Financial Management Department
Purchasing Division
1112 Manatee Ave W Suite 803
Bradenton, FL 34205
Phone: (941) 749-3014
www.mymanatee.org

July 28, 2016

TO: All Interested Proposers

SUBJECT: Request for Proposal (RFP) #16-2572CD
Construction Management at Risk Services for Manatee County Health Department Medical Examiner's Office Building

ADDENDUM #1

The following items are issued to add to, modify and clarify the Request for Proposal document. Proposals are to be submitted on the specified time and date due, in conformance with the additions and revisions listed herein.

1. **ADD** the Draft Project Manual for the Relocation of EMS and Medical Examiners Office to the DNR Building dated July 27, 2016 that is attached to this Addendum #1 to the Request for Proposal soliciation documents.
2. **ADD** the 30% Plan Set for the Medical Examiner's Office and Emergency Mecial Services Renovation that is attached to this Addendum #1 to the Request for Proposal soliciation documents.

END OF ADDENDUM #1

Proposals will be received at Manatee County Purchasing, 1112 Manatee Avenue West, Bradenton, Florida 34205 until **Monday, August 22, 2016 at 4:00 PM.**

Sincerely,

Dennis Wallace
Procurement Contracts & Buyer Manager

DRAFT PROJECT MANUAL

RELOCATION OF EMS AND MEDICAL EXAMINERS OFFICE TO THE DNR BUILDING

202 6th AVENUE EAST
BRADENTON, FLORIDA

MANATEE COUNTY

HALL ARCHITECTS, PA
Architecture

ZNS Engineering
Civil Engineering

Stirling & Wilbur Engineering Group, Inc.
Structural Engineering

ATP Engineering South, PL.
M/E/P/FP Engineering

July 27, 2016 **DRAFT** **ISSUED FOR REVIEW ONLY**

**PROJECT MANUAL INCLUDING SPECIFICATIONS FOR
THE MANATEE COUNTY
ROLCATION OF EMS AND MORGUE TO DNR BUILDING
BRADENTON, FLORIDA**

ARCHITECTS: HALL ARCHITECTS, PA
513 CENTRAL AVENUE
SARASOTA, FL 34236

TELEPHONE: (941) 917-0883

CIVIL ZNS ENGINEERING
201 5th AVENUE DRIVE EAST
BRADENTON, FL 34208

TELEPHONE: (941) 748-8080

STRUCTURAL STIRLING & WILBUR ENGINEERING GROUPS, PA
7085 TAMIAMI TRAIL
SARASOTA, FL 34231

TELEPHONE: (941) 929-1552

MECHANICAL
ELECTRICAL &
PLUMBING
ENGINEER: ATP ENGINEERING SOUTH, PL.
5227 OFFICE PARK BOULEVARD
BRADENTON, FL 34203

TELEPHONE: (941) 751-06485

Address all communications regarding this Work to the Architect at the address listed above.

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END OF TECHNICAL SPECIFICATIONS

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SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Use of premises.
4. Specification formats and conventions.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Relocation of EMS Unit and Medical Examiners Office to the DNR Building.
1. Project Location: 202 6th Street West, Bradenton, Florida

B. Owner: Manatee County Board of County Commissioners

C. Architect: Hall Architects, PA, 513 Central Avenue, Sarasota, FL 34236

D. The Work consists of the following:
1. The Work includes renovation of an existing two-story masonry building for use by EMS Unit and the Medical Examiners Office.
2. The work includes selective demolition, reroofing, structural reinforcement of the building envelope and roof, new mechanical, electrical, plumbing, fire protection, fire alarm, stairs, elevator, interior partitions, terrazzo restoration, impact window and doors, covered parking canopy, and related architectural finishes.

1.4 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.5 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits. Other government campus areas will only be available by special arrangement with the project manager and county administration.

B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
a. Schedule deliveries to minimize use of driveways and entrances.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.6 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.
   1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
   2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
   2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
      a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.7 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.
   1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:
   1. Unit-cost allowances.
   2. Testing and inspecting allowances.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 UNIT-COST ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by

Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: TBD.

B. Allowance No. 2: TBD.

C. Allowance No. 3: TBD.

D. Allowance No. 4: TBD.

END OF SECTION 01 21 00

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

1.3 DEFINITIONS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. TBD.

END OF SECTION 01 22 00

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SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. TBD.

END OF SECTION 01 23 00

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SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Unless noted otherwise in the Proposal Request, within 5 business days of receipt of the Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times,

and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Coordination Drawings.
   2. Project meetings.
   3. Requests for Interpretation (RFIs).

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

1.3 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.
   4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's Construction Schedule.
   2. Preparation of the Schedule of Values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.

