction, relocate as directed by the Architect and at no additional cost to the Owner.

F. The Electrical Drawings are diagrammatic but are required to be followed as closely as actual construction and Work of other trades will permit. Where deviations are required to conform with actual construction and the Work of other trades, make such deviations without additional cost to the Owner.

3.2 INSTALLATION OF LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

A. Conductor Material Applications:
   1. Feeders: Copper for feeders smaller than No. 250 MCM; copper or aluminum for feeders No. 250 MCM and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Adjust raceway sizes accordingly where use of aluminum material is allowed.
   2. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
   3. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

B. Conductor Insulation and Multiconductor Cable Applications and Wiring Methods:
   1. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
   2. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
   3. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.
   4. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
   5. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
   6. Branch Circuits Concealed in Millwork and Wall Partitions: Metal-clad cable, Type MC.
   7. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

C. Installation of Conductors and Cables:
   1. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
   2. Complete raceway installation between conductor and cable termination points according to Section 260400 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

3. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
4. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
5. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
6. Support cables according to Section 260400 "Hangers and Supports for Electrical Systems."

D. Connections:
1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
2. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

E. Identification: Identify and color-code conductors and cables according to NFPA 70. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

G. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260400 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

H. Other Requirements:
1. Conductors No. 4 and larger, provide insulating bushings or insulating sleeves.
2. Provide barriers in boxes where different voltages and conductor insulation exist.
3. Install control wiring for equipment or as required by other Division Trade Work.
4. Tape all joints with rubber tape 1-1/2 times the thickness of the conductor insulation, then cover with a minimum of two half-lapped layers of Scotch Brand No. 33 vinyl-plastic electrical tape.
5. Provide expansion fittings in conduits which are non-continuous and exposed to the weather.

I. Wire Sizes:
1. Increase wire sizes and raceway to next largest AWG size for: (Size shown of 60% load, increase as required for larger loading)
   a. 120 volt circuits exceeding 150 feet in circuit length.
   b. 208 volt circuits exceeding 250 feet in circuit length.
2. Wire sizes shall be increased for the above conditions whether indicated on the Drawings.

J. Use identified (white) neutrals and colored-coded phase wires for all branch circuit wiring.

1. Make splices electrically and mechanically secure with pressure-type ILSCO Snapblock connectors, or LSI lugs to make splices electrically and mechanically secure. Soldering is not permitted for grounding equipment.
    a. For wires size 6 AWG and smaller, provide "Scotch-lock" connectors.
    b. For wires size 4 AWG and larger, provide Burndy "Versitaps" and heavy-duty connectors, or T&B "lock-tite" connectors.

3.3 INSTALLATION OF GROUNDING SYSTEMS

A. Coordinate existing conditions and wiring configurations to assure proper grounding systems are installed per NEC Art. 250. Where existing system grounding means are not known or clearly identifiable, contact Owner to provide as-built documents prior to start of Work.

B. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

C. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
    1. Bury at least 24 inches below grade.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
    1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
    2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:
    1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
    2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
    3. Connections to Ground Rods at Test Wells: Bolted connectors.
    4. Connections to Structural Steel: Welded connectors.

F. Grounding at The Service: Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

G. Grounding Separately Derived Systems: Generator - Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

H. Comply with IEEE C2 grounding requirements.

I. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0

AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

J. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

K. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation. Coordinate with the local utility company requirements and specifications for utility transformers prior to Work.

L. Equipment Grounding: Install insulated equipment grounding conductors with all feeders and branch circuits.

M. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

N. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

O. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

P. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

Q. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

R. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

S. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
   3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

T. Perform tests and inspections.

U. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.
   4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
   5. Prior to energizing main switchboards with GFPE, disconnect switchboard neutral link or terminal to which the neutral conductor is connected. Once link is

removed, test to verify that the neutral is isolated from grounding connections on the load side of the service disconnect. Once the tests is completed, the testing agency shall field label the equipment with the results and date listed. Test records must be made available to the Engineer of Record and AHJ

V. Grounding system will be considered defective if it does not pass tests and inspections.

W. Prepare test and inspection reports.

X. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

Y. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

3.4 HANGERS AND SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70 utilizing listed beam clamps and supports. Tie-wires shall not be an acceptable method of securing raceways.

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

F. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb .

G. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
   7. To Light Steel: Sheet metal screws.
   8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

H. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

I. Concrete Bases:
   1. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
   2. Use 3000-psi , 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements as specified by equipment manufacturer.
   3. Anchor equipment to concrete base:
      a. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
      b. Install anchor bolts to elevations required for proper attachment to supported equipment.
      c. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 RACEWAYS AND BOXES INSTALLATION

A. Selection of Raceways: Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.

B. Outdoors:
   1. Exposed and Subject to Physical Damage: RMC.
   2. Exposed and Not Subject to Physical Damage: IMC.
   3. Concealed Aboveground: EMT.
   4. Direct Buried: PVC-40.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors:
   1. Hazardous Classified Locations: RMC.
   2. Exposed and Subject to Physical Damage: IMC.
   3. Exposed and Not Subject to Physical Damage: EMT.
   4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
   5. Damp or Wet Locations: IMC.
   6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.

D. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
   1. RMC and IMC: Provide threaded type fittings unless otherwise indicated.

E. Installation of Raceways:
   1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
   2. Comply with requirements in Section 260400 "Hangers and Supports for Electrical Systems" for hangers and supports.
   3. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
   4. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4” and insulated throat metal bushings on 1-1/2” and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
   5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
   6. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
   7. Support conduit within 12” of enclosures to which attached.
   8. MC Cable or FMC is allowed in limited uses: Lighting whips, interior partition walls, and millwork. MC Cable is NOT allowed for homerun branch circuits.
   9. Adjust raceway sizes required for derating and ambient temperatures.
   10. Provide necessary sleeves and chases where conduits pass through floors and walls, and provide other necessary openings and spaces, arranging to prevent unnecessary cutting.

11. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    b. Where an underground service raceway enters a building or structure.
    c. Conduit extending from interior to exterior of building.
12. Do not install conduits within 2” of the bottom side of a metal deck roof.
13. Keep raceways at least 6” away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
14. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength.
15. Do not install aluminum raceways or fittings in contact with concrete or earth.

F. Underground conduit installations where open trenching occurs and accessible to public, shall require barriers and warning tape per OSHA guidelines.

G. Where conduit or wiring is exposed, run parallel to, or at right angles with, lines of the building.
1. Make bends with standard conduit elbows or conduit bent to not less than the same radius.
2. Make bends free from dents and flattening.
3. Where outlets and devices are installed exposed on masonry walls, contractor shall route conduit up to highest point on wall to junction box serving the device vertically.

H. Where conduits pierce the roof, provide 24-gauge galvanized iron roof jacks and flashing collar brazed onto the conduits and covering the top of the roof jacks. Any brazing shall occur prior to installation of conductors.

I. When boring, cutting or drilling structural wood or wall members, drill only in locations as approved by the Architect.

J. Installation of Boxes and Enclosures:
1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
2. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
3. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
4. Locate boxes so that cover or plate will not span different building finishes.
5. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
6. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
7. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.

8. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

K. INSTALLATION OF UNDERGROUND CONDUIT

L. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit 36-inch below grade and 24-inch below finished slab-on-grade. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles, equipment pads and at building entrances through floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
   b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
   c. For PVC stub-ups at equipment mounted on concrete bases with formed raceway opening to enter cabinets, enclosures and boxes. Install PVC End Bell on service conduits for conductors No. 4 AWG and larger prior to pulling conductors.
5. Underground Warning Tape: Provide at all utility and onsite generation for service entrances and comply with requirements listed by the Owner and local utility company.

3.6 SLEEVE-SEAL SYTEM INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work and as specified by roofing manufacturer.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

H. SLEEVE-SEAL-SYSTEM INSTALLATION
1. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
2. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

I. SLEEVE-SEAL-FITTING INSTALLATION
1. Install sleeve-seal fittings in new walls and slabs as they are constructed.
2. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
3. Secure nailing flanges to concrete forms.
4. Using grout, seal the space around outside of sleeve-seal fittings.

3.7 LIGHTING CONTROL DEVICE INSTALLATION

A. SENSOR INSTALLATION

1. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
2. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
3. Multiple Switching: The use of multiple switching shall be evaluated for each space and condition. Occupancy sensors shall not be used as the sole means of switching. Manual switches will be provided in all areas with single occupancy sensors.

B. WIRING INSTALLATION

1. Wiring Method: Comply with Section 260400 "Low-Voltage Electrical Power Conductors and Cables."
2. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
3. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
4. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

C. IDENTIFICATION

1. Identify components and power and control wiring according to Section 260400 "Identification for Electrical Systems."
    a. Identify controlled circuits in lighting contactors.
    b. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
2. Label time switches and contactors with a unique designation.

D. FIELD QUALITY CONTROL

1. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
    a. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
    b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Lighting control devices will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

E. ADJUSTING

1. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
    a. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
    b. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
    c. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

F. DEMONSTRATION
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

3.8 INSTALLATION OF WIRING DEVICES

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.

3.9 INSTALLATION OF FUSES

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install labels complying with requirements for identification specified in "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

3.10 INSTALLATION OF ENCLOSED SWITCHES AND CIRCUIT BREAKERS

A. ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS
   1. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
      a. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
      b. Outdoor Locations: NEMA 250, Type 3R.
      c. Kitchen or Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
      d. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
      e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
      f. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 with cover attached by Type 316 stainless steel bolts.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Owner no fewer than ten days in advance of proposed interruption of electric service.
   2. Indicate method of providing temporary electric service.
   3. Do not proceed with interruption of electric service without Owner or Construction Manager's written permission.
   4. Comply with NFPA 70E.

C. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

D. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

E. Install fuses in fusible devices.

F. Comply with NFPA 70 and NECA 1.

G. IDENTIFICATION
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

H. Test and Inspections: Section 260400 "Testing and Inspections."
   1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

I. Prepare test and inspection reports.
   1. Test procedures used.
   2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
   3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.11 INSTALLATION OF INTERIOR LIGHTING

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports: Sized and rated for luminaire weight.

E. Flush-Mounted Luminaire Support: Secured to outlet box.

F. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.
   2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:
   1. Ceiling mount with two 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
   2. Ceiling mount with pendant mount with 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
   3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
   3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
   4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260400 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

K. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260400 "Identification for Electrical Systems."

L. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
3. Photometric Requirements:
   a. The performance shall be adjusted (depreciated) by using the LED manufacturer’s data or the data from the IESNA Standard TM-21 test report, which ever one results in a higher level of lumen depreciation.
   b. The initial minimum illuminance level is achieved in 100% of the area of the specified lighting pattern.
   c. The measurements shall be calibrated to standard photopic calibrations.
   d. Luminaire shall be tested per IESNA LM 79-08.

M. Luminaire will be considered defective if it does not pass operation tests and inspections.

N. Prepare test and inspection reports.

3.12 INSTALLATION OF SURGE PROTECTION FOR ELECTRICAL POWER CIRCUITS

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Complete startup checks according to manufacturer's written instructions. Energize SPDs after power system has been energized, stabilized, and tested.

F. Test and Inspections: Section 260400 "Testing and Inspections."

1. An SPD will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Train Owner's maintenance personnel to operate and maintain SPDs.

3.13 INSTALLATION OF POWER EQUIPMENT

A. FLOOR- MOUNTED EQUIPMENT CONCRETE PAD: Install switchboards, transformers and enclosed controllers on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
   1. Install conduits entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches above concrete base after equipment is anchored in place.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from enclosures and components.

C. Provide power and control wiring for HVAC, switchboards, panelboards, motor starters and safety switches as shown on the Drawings.

D. Connections to miscellaneous building equipment:
   1. Wire to, and connect to, all items of building equipment not specifically described but to which line-voltage electrical power is required.
   2. Coordinate as necessary with other trades and suppliers to verify types, numbers and locations of equipment.
   3. Make final connections to all kitchen equipment per manufacturer's instructions.
   4. Mark each pull-box/junction box with a permanent ink marker the panel designation and circuit number contained.

E. Mounting Heights:
   1. Install light switch at 48 inches to center of device above finished floor. Unless otherwise noted.
   2. Install convenience receptacle at 18 inches to center of device above finished floor. Unless otherwise noted.
   3. Install convenience receptacle at 4 inches to center of device, above back splash of counter top. Unless otherwise noted.

4. Install telephone jack rough in at 18 inches to center of device above finished floor. Unless otherwise noted.
5. Install telephone jack for side-reach wall telephone, to position top of telephone at 54 inches to center of device, above finished floor. Unless otherwise noted.

3.14 MATERIAL AND EQUIPMENT

A. All materials and equipment shall be new, of the same type and manufacture, and shall be of the best quality and design and free from defects.

B. A Manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer's name, address and catalog number.

3.15 MISCELLANEOUS ITEMS

A. The Contractor shall provide all miscellaneous items that would normally be required for proper installation of all electrical systems specified herein.

B. Completed wiring systems shall be free from short circuits. After completion, this Division 26 shall perform tests for insulation resistance in accordance with the requirements of the National Electrical Code.

C. Complete temperature control wiring rough-in is the responsibility of this Division 26. Coordinate with Division 23 to provide all locations for rough-in box and conduit requirements. Temperature control wiring shall be installed in conduit as specified by Division 23. Final terminations shall be by Division 23 unless system is 110 volts or greater.

D. Provide all disconnects and safety switches for mechanical and plumbing equipment. Where safety switches serve equipment with multiple motors, switches shall be fused according to the nameplate of the equipment, or the breaker serving the equipment shall be "HACR" type.

3.16 CUTTING AND PATCHING

A. The Electrical Contractor shall be responsible for cutting all floors, walls, partitions, ceilings or other construction required for proper installation of his Work. No cutting shall be done without prior approval of the Architect and all cutting shall be performed as directed by the Architect. Compacting of soil shall be provided in accordance to Division 2 Work. Concrete and Asphalt Work shall be provided in accordance to Division 2 Work.

B. The Electrical Contractor shall provide and install fire-safing material in penetrations through fire rated walls, floors, and ceilings in accordance with local codes.

3.17 CLEANING AND PLACING IN SERVICE

A. Immediately prior to final inspection, the Contractor shall make a final cleanup of dirt and refuse resulting from his Work and shall assist in keeping the premises clean at all times.

B. Immediately prior to final inspection, the Contractor shall clean all material and equipment installed under this Contract. Dirt, dust, plaster, stains and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched up and restored to their original Condition.

C. Mechanism of all equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required to produce the intended performance.

3.18 ADJUSTMENT AND INSTRUCTION

A. Energize all systems, equipment, and fixtures and check for proper operation. Check electrical feeders for proper phasing and balance loads between phases.

B. Position adjustable light fixtures to meet approval of Architect.

3.19 TESTING AND INSPECTIONS

A. Make written notice to the Architect/Engineer adequately in advance of each of the following stages of construction:
   1. Underground electrical system installation is complete, but not covered.
   2. Rough-in installation of electrical systems are complete, but not covered.
   3. At final completion of the Work of this Section 260400.

B. Provide personnel and equipment to perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Acceptance Testing:
      a. Test insulation resistance for each distribution bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the enclosure and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
      b. Test continuity of each circuit. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Values shall not deviate more than 50 percent of lowest value tested.
      c. Test ground-fault protection for service equipment per NFPA 70.
      d. Use suitable test instrument to measure resistance to ground system. Test in accordance with test instrument manufacturer's specified fall-of potential method.
   2. Tests and Inspections:

a. Perform each visual, accessible bolted electrical connection, mechanical inspection and electrical test for component type stated in NETA Acceptance Testing Specification including Tables. Certify compliance with test parameters.
b. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
c. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
d. Prior to energizing motors, verify voltages are within plus or minus 10 percent of nameplate rated voltages at motor.
e. Test each connected motor for proper phase rotation.

C. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance, remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.

3.20 PROJECT COMPLETION

A. Upon completion of the Work of this Section, thoroughly clean all exposed portions of the electrical installation, removing all traces of soil, labels, grease, oil, and other foreign material, and using only the type cleaner recommended by the Manufacturer of the item being cleaned.

B. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual required to be submitted under Article 1.05 of this Section of these Specifications. Provide thorough training of personnel required to operate systems installed.

END OF SECTION

SECTION 262550 – GENERATOR DOCKING STATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Shop Drawings: For docking station. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For docking station to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.6 GUARANTEE/WARRANTY

A. The equipment installed under this contract shall be left in proper working order.

B. New materials and equipment shall be guaranteed against defects in composition, design or workmanship. Guarantee certificates shall be furnished.

PART 2 - PRODUCTS

2.1 GENERATOR DOCKING STATION

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton.
2. TRYSTAR: Generator Docking Station
3. Square D; by Schneider Electric.

B. Docking station shall include 16 Series Camlok Panel Mounts for use as connection to Portable Generator.

C. Entire package must be listed to ETL or UL 1008 Standards. UL listing of individual components is not acceptable.

2.2 ENCLOSURES

A. NEMA 3R rain-tight, 304 GA aluminum enclosure:
1. NEMA 3R rain-tight, 304 GA aluminum enclosure
   a. Pad-lockable front door shall be hinged access plate at the bottom for entry of cables from poratable generator or portable load bank. NEMA 3R integrity shall be maintained with access plate open for cable entry.
   b. Front and side through a front access panel shall be accessible for maintenance.
   c. Top, side and bottom through a front access panel shall be accessible for permanent cabling.
2. Finishes:
   a. Paint after fabrication. Powder coated gray.

B. Phase, Neutral, and Ground Buses:
1. Material: Silver-plated Copper
2. Equipment Ground Bus: bonded to box.
3. Ground Bus: 50% of phase size.
4. Neutral Bus: Neutral bus rated 100 percent of phase bus.
5. Round edges on bus.

C. Temporary generator connectors shall be Camlok style mounted on gland plate.

1. Camlok shall be color coded according to system voltage
   a. A phase – Black or Brown
   b. B phase – Red or Orange
   c. C phase – Blue or Yellow
   d. N Neutral – White
   e. G Ground – Green

D. Temporary connectors shall include protective flip lids to prevent accidental contact.

E. Permanent connectors shall be broad range set-screw type, located behind an aluminum barrier.

F. Short Circuit & Withstand Rating
1. Shall be minimum 65KAIC unless otherwise indicated on drawings.

G. Voltage & Amperage:
1. 480Y/277V, 3PH, 800-Amp.

H. Phase Rotation Monitor Device:
1. Phase monitoring relay to be Siemens 3U4512-1AR20 or equal.

I. Additional accessories shall be included in submittal drawings as follows:

1. A: Two Wire Auto Start
2. K: Kirk Key Door Interlock
3. U: Utility Light/Alarm (Customer Specified)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive Generator Docking Station for compliance with installation tolerances and other conditions affecting performance of the Work.

3.2 INSTALLATION

A. Surface, Flush or Base Mounted: Determined by Application
1. Install anchor bolts to elevations required for proper attachment to Generator Docking Station.

3.3 FIELD QUALITY CONTROL

A. Third Party Tests and Inspections to include the following:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Prepare test and inspection reports, including a certified report that identifies Generator Docking Station and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262550

SECTION 263213 - GASEOUS EMERGENCY ENGINE GENERATORS

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. Section includes packaged engine generators for emergency use with the following features:

1. Dual fuel engine.
2. Gaseous fuel system.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Load banks.
7. Outdoor engine generator enclosure.
8. Vibration isolation devices.
9. Finishes.

B. Related Requirements:
1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.
2. Natural Gas Piping: Comply with requirements in Section 231123 "Facility Natural Gas Piping."
3. LP Gas Piping: Comply with requirements in Section 231126 "Facility Liquefied-Petroleum Gas Piping."
4. Gas Train: Comply with NFPA 37.

1.3 DEFINITIONS

A. EPS: Emergency power supply.

B. EPSS: Emergency power supply system.

C. LP: Liquid petroleum.

D. 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 product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in cubic feet per hour at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
6. Include airflow requirements for cooling and combustion air in cubic feet per minute at 0.8 power factor, with air-supply temperature of 95, 80, 70, and 50 deg F. Provide Drawings indicating requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine generator and other components specified.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

B. Seismic Qualification Data: Certificates, for engine generator, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails, identify center of gravity and total weight, including full fuel tank, supplied enclosure, external silencer, skid-mounted load bank, and each

piece of equipment not integral to the engine generator, 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.

C. Source Quality-Control Reports: Including, but not limited to, the following:

1. Certified summary of prototype-unit test report.
2. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
3. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
4. Report of sound generation.
5. Report of exhaust emissions showing compliance with applicable regulations.
6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

D. Field quality-control reports.

E. Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
b. Operating instructions laminated and mounted adjacent to generator location.
c. Training plan.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Cummins Onan, Genset - Cummins QSJ8.9G model generator or comparable product by one of the following:
1. Cummins Onan; Industrial Business Group.
2. Caterpillar; Engine Div.
3. Kohler Co.; Generator Division.
4. Only approved bidders shall supply equipment provided under this contract. Equipment by other suppliers that meets the requirement of this specification are acceptable, if approved not less than 2 weeks before scheduled bid date. Proposals must include a line by line compliance statement based on this specification.