6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

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

1.5 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
      a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      b. Indicate required installation sequences.
      c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
   2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
   3. Number of Copies: Submit five opaque copies of each submittal. Architect will return three copies.
      a. Submit five copies where Coordination Drawings are required for operation and maintenance manuals. Architect will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.
   4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

1.6 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location at the Brighton Reservation. Conduct the meeting to review responsibilities and personnel assignments.
   1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned

parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Tentative construction schedule.
   b. Phasing.
   c. Critical work sequencing and long-lead items.
   d. Designation of key personnel and their duties.
   e. Procedures for processing field decisions and Change Orders.
   f. Procedures for RFIs.
   g. Procedures for testing and inspecting.
   h. Procedures for processing Applications for Payment.
   i. Submittal procedures.
   j. Preparation of Record Documents.
   k. Work restrictions.
   l. Responsibility for temporary facilities and controls.
   m. Progress cleaning.
   n. Working hours.
3. Minutes: The Contractor will record and distribute meeting minutes.

C. Progress Meetings: Conduct progress meetings at intervals necessary for orderly management of the construction project. In no case will the progress meeting be greater than four weeks apart. Coordinate dates of meetings with preparation of payment requests.
   1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
         1) Review schedule for next period.
      b. Review present and future needs of each entity present, including the following:
         1) Interface requirements.
         2) Sequence of operations.
         3) Status of submittals.
         4) Deliveries.
         5) Temporary facilities and controls.
         6) Work hours.
         7) Hazards and risks.
         8) Progress cleaning.
         9) Status of proposal requests.
         10) Pending changes.
         11) Status of Change Orders.
         12) Documentation of information for payment requests.
   3. Minutes: The Contractor will record and distribute the meeting minutes.
   4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
      a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.7 REQUESTS FOR INTERPRETATION (RFIs)

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

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

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

D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow five working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
   1. The following RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for coordination information already indicated in the Contract Documents.
      d. Requests for adjustments in the Contract Time or the Contract Sum.
      e. Requests for interpretation of Architect's actions on submittals.
      f. Incomplete RFIs or RFIs with numerous errors.
   2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
   3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within five days if Contractor disagrees with response.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

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SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.
   3. Final Completion construction photographs.

1.3 SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation. Include same label information as corresponding set of photographic files.

B. Construction Photographs: Submit electronic copies as .jpg or .tiff files within five days of taking photographs.
   1. Identification: label each photographic file with name of project, date and view number.

1.4 QUALITY ASSURANCE

A. Photographer Qualifications: Construction Project Manager or Superintendent.

1.5 COORDINATION

A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

1.6 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in uncompressed JPG or TIFF format, produced by a digital camera with minimum sensor size of 15.0 megapixels, and at an image resolution of not less than 1600 by 1200 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Construction Project Manager or Superintendent.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
   1. Date and Time: Include date and time in filename for each image.
   2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.

D. Preconstruction Photographs: Before commencement of excavation, take, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
   1. Flag excavation areas before taking construction photographs.
   2. Take eight photographs to show existing conditions adjacent to property before starting the Work.

E. Periodic Construction Photographs: Take 12, digital photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of, digital photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

G. Final Completion Construction Photographs: Take eight digital photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.
   1. Do not include date stamp.

H. Additional Photographs: Architect may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
   1. Three days' notice will be given, where feasible.
   2. In emergency situations, take additional photographs within 24 hours of request.
   3. Circumstances that could require additional photographs include, but are not limited to, the following:
      a. Special events planned at Project site.
      b. Immediate follow-up when on-site events result in construction damage or losses.
      c. Owner's request for special publicity photographs.

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 7 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 7 days for review of each resubmittal.
   4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 14 days for initial review of each submittal.
      a. Structural Related
      b. Mechanical Related
      c. Electrical Related

E. Identification: Place a permanent label or title block on each submittal for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
   2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
   3. Include the following information on label for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name and address of Architect.
      d. Name and address of Contractor.
      e. Name and address of subcontractor.
      f. Name and address of supplier.
      g. Name of manufacturer.
      h. Submittal number or other unique identifier, including revision identifier.
         1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
      i. Number and title of appropriate Specification Section.
      j. Drawing number and detail references, as appropriate.
      k. Location(s) where product is to be installed, as appropriate.
      l. Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
   1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
   2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
   1. Transmittal Form: Use AIA Document G810.
   2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked "Approved as Noted."

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals with mark indicating "Approved as noted or approved" taken by Architect.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
   1. Release is signed by contractor
   2. A $50.00 per sheet use fee for drawings and $0.10 use fee per sheet for specifications is remitted to the Architect at the time of delivery.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's written recommendations.
      b. Manufacturer's product specifications.
      c. Manufacturer's installation instructions.
      d. Standard color charts.
      e. Manufacturer's catalog cuts.
      f. Wiring diagrams showing factory-installed wiring.
      g. Printed performance curves.
      h. Operational range diagrams.
      i. Standard product operation and maintenance manuals.
      j. Compliance with specified referenced standards.
      k. Testing by recognized testing agency.
      l. Notation of coordination requirements.
   4. Submit Product Data before or concurrent with Samples.
   5. Number of Copies: Submit three copies of Product Data, unless otherwise indicated. Architect will return two copies. Mark up and retain one returned copy as a Project Record Document.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Dimensions.
      b. Identification of products.
      c. Fabrication and installation drawings.
      d. Roughing-in and setting diagrams.
      e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
      f. Shopwork manufacturing instructions.
      g. Templates and patterns.
      h. Schedules.
      i. Design calculations.
      j. Compliance with specified standards.
      k. Notation of dimensions established by field measurement.
      l. Relationship to adjoining construction clearly indicated.

m. Seal and signature of professional engineer if specified.
n. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
3. Number of Copies: Submit three opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit five copies where copies are required for operation and maintenance manuals. Architect will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of appropriate Specification Section.
3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.
4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Architect will return two copies.
a. Mark up and retain one returned copy as a Project Record Document.

F. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be

signed by an officer or other individual authorized to sign documents on behalf of that entity.

3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

C. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

D. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

E. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

F. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

G. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

H. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

I. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

J. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

K. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.

1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S/ ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
   1. Not Subject to Review
   2. Approved
   3. Approved as Noted
   4. No Action Required
   5. Revise/Resubmit
   6. Rejected/Resubmit
   7. Approved as Noted/Resubmit

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

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

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

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

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

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Description of test and inspection.
   3. Identification of applicable standards.
   4. Identification of test and inspection methods.
   5. Number of tests and inspections required.
   6. Time schedule or time span for tests and inspections.
   7. Entity responsible for performing tests and inspections.
   8. Requirements for obtaining samples.

C. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue.
   2. Project title and number.

3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
a. Provide test specimens representative of proposed products and construction.

b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

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

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

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

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

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

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

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
   2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.5 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.6 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry."

B. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

C. Paint: Comply with requirements in Division 09 painting Sections.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:
1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack board.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 78 deg F.
6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

D. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead, unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

G. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
1. Provide additional telephone lines for the following:
a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.
2. At each telephone, post a list of important telephone numbers.
a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Architect's office.
e. Engineers' offices.
f. Owner's office.
g. Principal subcontractors' field and home offices.
3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Parking: Provide temporary parking areas for construction personnel.

C. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
1. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.

D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Division 01 Section "Summary."

B. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Division 31 Section "Site Clearing."

C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
   1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
   2. Form: Tabulate information for each product under the following column headings:
      a. Specification Section number and title.
      b. Proprietary name, model number, and similar designations.
      c. Manufacturer's name and address.
      d. Supplier's name and address.
      e. Installer's name and address.
      f. Projected delivery date or time span of delivery period.
      g. Identification of items that require early submittal approval for scheduled delivery date.
   3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
      a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
   4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.

5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
   g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
   i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
   j. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
   k. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
   a. Form of Acceptance: Change Order.
   b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

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

C. Storage:
   1. Store materials in a manner that will not endanger Project structure.
   2. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   3. Store cementitious products and materials on elevated platforms.
   4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 15 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
   1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
   2. Requested substitution does not require extensive revisions to the Contract Documents.
   3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   4. Substitution request is fully documented and properly submitted.
   5. Requested substitution will not adversely affect Contractor's Construction Schedule.
   6. Requested substitution has received necessary approvals of authorities having jurisdiction.
   7. Requested substitution is compatible with other portions of the Work.
   8. Requested substitution has been coordinated with other portions of the Work.
   9. Requested substitution provides specified warranty.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. General installation of products.
   4. Progress cleaning.
   5. Starting and adjusting.
   6. Protection of installed construction.
   7. Correction of the Work.

1.3 SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certified Surveys: Submit ten copies signed by land surveyor.

C. Final Property Survey: Submit 5 copies showing the Work performed and record survey data.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
      a. Description of the Work.
      b. List of detrimental conditions, including substrates.
      c. List of unacceptable installation tolerances.

d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name

and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
   2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
   3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
   2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
   4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
   1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
   2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
   3. Products: List products to be used and firms or entities that will perform the Work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
   6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
   7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
   1. Primary operational systems and equipment.
   2. Mechanical systems piping and ducts.
   3. Control systems.

4. Communication systems.
5. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Equipment supports.
4. Piping, ductwork, vessels, and equipment.
5. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

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SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following:
   1. Recycling non-hazardous construction waste.
   2. Disposing of non-hazardous construction waste.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.4 PERFORMANCE GOALS

A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 50 percent by weight of total waste generated by the Work.

1.5 SUBMITTALS

A. Waste Management Plan: Submit 3 copies of plan within 7 days of date established for commencement of the Work.

B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include the following information:
   1. Material category.
   2. Generation point of waste.
   3. Total quantity of waste in tons.
   4. Quantity of waste recycled, both estimated and actual in tons.
   5. Total quantity of waste recovered (salvaged plus recycled) in tons.
   6. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
   2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.
   2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   3. Stockpile materials away from construction area.
   4. Store components off the ground and protect from the weather.
   5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Warranties.
   3. Final cleaning.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   8. Complete startup testing of systems.
   9. Submit test/adjust/balance records.
   10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
   12. Complete final cleaning requirements, including touchup painting.
   13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
   1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
   2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report and warranty.
   5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Contractor.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace parts subject to unusual operating conditions.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction.
q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Maintenance manuals for the care and maintenance of products, materials, and finishes systems and equipment.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
   1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Flood.
2. Gas leak.
3. Water leak.
4. Power failure.
5. Water outage.
6. System, subsystem, or equipment failure.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.