B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. B11 Compliance: Comply with B11.19.

B. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 110 requirements for Level 1 EPSS.

C. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.

D. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator, including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

E. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 104 deg F.
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 1000 feet.

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. EPSS Class: Engine generator shall be classified as Class X according to NFPA 110.

D. Service Load: 218 kVA.

E. Power Factor: 0.8 Insert number, lagging.

F. Frequency: 60 Hz.

G. Voltage: 208-V ac.

H. Phase: Three-phase, three four-wire wye, separately derived system.

I. Induction Method: Turbo charged aftercooled.

J. Governor: Adjustable isochronous, with speed sensing.

K. Mounting Frame: Structural-steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.

L. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries, with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

M. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 3 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 three 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: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.4 ENGINE

A. Fuel: Dual fuel –Natural Gas with LP Gas Backup is preferred primary fuel source.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: Engine or skid mounted.

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
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. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and with UL 499.

E. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant, from cold start to 110 percent load condition.
3. 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.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.

    a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Configuration: Vertical air discharge.
2. Radiator Core Tubes: Aluminum.
3. Size of Radiator: 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. Fan: Driven by multiple belts from engine shaft.
6. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
7. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

G. Muffler/Silencer: Commercial type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 12 dB at 500 Hz.
2. Sound level measured at a distance of 25 feet from exhaust discharge after installation is complete shall be 90 dBA or less.

H. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

I. Starting System: 12-V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle, with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least twice without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 2A 10 A 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 40 to 140 deg F 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. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. 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.
    f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 GASEOUS FUEL SYSTEM

A. Natural Gas Piping: Comply with requirements in Section 231123 "Facility Natural Gas Piping."

B. LP Gas Piping: Comply with requirements in Section 231126 "Facility Liquefied-Petroleum Gas Piping."

C. Gas Train: Comply with NFPA 37.

D. Tanks: Comply with requirements for storage containers in Section 231126 "Facility Liquefied-Petroleum Gas Piping."

E. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions.

1. Natural Gas with LP Gas Backup, Vapor-Withdrawal System:
   a. Carburetor.
   b. Fuel-Shutoff Solenoid Valves: One (1) for each fuel source.
   c. Flexible Fuel Connectors: One (1) for each fuel source.

2. Fuel Filters: One for each fuel type.
3. Manual Fuel Shutoff Valves: One for each fuel type.
4. Flexible Fuel Connectors: Minimum one for each fuel connection.
5. LP gas flow adjusting valve.
6. Fuel change gas pressure switch.

2.6 CONTROL AND MONITORING

A. 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 engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Provide minimum run-time control set for 30 minutes, with override only by operation of a remote emergency-stop switch.

C. Comply with UL 508A.

D. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.

1. Wall-Mounting Cabinet Construction: Rigid, self-supporting steel unit complying with NEMA ICS 6.

E. Control and Monitoring Panel:

1. Digital controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Instruments: Located on the control and monitoring panel and viewable during operation.

    a. Engine lubricating-oil pressure gage.
    b. Engine-coolant temperature gage.
    c. DC voltmeter (alternator battery charging).
    d. Running-time meter.
    e. AC voltmeter, for each phase.
    f. AC ammeter, for each phase.
    g. AC frequency meter.
    h. Generator-voltage adjusting rheostat.

3. Controls and Protective Devices: Controls, shutdown devices, and common visual alarm indication as required by NFPA 110 for Level 1 system, including the following:

    a. Cranking control equipment.
    b. Run-Off-Auto switch.
    c. Control switch not in automatic position alarm.
    d. Overcrank alarm.
    e. Overcrank shutdown device.
    f. Low water temperature alarm.
    g. High engine temperature pre-alarm.
    h. High engine temperature.
    i. High engine temperature shutdown device.
    j. Overspeed alarm.
    k. Overspeed shutdown device.
    l. Coolant low-level alarm.
    m. Coolant low-level shutdown device.
    n. Battery high-voltage alarm.
    o. Low-cranking voltage alarm.
    p. Battery-charger malfunction alarm.
    q. Battery low-voltage alarm.
    r. Lamp test.
    s. Contacts for local and remote common alarm.
    t. Low-starting hydraulic pressure alarm.
    u. Remote manual-stop shutdown device.
    v. Air shutdown damper alarm when used.
    w. Air shutdown damper shutdown device when used.
    x. Generator overcurrent-protective-device not-closed alarm.

F. Common Remote Panel with Common Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control

and monitoring panel. Remote panel shall be powered from the engine generator battery.

G. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.
2. Coolant low-temperature alarm.
3. High engine temperature pre-alarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low-fuel main tank alarm.
8. Low coolant level alarm.
9. Low-cranking voltage alarm.
10. Contacts for local and remote common alarm.
11. Audible-alarm silencing switch.
12. Air shutdown damper when used.
13. Run-Off-Auto switch.
14. Control switch not in automatic position alarm.
15. Low-cranking voltage alarm.
16. Generator overcurrent-protective-device not-closed alarm.

H. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.

I. Remote Emergency-Stop Switch: Flush; wall mounted unless otherwise indicated; and labeled. Push button shall be protected from accidental operation. Generators located outside shall have weatherproof rated, pedestal mounted switch with horn located adjacent to unit.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.

1. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.

1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

2.8 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 or Class F.

D. Temperature Rise: 125 / Class H environment.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Drip-proof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: SCR type, separate from exciter, providing performance as specified and as required by NFPA 110.

1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Maintain voltage within 15 percent on one step, full load.
3. Provide anti-hunt provision to stabilize voltage.
4. Maintain frequency within 5 percent and stabilize at rated frequency within two seconds.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 15 percent, maximum based on the rating of the engine generator set.

2.9 OUTDOOR ENGINE GENERATOR ENCLOSURE

A. Description: Sound-attenuating, weatherproof steel housing erected on concrete foundation. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

1. Sound Attenuation Level: 77 dBA or less.

B. Construction:
1. Structural Design and Anchorage: Comply with ASCE/SEI 7 for wind loads up to 100 mph.
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. Hardware: All hardware and hinges shall be stainless steel.
4. Space Heater: Thermostatically controlled and sized to prevent condensation.
5. Lighting: Provide weather-resistant LED lighting with 50 fc average maintained.
6. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine generator components to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.
7. Muffler Location: Within enclosure.

C. Engine-Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for two hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Stormproof and drainable louvers prevent entry of rain and snow.
2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
3. Ventilation: Provide temperature-controlled exhaust fan interlocked to prevent operation when engine is running.

D. Interior Lights with Switch: Factory-wired, vaporproof luminaires within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.

1. AC lighting system and connection point for operation when remote source is available.
2. DC lighting system for operation when remote source and generator are both unavailable.

E. Convenience Outlets: Factory-wired, GFCI. Arrange for external electrical connection.

F. Site Provisions:

1. Lifting: Complete assembly of engine generator, enclosure shall be designed to be lifted into place as a single unit, using spreader bars.

2.10 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.

2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer’s standard color or as directed on the drawings.

2.12 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator 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 and with IEEE 115. 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.
8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections to verify actual locations of connections before packaged engine generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than 3 working days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

3.3 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.

C. 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.

D. 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.

E. 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.

F. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.

G. 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.

H. Gaseous Fuel Piping:

1. Natural gas piping, valves, and specialties for gas distribution are specified in Section 231123 "Facility Natural Gas Piping."
2. LP gas piping, valves, and specialties for gas piping are specified in Section 231126 "Facility Liquefied-Petroleum Gas Piping."

I. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

C. Connect engine exhaust pipe to engine with flexible connector.

D. Gaseous Fuel Connections:

1. Connect fuel piping to engines with a gate valve and union and flexible connector.
2. Install manual shutoff valve in a remote location to isolate gaseous fuel supply to the generator.
3. Vent gas pressure regulators outside building a minimum of 60 inches from building openings.

E. Ground equipment according to NFPA 70.

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

G. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.5 IDENTIFICATION

A. Install a sign indicating the generator neutral is bonded to the frame for a separately derived system.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in first two subparagraphs below, as specified in NETA ATS. Certify compliance with test parameters.

    a. Visual and Mechanical Inspection:

        1) Compare equipment nameplate data with Drawings and the Specifications.
        2) Inspect physical and mechanical condition.
        3) Inspect anchorage, alignment, and grounding.
        4) Verify that the unit is clean.

    b. Electrical and Mechanical Tests:

        1) Perform insulation-resistance tests according to IEEE 43.

            a) Machines Larger Than 200 hp Test duration shall be 10 minutes. Calculate polarization index.
            b) Machines 200 hp or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.

        2) Test protective relay devices.
        3) Verify phase rotation, phasing, and synchronized operation as required by the application.
        4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
        5) Conduct performance test according to NFPA 110.
        6) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.

3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust Emissions Test: Comply with applicable government test criteria.
7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
8. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
9. Noise Level Tests: Measure A-weighted level of noise emanating from engine generator installation, including engine exhaust and cooling-air intake and discharge, at 2 locations 25 feet from edge of the generator enclosure, and compare measured levels with required values.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes automatic transfer switches rated 600 V and less.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
2. Single-Line Diagram: Show connections between transfer switch, power sources, and load.

1.03 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For transfer switches, accessories, and components, from manufacturer.

B. Source quality control reports.

C. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Contactor Transfer Switches:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Cummins/Onan ATS or comparable product by one of the following:

    a. Caterpillar; Engine Div.
    b. Kohler Power Systems; Generator Division.
    c. ASCO.
    d. Onan/Cummins Power Generation; Industrial Business Group.

2.02 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA ICS 1.

C. Comply with NFPA 110.

D. Comply with UL 1008 unless requirements of these Specifications are stricter.

E. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

F. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

    1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
    2. Short-time withstand capability for three cycles.

G. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

H. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

I. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.

J. Neutral Switching: Where a Separately Derived System or four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

K. Neutral Terminal: Solid and fully rated unless otherwise indicated where three-pole switches are indicated.

L. Battery Charger: For generator starting batteries.

1. Float type, rated 2 A. (10A for 250 kW and larger)
2. Ammeter to display charging current.
3. Fused ac inputs and dc outputs.

M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
4. Surge Protection Device: Integral, Type I specified in Section 264313 “Surge Protection for Low-Voltage Electrical Power Circuits” for voltage indicated.
5. Accessible via front access.

N. Enclosures: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.03 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Cummins/Onan ATS or comparable product by one of the following:
1. Caterpillar; Engine Div.
2. Kohler Power Systems; Generator Division.
3. Onan/Cummins Power Generation; Industrial Business Group.

B. Comply with Level 1 equipment according to NFPA 110.

C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Contactor-style automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
4. Conductor Connectors: Suitable for use with conductor material and sizes.
5. Material: Hard-drawn copper, 98 percent conductivity.
6. Main and Neutral Lugs: Mechanical type.
7. Ground Lugs and Bus-Configured Terminators: Mechanical type.
8. Connectors shall be marked for conductor size and type according to UL 1008.

D. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.

1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.

E. Automatic Transfer-Switch Controller Features:

1. Controller operates through a period of loss of control power.
2. Undervoltage Sensing for Each Phase of Normal and Alternate Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
11. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is unavailable.

2.04 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

B. Prepare test and inspection reports.

1. For each of the tests required by UL 1008, performed on representative devices, for emergency systems. Include results of test for the following conditions:

a. Overvoltage.
b. Undervoltage.
c. Loss of supply voltage.
d. Reduction of supply voltage.
e. Alternative supply voltage or frequency is at minimum acceptable values.
f. Temperature rise.
g. Dielectric voltage-withstand; before and after short-circuit test.
h. Overload.
i. Contact opening.
j. Endurance.
k. Short circuit.
l. Short-time current capability.
m. Receptacle withstand capability.
n. Insulating base and supports damage.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to latest seismic-restraint information.

B. Floor-Mounting Switch: Anchor to floor by bolting.
1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 033000 or 260529 "Hangers and Supports for Electrical Systems."
2. Provide workspace and clearances required by NFPA 70.

C. Identify components according to Section 260553 "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

E. Comply with NECA 1.

3.02 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, motor controls, 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. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

E. Route and brace conductors according to manufacturer's written instructions. Do not obscure manufacturer's markings and labels.

F. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches in length.

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual and Mechanical Inspection:

a. Compare equipment nameplate data with Drawings and Specifications.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and required clearances.
d. Verify that the unit is clean.
e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
f. Verify that manual transfer warnings are attached and visible.
g. Verify tightness of all control connections.
h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:

1) Use of low-resistance ohmmeter.
2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.

i. Perform manual transfer operation.
j. Verify positive mechanical interlocking between normal and alternate sources.
k. Perform visual and mechanical inspection of surge arresters.
l. Inspect control power transformers.

1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.

2. Electrical Tests:

a. Perform insulation-resistance tests on all control wiring with respect to ground.
b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.

c. Verify settings and operation of control devices.
d. Calibrate and set all relays and timers.
e. Verify phase rotation, phasing, and synchronized operation.
f. Perform automatic transfer tests.
g. Verify correct operation and timing of the following functions:

1) Normal source voltage-sensing and frequency-sensing relays.
2) Engine start sequence.
3) Time delay on transfer.
4) Alternative source voltage-sensing and frequency-sensing relays.
5) Automatic transfer operation.
6) Interlocks and limit switch function.
7) Time delay and retransfer on normal power restoration.
8) Engine cool-down and shutdown feature.