7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
   1. Do not use original Project Record Documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set(s) of marked-up Record Prints.
   2. Number of Copies: Submit copies of Record Drawings as follows:
      a. Initial Submittal: Submit one set(s) of plots from corrected Record CAD Drawings and one set(s) of marked-up Record Prints. Architect will initial and date each plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Architect will return plots and prints for organizing into sets, printing, binding, and final submittal.
      b. Final Submittal: Submit one set(s) of marked-up Record Prints, one set(s) of Record CAD Drawing files, one set(s) of Record CAD Drawing plots. Plot and print each Drawing, whether or not changes and additional information were recorded.
         1) Electronic Media: CD-R.

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

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

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an understandable drawing technique.
      c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:
1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
2. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.
   a. Architect makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.

3. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

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

2.3 RECORD PRODUCT DATA

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

2.4 MISCELLANEOUS RECORD SUBMITTALS

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

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

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

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

END OF SECTION 01 78 39

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SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

1.3 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names. Include learning objective and outline for each training module.
   1. At completion of training, submit one complete training manual(s) for Owner's use.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
   1. Refrigeration systems, including chillers condensers.

2. HVAC systems, including air-handling equipment air distribution systems and terminal equipment and devices.
3. HVAC instrumentation and controls.
4. Electrical service and distribution, including transformers switchboards panelboards and motor controls.
5. Lighting equipment and controls.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.
2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner with at least seven days' advance notice.

D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01 79 00

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DIVISION 15 - MECHANICAL

SECTION 15000 - MECHANICAL SYSTEMS DESCRIPTIONS

A. PROJECT INCLUDES

1. Fire Protection Systems: Refer to individual specification sections following for detailed requirements.
    a. Sprinkler systems.

2. Plumbing Systems and Specialties: Refer to individual specification sections following for detailed requirements.

    a. Domestic water service and distribution.
    b. Sanitary waste and vents.

3. HVAC Piping Systems: Refer to individual specification sections following for detailed requirements.

    a. Refrigerant systems.

4. Heat Rejection Systems: Refer to individual specification sections following for detailed requirements.

    a. Condensers.

5. Heat Transfer Systems: Refer to individual specification sections following for detailed requirements.

    a. Package rooftop heating and cooling units, and 100% outside air unit, and package unitary fan coils

6. Ventilation Systems: Refer to individual specification sections following for detailed requirements.

    a. Fans.
    b. Ducts.
    c. Terminal devices.
    d. Package kitchen hood, exhaust fan, make up air fan, and chemical extinguisher system for a small kitchen range and oven combination.

7. HVAC Control Systems: Refer to individual specification sections following for detailed requirements.

a. Electric control systems- ALC Controls.

8. Design Conditions: Provide cooling, ventilation, and heating for autopsy, viewing, receiving, specimen storage, darkroom, break-room, offices, day room, bedrooms, equipment rooms, IT data , electrical, and restroom areas .

a. Summer Outdoor Conditions: 93 degrees F dry bulb, ASHRAE 1 percentile; 79 degrees F wet bulb, ASHRAE 1 percentile.
b. Winter Outdoor Conditions: 34 degrees F dry bulb, ASHRAE 99 percentile.
c. Summer Indoor Conditions: 75 degrees plus or minus 5 degrees; 50 percent relative humidity plus or minus 5 percent
d. Winter Indoor Conditions: 70 degrees plus or minus 5 degrees; 40 percent relative humidity plus or minus 10 percent.

9. Additional Systems and Requirements:

a. Ventilation Rates: All ventilation shall meet Florida Mechanical Code and ASHRAE 62-2010 ventilation standard. All toilets, shower rooms, dark rooms, autopsy, viewing room, specimen storage, receiving, and janitor rooms shall be exhausted in accordance with Code.
b. Indoor Air Quality: Systems shall be filtered using MERV 8, 30 % effective filtration systems in the air handler.

B. PRODUCTS

1. Systems, products, and standards are listed in individual specification sections which follow. All Manatee County Facility standards are incorporated into the project.

END OF SECTION

SECTION 15050 - BASIC MECHANICAL MATERIALS

A. PROJECT INCLUDES

1. Basic mechanical materials including valves, pipe expansion joints, meters and gages, supports and anchors, motors, mechanical identification, and vibration control.

B. PRODUCTS

1. Pipe, Fittings, and Specialties: Refer to individual piping systems specifications for materials and installation requirements.

2. Valves: General duty valves cast iron, bronze, and brass, fabricated to comply with Manufacturers Standardization Society (MSS) classification listed. Gate, globe, ball, butterfly, and plug valves for shutoff duty; globe, ball, and plug valves for throttling duty.

a. Gate Valves, 2-Inch and Smaller for Domestic Hot and Cold Water: MSS SP-80, Class 125 based on system pressure, cast bronze, threaded or solder ends based on service.

b. Ball Valves, 1 Inch and Smaller: Rated for 125 psi pressure, 200 WOG pressure, 2 piece construction, bronze body, threaded or solder ends based on service.

c. Ball Valves, 1-1/4-Inch to 2-Inch: Rated for 125 psi saturated steam pressure, 200 WOG pressure, 3 piece construction, bronze body, threaded or solder ends based on service.

d. Plug Valves, 2-Inch and Smaller: Rated at 150 psi WOG, bronze body, threaded ends.

e. Globe Valves, 2-Inch and Smaller: MSS SP-80, Class 125 or 150 based on system pressure, cast bronze, threaded or solder ends based on service.

f. Butterfly Valves: 2-1/2-Inch and Larger: MSS SP-67, rated at 200 psi, cast iron body, field replaceable sleeve, stainless steel stem, lug or wafer type based on service.

g. Swing Check Valves, 2-Inch and Smaller: MSS SP-80, Class 125 or 150 based on system pressure, cast-iron body and cap, threaded or solder ends based on service.

h. Swing Check Valves, 2-1/2 Inch and Larger: MSS SP-71, Class 125 (Class 175 FM for fire protection piping systems), cast iron body and cap, flanged ends.

i. Lift Check Valves, 2-Inch and Smaller: Class 125, cast-bronze body and cap, threaded ends.

3. Expansion Joints for Piping Systems: Joints shall provide 200 percent absorption capacity of piping expansion between anchors.

a. Packless expansion joints.
b. Slip joints.
c. Flexible ball pipe joints.

4. Meters and Gages: Temperature and indicator ranges for services required. Accuracy of thermometers plus or minus 1 percent.

a. Direct-Mount Filled-System Dial Thermometers: Vapor actuated, universal angle, drawn steel or cast aluminum case with glass lens.
b. Remote-Reading Filled-System Dial Thermometers: Vapor actuated, drawn steel or cast aluminum case with glass lens.
c. Bimetal Dial Thermometers: Direct mounted, bimetal, universal angle type with stainless steel case, glass lens.
d. Dial-Type Insertion Thermometers: Bimetal, stainless steel case and stem.
e. Pressure Gages: General use, ASME B40.1, Grade A, phosphor bronze bourdon-tube type, drawn steel or brass case, glass lens.
f. Pressure Gage Accessories: Brass tubing straight coil syphon; brass snubber with disc suitable for fluid served and rated pressure.

5. Supports and Anchors: Hangers and Support Components: MSS SP-58, pipe and equipment hangers and supports including clamps, hanger-rod attachments, saddles and shields, spring hangers, pipe alignment guides, and anchors. Hangars shall meet Florida Building Codes .

6. Motors: NEMA MG 1 premium efficiency motors with phase, frequency rating, voltage rating, and capacity suitable for use. Service factor on all motors 1.15. Class F insulation on all VFD driven motors.

7. Mechanical Identification: ASME A13.1 as applicable, color coded, of the following types: Standard stencils, snap-on plastic pipe markers, pressure-sensitive pipe markers, plastic duct markers, plastic tape, valve tags, valve tag fasteners, access panel markers, valve schedule frames, engraved plastic laminate signs, plastic equipment markers, plasticized tags suitable for use.

8. Vibration Control: Neoprene pads, vibration isolation springs, pad-type isolators, all-directional anchors, neoprene mountings, equipment rails, fabricated equipment bases, isolation hangers, riser isolators, flexible pipe connectors suitable for use.

END OF SECTION

SECTION 15250 - MECHANICAL INSULATION

A. PROJECT INCLUDES

1. Pipe insulation, equipment insulation, and external duct and plenum insulation.

B. PRODUCTS

1. Mechanical Insulation Types:

   a. Pipe Insulation: Glass fiber, Flexible elastomeric cellular type.
   b. Equipment Insulation: Glass fiber, Flexible elastomeric cellular type.
   c. Duct and Plenum Insulation: Glass fiber, Flexible elastomeric cellular type.

2. Mechanical Insulation Materials:

   a. Glass Fiber Insulation: Inorganic glass fibers bonded with thermosetting resin; board type, ASTM C 612, Class 2, semi-rigid jacketed board; blanket type, ASTM C 553, Type II, Class F-1, jacketed flexible blankets; preformed pipe insulation, ASTM C 547, Class 1, rigid pipe insulation, jacketed.
   b. Flexible Elastomeric Cellular Insulation: Flexible expanded closed-cell structure with smooth skin on both sides; tubular materials, ASTM C 534, TypeI;sheetmaterials,ASTMC534,TypeII.

   c. Fire Performance: Type suitable for service.
   d. Vapor Barrier: Type suitable for service, white kraft paper. Painted elastomeric cellular insulation for exterior.
   e. Insulation Accessories: Insulating cements, adhesives, jackets, glass cloth and tape, bands, wire, and sealing compounds suitable for service and exposure.