3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.
b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

4. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
b. Verify time-delay settings.
c. Verify pickup and dropout voltages by data readout or inspection of control settings.
d. For 1600A switches and larger: Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
e. 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.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

B. Coordinate tests with tests of generator and run them concurrently.

C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

SECTION 270400 – ELECTRICAL COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Provide complete electrical communications systems and components as shown on the Drawings and as specified herein, along with proper installation of materials and equipment including, but not necessarily limited to:

2.01 Basic Materials and Methods

2.02 Grounding and Bonding for Communications Systems

2.03 Hangers and Supports for Communications Systems

2.04 Pathways for Communications Systems

2.05 Other Materials

B. Drawings:

1. These Specifications are accompanied by floor plans of the building showing the location of the outlets. Exact locations shall be subject to the approval of the Architect who reserves the right to make any reasonable changes in locations indicated, prior to rough-in, without cost to the Owner. While the general run of feeders, branches, and conduits are indicated on the Drawings, it is not intended that the exact routing of circuits or locations of conduits be determined by said Drawings. Detailed arrangements of all Work shall be subject to the Owner and Architect's approval. Contractor shall coordinate all materials, equipment, devices and routing pathways with all Trades affected by this Scope of Work prior to bidding. Provide written documentation of identified systems which shall require any deviation from the drawings and issue to the Architect prior to bid.

C. Related Work:

1. Documents affecting Work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of the Specifications. Coordinate all requirements for the electrical service entrance with utility company. Deviations identified or discovered during the initial site investigation shall be documented and submitted to the Architect for equivalent Scope-of-Work prior to bid.

D. Temporary Systems:

1. Arrange, provide and pay for the costs of installing temporary systems to the site in accordance with the requirements of Division 1.

E. Errors in Bid Documents:
   1. The documents provided for bidding shall be defined as the Contract Documents inclusive of each Division and defined as all Drawings, Specifications, Addendums, Sketches and documented Request for Information (RFI). The Bidder shall promptly notify the Owner's Representative and the Architect/Engineer of Record upon discovery of any inconsistencies in the Contract Documents and be reported prior to the submitted Bid for proper correction utilizing the Addendum process listed in Division 1. Identified inconsistencies published by the Architect prior to bid shall be the contractor's responsibility for any and all incurred costs.

1.2 QUALITY ASSURANCE

A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section. Provide all warning signage and barriers required and as directed by the Owner to maintain the highest quality installation including safety of the overall site conditions.

B. CODES AND ORDINANCES:
   1. The installation shall comply with requirements of all applicable laws, codes and ordinances including those of the state, county and city.
   2. Where these Drawings, Design Guidelines and Specifications show more stringent requirements than required codes, the more stringent shall prevail.
   3. The Work shall comply with current standards of the serving utility companies and the Contractor shall support the Owner in efforts to coordinate trenches and pathways in unison as to not burden the site with multiple efforts. Provide all necessary materials to match or exceed existing standards of installations from the previous Work.
   4. System grounding per ANSI/NFPA70: National Electrode Code. Performance requirement of grounding system resistance shall be 10 ohms. Furnish products listed and classified by Underwriters Laboratories Inc. to obtain the results listed.

C. PERMITS, FEES AND LICENSES:
   1. The Contractor shall obtain and pay for all permits, fees and licenses, for Work required under these Specifications.

D. UTILITY COMPANY FEES:
   1. The Owner shall pay the utility company directly for all Work required for a complete and operable system.
   2. Coordination of existing utilities: Comply with the requirements of the authorities having jurisdiction, and of the utility companies providing electrical power and other services. The existing utilities shall be clearly marked by the Contractor and all parameters that affect the Work shall be submitted to each Division's Contractor for a complete coordinated installation. Failure to notify

Division 1 through 27 Contractors of conditions that will cause monetary or construction delays shall be the direct responsibility of the Contractor.

E. Without additional cost to the Owner, provide such other labor and materials as required to complete the Work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

F. Contractor shall coordinate all sub-contractors sequence/phasing of work and proposed equipment installation pathways through the existing building with all other Divisions listed in Specifications prior to final connection.

1.3 EXAMINATION OF SITE

A. All Contractors and Sub-Contractor shall be required to visit the site and inspect the existing Conditions with the Drawings and Specifications so as to be fully informed of the requirements for completion of the Work.

B. Contractors shall provide contact information on a Pre-construction sign-in sheet. Lack of such information shall constitute the Owner’s right of refusal.

1.4 MATERIAL AND EQUIPMENT

A. All materials and equipment shall be new, of the same type and Manufacturer of the existing facility and shall be of the best quality and design, free from defects and meet the requirements of UL and NFPA where standards are established for those items.

B. A Manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer's name, address, ratings, capacity and catalog number.

C. Manufacturer's name and model number used herein and on the Drawings establish type and quality required. Equal products may be considered if submitted in writing to the Engineer/Architect for approval 10 (ten) days prior to bid date. The Contractor shall be responsible for assuring the items and equipment substituted for those shown on the Drawings will physically fit in the space allocated. If substitutions are not submitted as defined, the Contractor shall be responsible for all costs incurred for installation or re-installation of systems.

D. Firestopping material shall be 3M Fire Seal Caulking, or approved substitution.

1.5 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings and Submittal Data:

1. Contractor shall process shop drawings and submittal data to insure that the proposed materials, equipment and devices conform to the requirements of the Contract Documents, all local code requirements and that there are no omissions or duplications in the various Divisions of Work. Contractor shall coordinate with each Division for the proposed submittal data or shop drawings and note on the Submittals Contractor requirements for these coordinated trades prior to sending to Architect. Provide layouts, fabrication information and data for systems, materials, equipment and devices proposed for the project.
    a. Shop drawings shall be drawn on a scale not less than 1/8-inch equals 1-foot showing actual dimensions.
    b. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including ground rods, ground rings, UFER systems BCT, TMGB, TGB's, and routing of their bonding conductors.
    c. Wiring Devices and all equipment specified as an Assembly.
    d. Rooms for Main/Intermediate Distribution Frame (MDF/IDF) layout and elevations.
2. Submittal data (manufacturer's catalog data) shall include Manufacturer's Specifications, product literature and other data needed to demonstrate compliance with the specified requirements, to include but not be limited to the following:
    a. Grounding System: Test report and record of location.
3. Manufacturer's recommended installation procedure which, when approved by the Architect or Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
4. The submittal data shall consist of manufacturer's cut sheets that clearly indicate the exact product and size offered, indicating UL Listed ratings. Sending catalogs will be returned for resubmission.
5. Do not submit detailed quantitative listings of materials, equipment and devices. It is the Contractor's responsibility to provide proper sizes and quantities to conform to Contract Documents.
6. Assemble submittals on related items procured from a single manufacturer in brochures or other suitable package form, rather than submitting a multiplicity of loose sheets.
7. The Contractor shall submit shop drawings whenever equipment proposed varies in physical size and arrangement from that indicated thus causing rearrangement of equipment space, where tight spaces require extreme coordination between this work and other work, where called for elsewhere in these Specifications and where specifically requested by the Architect/ Engineer. Shop drawings shall be prepared at a scale of not less than ¼ inch equals 1 foot.
8. Contractor shall only submit proposed equipment; materials and devices that are coordinated between all trades of Work listed in the Contract Documents and shall be identified as so on the inside cover of the Submittal packages indicating the affected Divisions. Coordination of Divisions shall be the sole responsibility of the Contractor and lack of coordination resulting in additional service costs shall be paid by the Contractor in addition to any consultant fees incurred by the Owner.