END OF SECTION

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SECTION 15325 - SPRINKLER SYSTEMS

A. PROJECT INCLUDES

1. Sprinkler System:

a. Wet pipe system with automatic sprinklers. Light hazard facility. Two zones for the two floor levels. Dry type refrigerator heads shall be installed for the cooler for the Morgue.
b. Tie into the existing 12" Utility water main near the street for fire supply, provide a 6" fire main with backflow preventor and fire department connection to the building.

B. QUALITY ASSURANCE

1. Compliance: NFPA 13 and 25 for sprinkler system, UL listed and labeled; FM approved.

2. Calculations: Hydraulic calculations for pipe sizing by Contractor if not provided.

C. PRODUCTS

1. Pipes and Fittings:

a. Ductile Iron Pipe: AWWA C115, ductile-iron barrel with iron-alloy threaded flanges.
b. Steel Pipe: ASTM A 53, Schedule 40 in sizes 6 inches and small, Schedule 30 in sized 8 inches and larger, black and galvanized.
c. Steel Pipe: ASTM A 135, Schedule 10 through 5 inch and NFPA 13 wall thickness for 6 inch through 10 inch, plain ends, black and galvanized.
d Fittings: Suitable for service class and piping type; threaded, grooved-end, press-seal types.
e. Joining Materials: Welding and gasket materials suitable for design temperatures and pressures.

2. Valves and Accessories:

a. General Duty Valves: Gate valves, swing check valves.
b. Specialty Valves: Alarm check valves, dry-pipe valves, deluge valves,

detector check valves suitable for system use.

c. Manual Control Stations: Hydraulic operation, with union, pipe nipple and bronze ball valve.

d. Control Panels: Single area, two area, or single area cross-zoned as required, NEMA ICS 6 Type 1 enclosure.

e. Backflow Preventers: ASSE, sized for maximum flow rate and maximum pressure loss with Stortz or check valve fittings for local Fire Department use.

f. Alarm Devices: Water-motor-operated alarms, water flow indicators, pressure switches, supervisory switches.

g. Pressure Gages: UL 393.

3. Sprinklers and Accessories:

a. Automatic Sprinklers: Fusible link type; upright, pendant, styles; recessed styles; wall-mounted sprinkler head cabinet and wrench, six spare sprinklers, suitable for service required.

b. Sprinkler Fittings: UL listed and FM approved.

c. Sprinklers in the cooler for the NFPA 13 standard.

END OF SECTION

SECTION 15410 - PLUMBING PIPING AND SPECIALTIES

A. PROJECT INCLUDES

1. Plumbing piping systems within the building including the following:

a. Potable water distribution, including cold and hot water supply and hot water circulation.
b. Drainage and vent systems, including sanitary and storm.

2. Plumbing specialties for water distribution systems; soil, waste, and vent systems; and storm drainage systems.

3. The Morgue, EMS, and unoccupied office space shall have new separate water metering.
The morgue shall have an interceptor installed in the sanitary line from the autopsy sinks and a neutralization interceptor for the dark room prior to entering the sanitary line.

B. QUALITY ASSURANCE

1. Compliance: ASME B31.9.

C. PRODUCTS

1. Piping System Working Pressure Ratings:

a. Water Distribution Systems, Below Ground: 150 psig.
b. Water Distribution Systems, Above Ground: 125 psig.
c. Soil, Waste, and Vent Systems: 10 foot head of water.

2. Pipes and Tubes:

a. Hard Copper Tube: ASTM B 88, Types K, L, and M, water tube, drawn temper.
b. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
c. Copper Drainage Tube: ASTM B 306, Type DWV, drawn temper.
d. Steel Pipe: ASTM A 53, Type S, Grade A, Schedule 40, galvanized, plain

ends.

e. Ductile-Iron Pipe: AWWA C151, Classes 50 and 51, mechanical joint and push-on joint, with AWWA C104 cement-mortar lining

f. Flanged Ductile-Iron Pipe: AWWA C115, ductile-iron barrel, Class 150 or 300 iron-alloy threaded flanges, with AWWA C104 cement-mortar lining.

g. Hub and Spigot, Cast-Iron Soil Pipe: ASTM A 74, service class.

h. Hubless, Cast-Iron Soil Pipe: CISPI 301.

i. PVC Plastic Water Pipe: ASTM D 1785; Schedules 40, 80, and 120; plain ends.

j. PVC Plastic DWV Pipe: ASTM D 2665, Schedule 40, plain ends.

3. Fittings and Valves:

a. Pressure and Drainage Fittings for Pipe and Tubes: Suitable for working pressure, pipe, tube, and service.

b. Joining Materials: Solder, brazing and welding filler metals; couplings.

c. Valves: Gate, globe, ball, butterfly, and check valves suitable for service.

4. Plumbing Specialties:

a. Water Meters: AWWA C700-C710 series; type as required for service, register in gallons or cubic feet as required.

b. Backflow Preventers: ASSE Standard backflow preventers for flow rate and maximum pressure loss required, 150 psig minimum working pressure.

c. Thermostatic Water-Mixing Valves: ASSE 107, manually adjustable.

d. Miscellaneous Piping Specialties: Strainers, hose bibbs, wall hydrants,; water hammer arresters, trap seal primer valves, roof and overflow roof drains, stack flashing fittings, vent caps, vent terminals, roof flashing assemblies.

e. Cleanouts: Cast-iron cleanouts, ASME A112.36.2M..

f. Floor Drains: Cast-iron floor drains, ASME A112.21.1M; related fittings.

g. Sleeve Penetration Systems: UL 1479, through-penetration firestop assembly.

h. Concrete and metal interceptors meeting the Florida Plumbing Code requirements for the sanitary sewer connection.

i. Roof Drains: Cast-iron body, ASME A112.21.2M with combination flashing ring and gravel/ fabric stop.

END OF SECTION

SECTION 15440 - PLUMBING FIXTURES

A. PROJECT INCLUDES

1. Plumbing fixtures and trim, fittings, and related accessories and appliances.

B. QUALITY ASSURANCE

1. Compliance: ANSI A117.1; Applicable accessibility regulations.

C. PRODUCTS

1. Plumbing Fixtures: Manufacturers include as listed on the Plumbing Fixture Schedule as well as Kohler, Elkay, Haws, Watts, Jay R Smith, American Standard, Dayton, Woodford, Sioux Chief, Zurn, Symmons, Moen, Fiat , Insinkerator, T&S Brass, McGuire, Proflo, and Sloan . Systems are denoted on the plans to meet ADA guidelines.

a. Water Closets: Consumption per flush cycle, material, bowl type, mounting, outlet, rim height, tank type, trim suitable for service required.
b. Urinals: Consumption per flush cycle, material, floor wall hanging type, outlet, trim suitable for service required.
c. Lavatories: Material, mounting, fittings and accessories suitable for service required.
d. Sinks: Material ceramic and stainless steel, type, counter mounting type, fittings and accessories suitable for service required.
e. Service Sinks: Material, trap, floor mounting, fittings suitable for service required.
f. Showers: tile enclosure, shower curtain and ADA shower with wand and grab bars, with mixing valve and standard shower with fittings suitable for service required.
g. Water Coolers: ARI 100, type, dual level, and fittings suitable for service required.
h. Toilet Seats: Compatible with water closet.
i. Flushometers: Water closet and urinal types.

j. Commercial Faucets: Cast-brass faucets. All sinks have strainers only no stoppers.
k. Bath/Shower Thermostatic Mixing Valve Faucets: Single-lever type.

l. Fittings, Except Faucets: Supplies, stops, traps, continuous wastes, and escutcheons.
m . Supports: ASME A112.6.1M, categories and types as required for fixtures required, including wall reinforcement.
n. Disposers: Continuous feet type food waste disposer, UL 430.
o. All morgue autopsy units sinks shall be provided by the user group matching existing. All setting and fit up of the systems shall be by the contractor from the disposer to the interceptor in the floor.

END OF SECTION

SECTION 15450 - PLUMBING EQUIPMENT

A. PROJECT INCLUDES

1. Water storage tanks for use in plumbing water supply system.

2. Commercial water heaters for potable water heat systems.

B. QUALITY ASSURANCE

1. Compliance, Storage Tanks: ASME Code;

2. Compliance, Water Heaters: UL 174, 732, 778, 1261, 1453; NSF 5; ASME Code Compliance.

C. PRODUCTS

1. Water Compression Tanks and Accessories:

a. Water: Potable.
b. Pressure Rating: 125 psig.
c. Steel, Precharged Water Storage Tanks:Butyl-rubber diaphragm ASTM Code steel construction of suitable size and capacity.
d. Construction: Non-toxic welded joints; interior [glass] lining suitable for service.
e. Accessories: Manholes, tappings, valves, gages, controls, compression stops, concrete base.

2. Water Heaters: Heat traps and diaphragm tanks on cold water supplies required.

a. Electric Water Heaters: Automatic type, vertical 150 psig rated storage tank,

integral controls, drain valve, relief valve. Drain pan also required. Manufacturers include; AO Smith, Rheem , and State Water Heater.

b. An alternate instantaneous water heater cost for the EMS facility shall be requested.

b. Accessories: Valves, gages, concrete base, wall bracket stand.

END OF SECTION

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SECTION 15453 - PLUMBING PUMPS

A. PROJECT INCLUDES

1. Centrifugal pumps for water distribution systems for recirculating water piping systems.

B. QUALITY ASSURANCE

1. Compliance: UL 778.

C. PRODUCTS

1. Plumbing Pumps:

a. Compact Inline Circulator Pumps: Leakproof, inline, without seal, volute-type pump.
b. Inline Circulators: Horizontal inline, centrifugal, separately coupled, single-stage, all-bronze, radially split case type.