C. SUBSTITUTIONS

1. Where a single manufacturer is mentioned by trade name or manufacturer's name, it has been done in order to establish a standard rather than to discriminate against an equal product made by another manufacturer.
2. Where multiple manufacturers are listed, none other than those manufacturers will be accepted.
3. Substitute manufacturers will be considered (10) ten-days prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum ten (10) business days prior to bid with each sub-paragraph noted with the comment, "COMPLIANCE", "DEVIATION" or "ALTERNATE". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated along with indicated Divisions affected.
4. The term "COMPLIANCE" shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
5. By noting the term "DEVIATION" shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
6. By noting the term "ALTERNATE" shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.
7. Where a single manufacturer is mentioned by trade name or manufacturer's name in addition to listing acceptable substitute manufacturers, it has been previously determined that, although the equipment by these manufacturers may include some philosophical design differences from that specified their overall design philosophy and equipment quality are acceptable for the intended application.
8. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of equipment or devices of a particular manufacturer whether indicated or not. If any item of equipment or device is offered in substitution which differs substantially in dimension or configuration from that indicated on the Drawings or specifications, provide as part of the submittal ¼ inch equals 1 foot scaled drawings showing that the substitute can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.
9. Where substitute equipment or devices requiring different arrangement or connections from that indicated is accepted by the Architect/Engineer, install the equipment or devices to operate properly and in harmony with the intent of the Contract Documents, making all incidental changes in piping, ductwork or wiring resulting from the equipment or device selection without any additional cost to the Owner. The Contractor shall pay all additional costs incurred by other portions of the work in connection with the substituted equipment or device.
10. The Architect/Engineer reserves the right to call for samples of any item of material, equipment or device offered in substitution, together with a sample of

the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.

11. When any request for a substitution of material, equipment or device is submitted and rejected, the item named in the Contract Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

D. SAMPLES:
   1. When requested by the Architect/Engineer, promptly provide samples of items scheduled to be exposed in the final structure.
   2. When specifically so requested by the Contractor and approved by the Architect/Engineer, approved samples will be returned to the Contractor for installation on the Work.

E. RECORD DRAWINGS:
   1. Comply with provisions of Division 1.
   2. Include a copy of the Record Drawings and Shop Drawings in each copy of the operation and maintenance manual described below.

F. MANUAL:
   1. Upon completion of this portion of the Work, and as a Condition of its acceptance, deliver the operation and maintenance manual to the Architect compiled in accordance with the provisions of Division 1 of these specifications. Include within each manual.
      a. Copy of the approved Record Shop Documents for this portion of the Work.
      b. Copy of each warranty and guaranty.

1.6 PRODUCT HANDLING:

A. Comply with pertinent provisions of Division 1. Provide all offloading, logging, verification of conditions and setting of equipment as directed by the manufacturer.

1.7 GUARANTEE:

A. The Contractor guarantees all Work against any defects due to faulty workmanship or material and that all raceways, ducts and piping are free from foreign material, obstructions, holes or breaks of any nature.

B. Upon written notice from the Architect or Owner, the Contractor shall promptly remedy without cost to the Owner any defects occurring within a period of one (1) year from the date of final acceptance.

1.8 WARRANTY:

A. The Contractor shall properly execute in the Owner's name all Manufacturers' standard warranty certificates applying to equipment installed on the project and shall deliver said certificates to the Architect at completion of the job. All warranty cards shall also be properly executed and delivered to the supplier or Manufacturer's representative for Manufacturer's records. Standard warranties for equipment shall be not less than one (1) year.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND METHODS

A. Provide only materials that are new and of the type and quality specified. Where Underwriter's Laboratories, Inc. have established standards for such materials, provide only materials bearing the UL label and marked for intended location and application.

B. Firestopping material shall be 3M Fire Seal Caulking, or approved substitute.

C. All interior and exterior raceways shall be installed by Division 26 contractor.

D. Backbone Cabling – Owner provided.

2.2 GROUNDING AND BONDING FOR COMMUNICATION SYSTEMS

A. Related Requirements:
   1. Section 260400 "Grounding and Bonding for Electrical Systems".

B. Submittals:
   1. Product Data: For each type of product.

C. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

D. System Components: Comply with J-STD-607-A, UL 486A-486B.

E. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
   1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
   2. Cable Tray Equipment Grounding Wire: No. 6 AWG.

F. Grounding Busbars:
   1. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-A.
      a. Predrilling shall be with holes for use with lugs specified in this Section.

b. Mounting Hardware: Stand-off brackets that provide a 4-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
c. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

2. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-A. Predrilling shall be with holes for use with lugs specified in this Section.

G. Labeling: Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.3 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

A. Related Requirements:
1. Section 260400 “Hangers and Supports for Electrical Systems” for:
a. Steel slotted support systems for communication raceways.
b. Conduit and cable support.
c. Support for conductors in vertical conduit.
d. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
e. Fabricated metal equipment support assemblies.

B. J-Hooks:
1. Items for supporting high performance data cabling and fiber optic cabling per TIA specified spacings for cable strain relief and bend radius.

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

1) Erico-Pentair; Caddy Cable Support Systems.
2) Simpson Strong-Tie Co., Inc.

2. Meets TIA 568-C and TIA 569-C.
3. Single or Double-sided tree configurations to provide multiple J-Hooks with one structural element.
4. Fill capacity based on TIA and load rating.
5. Requires no special tools for assembly.
6. Smooth beveled edges for large bending radius.
7. Material: Steel.
8. Finish: Pre-galvanized. Zinc coated.
9. Multiple assembly components for attachment to structures.

2.4 PATHWAYS FOR COMMUNICATION SYSTEMS

A. Related Requirements:
1. Section 260400 “Raceways and Boxes for Electrical Systems” for:

a. Metal conduits and fittings.
b. Nonmetallic conduits and fittings.
c. Metal wireways and auxiliary gutters.
d. Nonmetallic wireways and auxiliary gutters.
e. Boxes, enclosures, and cabinets.

2. Section 280400 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving fire alarm systems, electronic safety and security systems.

B. Submittals:
1. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
2. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
a. Structural members in paths of pathway groups with common supports.
b. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
3. Product Schedule: Indicate type, use, location, and termination locations.

C. General Requirements: Comply with TIA-569-B, NEMA FB 1 and UL 514B, NEMA TC 2 and UL 651.

D. Metal Conduits and Fittings
1. GRC: Comply with ANSI C80.1 and UL 6.
2. IMC: Comply with ANSI C80.6 and UL 1242.
3. EMT: Comply with ANSI C80.3 and UL 797.
4. Size: 1-inch, minimum.
5. Fittings for EMT:
a. Material: Steel or die cast.
b. Type: Setscrew or compression.
6. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

E. Nonmetallic Conduits and Fittings
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. RNC: Type EPC-40-PVC, complying with unless otherwise indicated.
3. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

F. Optical-Fiber-Cable Pathways and Fittings:
1. Comply with UL 2024; flexible-type pathway with a circular cross section, approved for plenum, riser or general-use installation unless otherwise indicated.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Alpha Wire.
b. Carlon; a brand of Thomas & Betts Corporation.
c. Dura-Line.
d. Endot Industries Inc.

G. Hooks:
1. Prefabricated sheet metal cable supports for telecommunications cable.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. MonoSystems, Inc.
b. Panduit Corp.
c. Wiremold/ Legrand.
3. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
4. Comply with TIA-569-C.
5. Galvanized steel.
6. J or U shape.

PART 3 - EXECUTION

3.1 SITE COORDINATION AND PREPARATION

A. Examine the areas and the Conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of this work. Do not proceed until unsatisfactory conditions are corrected.

B. Coordinate with local utility company temporary and permanent communication requirements for the project. Provide a request for all utilities to be located and marked at project site prior to the start of Work. Prepare site easements for saw-cutting, trenching and backfill. Coordinate outages with Owner and utility company 10-days prior to outage.

C. Coordination with Division Trades:
1. Coordinate as necessary with other trades to assure proper and adequate provision in this Work of those trades for interface with the Work of this Section.
2. Coordinate the installation of electrical items with the schedule for Work of other trades to prevent unnecessary delays in the total Work.

D. Coordinate arrangement, mounting and support of electrical equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

E. Where outlets are not specifically located on the Drawings, locate as determined in the field by the Architect. Where outlets are installed without such specific direction, relocate as directed by the Architect and at no additional cost to the Owner.

F. The Electrical Drawings are diagrammatic but are required to be followed as closely as actual construction and Work of other trades will permit. Where deviations are required to conform with actual construction and the Work of other trades, make such deviations without additional cost to the Owner.

G. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider and Owner.

3.2 EXECUTION OF GROUNDING COMMUNICATION SYSTEMS

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1 and J-STD-607-A.

C. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
   1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
   2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.

D. Underground Grounding Conductors: Install bare copper conductor, No. 2 AWG minimum.

E. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.
   4. Connections to Structural Steel: Welded connectors.

F. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches minimum from wall, 12 inches above finished floor unless otherwise indicated.

G. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.

H. Primary Protector: Bond to the TMGB with insulated bonding conductor.

I. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot of

conductor length, up to a maximum size of No. 3/0 AWG 168 kcmils unless otherwise indicated.

J. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install top-mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.

K. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.

A. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.

B. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

C. Access Floors: Bond all metal parts of access floors to the TGB.

D. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

E. Perform tests and inspections.

F. Tests and Inspections:
   1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
      a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
   3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.

A. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.

B. Prepare test and inspection reports.

3.3 HANGERS AND SUPPORT INSTALLATION

A. Related Requirements:
   1. Section 260400 “Hangers and Supports for Electrical Systems”.

B. Comply with the following standards for application and installation requirements of hangers and supports for communication systems, except where requirements on Drawings or in Section 260400 are stricter.
   1. NECA 1.
   2. NECA/BICSI 568.
   3. TIA-569-C.
   4. NECA 101, 102 and 105.

C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

D. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."

3.4 INSTALLATION AND PATHWAY APPLICATION

A. Requirements listed in Section 260400 “Raceways and Boxes for Electrical Systems” listed under installations, part three.
   1. Minimum pathway Size: 3/4-inch trade size for single cable runs. 1-inch trade-size otherwise.
   2. Minimum size for optical-fiber cables is 1-1/2-inch.

B. Complete raceway installation between conductor and cable termination points according to Section 260400 "Raceways, Boxes and Fittings” for Electrical Systems prior to pulling conductors and cables.

C. General Installation:
   1. Comply with NECA 1, NECA 101, 102, 105, 111, and TIA-569-C for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
   2. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
   3. Complete pathway installation before starting conductor installation.
   4. Comply with requirements in Section 260400 "Hangers and Supports for Electrical Systems" for hangers and supports.

5. Arrange stub-ups so curved portions of bends are not visible above finished slab.
6. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
7. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
8. Support conduit within 12 inches of enclosures to which attached.

D. Pathways Embedded in Slabs:
1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to GRC or IMC before rising above floor.

E. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for pathways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

F. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

G. Surface Pathways:
1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
2. Install surface pathway with a minimum 2-inch radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

H. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 1-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet .
2. 1-1/2-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet .
3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull

or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

I. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

J. J -Hooks:
   1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
   2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
   3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
   4. Space hooks no more than 5 feet o.c.
   5. Provide a hook at each change in direction.

K. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

L. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

M. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260400 "Sleeves and Sleeve Seals for Electrical Pathways and Cabling."

N. Install firestopping at penetrations of fire-rated floor and wall assemblies.

O. GROUNDING
   1. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
   2. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
   3. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

P. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260400 "Identification for Electrical Systems."
   1. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

Q. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

R. Cable and Wire Identification:

1. Owner provided and installed.

3.5 MATERIAL AND EQUIPMENT

A. All materials and equipment shall be new, of the same type and manufacture, and shall be of the best quality and design and free from defects.

B. A Manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating Manufacturer's name, address and catalog number.

3.6 MISCELLANEOUS ITEMS

A. The Contractor shall provide all miscellaneous items that would normally be required for proper installation of all electrical systems specified herein.

3.7 CUTTING AND PATCHING

A. The Electrical Contractor shall be responsible for cutting all floors, walls, partitions, ceilings or other construction required for proper installation of his Work. No cutting shall be done without prior approval of the Architect and all cutting shall be performed as directed by the Architect. Compacting of soil shall be provided in accordance to Division 2 Work. Concrete and Asphalt Work shall be provided in accordance to Division 2 Work.

B. The Electrical Contractor shall provide and install fire-safing material in penetrations through fire rated walls, floors, and ceilings in accordance with local codes.

3.8 CLEANING AND PLACING IN SERVICE

A. Immediately prior to final inspection, the Contractor shall make a final cleanup of dirt and refuse resulting from his Work and shall assist in keeping the premises clean at all times.

B. Immediately prior to final inspection, the Contractor shall clean all material and equipment installed under this Contract. Dirt, dust, plaster, stains and foreign matter shall be removed from all surfaces. Damaged finishes shall be touched up and restored to their original Condition.

C. Mechanism of all equipment shall be checked, adjusted and tested for proper operation. Protective devices and parts shall be checked and tested for specified and required application and adjusted as required to produce the intended performance.

3.9 ADJUSTMENT AND INSTRUCTION

A. Energize all systems and check for proper operation.

3.10 TESTING AND INSPECTIONS

A. Make written notice to the Architect/Engineer adequately in advance of each of the following stages of construction:
   1. Underground electrical system installation is complete, but not covered.
   2. Rough-in installation of electrical systems are complete, but not covered.
   3. At final completion of the Work of this Section 260400.

B. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance, remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.

3.11 PROJECT COMPLETION

A. Upon completion of the Work of this Section, thoroughly clean all exposed portions of the electrical installation, removing all traces of soil, labels, grease, oil, and other foreign material, and using only the type cleaner recommended by the Manufacturer of the item being cleaned.

END OF SECTION