END OF SECTION

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SECTION 15488 - NATURAL GAS SYSTEMS

A. PROJECT INCLUDES

1. Natural gas systems within the generator.

B. QUALITY ASSURANCE

1. Compliance: NFPA 54.

C. PRODUCTS

1. Piping System Working Pressure:

   a. Low-Pressure Natural Gas Piping Systems: 6- 13" wc to 2 psig.
   b. Medium-Pressure Natural Gas Piping Systems: 10 psig.
   c. High-Pressure Natural Gas Piping Systems: 20 psig.
   d. Natural Gas Service: 100 psig. Or Local

2. Pipe, Fittings, and Specialties:
   a. Steel Pipe and Tubes: ASTM A 53, Type E welded or Type S seamless, Grade B, Schedule 40, black.
   b. Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
   c. Plastic Pipe: ASTM D 2513, polyethylene (PE), DR 11 or DR 11.5.
   d. Fittings and Valves: Suitable for piping type and service class.
   e. Gas Meter and Pressure Regulator: Diaphragm type meter and single stage gas pressure regulator if not provided by gas supplier; pressure regulator at device.

f. Piping Specialties: Flexible connectors, strainers.
g. Protective Coating: Corrosion-resistant polyethylene for use in corrosive atmosphere.
h. Vent location shall be coordinated .

END OF SECTION

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SECTION 15510 - HYDRONIC PIPING

A. PROJECT INCLUDES

1. Piping systems for condensate drain piping.

B. QUALITY ASSURANCE

1. Compliance: ASME Code, ASME B 31.9.

C. PRODUCTS

1. Pipes and Fittings:

a. Copper Pipe and Tube Material: Drawn temper copper tubing, ASTM B 88, Type L and annealed temper copper tubing, ASTM B 88, Type K.
b. Steel Pipe: ASTM A 53, Schedule 40, black steel pipe.
c. PVC schedule 40 pipe
c. Fittings: Suitable for piping type and service class.
d. Joints: Solder, gaskets, grooved mechanical joints, press-seal, glue fittings suitable for service.

END OF SECTION

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SECTION 15530 - REFRIGERANT PIPING

A. PROJECT INCLUDES

1. Refrigerant piping for air conditioning applications.

B. QUALITY ASSURANCE

1. Compliance: ASME Code, ASME B 31.5, ARI 760. , Refrigerant R410A

C. PRODUCTS

1. Pipes, Fittings, and Specialties:

a. Copper Tubing: ASTM B 280, Type ACR.
b. Fittings: Wrought-copper, ANSI B16.22.
c. Joining Materials: AWS A5.8, BAg-1 silver brazing filler metals.
d. Specialties: Moisture/liquid indicators, filter-driers, suction line filter-driers, suction line filters, flanged unions, flexible connectors, precharged and preinsulated tubing.
e. Refrigerant: ASHRAE 34. ASHRAE Handbook Refrigeration

2. Valves:

a. General Duty Valves: Globe, and check valves suitable for use.
b. Special Duty Valves: Solenoid valves, evaporator pressure regulating valves, thermal expansion valves, hot gas bypass valves.

END OF SECTION

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SECTION 15670 - CONDENSING UNITS

A. PROJECT INCLUDES

1. Condensing units for air-conditioning systems.

B. QUALITY ASSURANCE

1. Compliance: ARI 210, 360; ASHRAE 15; ASME Code

C. PRODUCTS

1. Condensing Units:

a. Air-Cooled Condensing Units: Factory-assembled and tested units, compressor, condenser coil, fan motor, refrigerant reservoir, operating controls, galvanized steel casing with baked enamel finish, capacity suitable for use.

2. Accessories:

a. Discharge line muffler.
b. Gage panel.
c. Electric solenoid unloading.
d. Control circuit transformer.
e. Pumpdown relay package.
f. Crankcase coverplates with equalizer connections.

END OF SECTION

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SECTION 15751 - PACKAGED HEAT TRANSFER EQUIPMENT

A. PROJECT INCLUDES

1. Heat transfer equipment for building HVAC systems.

B. PRODUCTS

1. Rooftop Heating and Cooling Units:

a. Rooftop Units Less Than 20 Tons: Factory-assembled and tested, compressors, condensers, electric and hot gas reheat heating evaporator coils, condenser and evaporator fans, refrigeration and temperature controls, filters, dampers, capacity suitable for use.

b. Manufacturers include Trane, York, Carrier, and Daikin.

END OF SECTION

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SECTION 15830 - TERMINAL HEAT TRANSFER UNITS

A. PROJECT INCLUDES

1. Terminal heat transfer units for heating and cooling.

B. PRODUCTS

1. Fan Coil Units:

a. Heating Medium: heqt pump heating.
b. Cooling Medium: refrigerant cooling.
c. Chassis: Galvanized steel with flanged edges.
d. Insulation: Faced heavy density glass fiber.
e. Cabinet: 18 gage steel removable panels, 16 gage front, insulation over entire coil section.
f. Coils: 5/8 inch seamless copper tubes mechanically bonded to configured aluminum fins.

g. Drain Pans: Galvanized steel, insulated.
h. Fans: Centrifugal forward curved double width wheels in galvanized steel fan scrolls.
i. Motors: Integral thermal overload protection type.
j. Filters: Throwaway type.
k. Dampers: 18 gage steel damper blades.
l. Accessories: Wall boxes, discharge grille panels, sub-bases, extended oilers, thermostats, recessing flanges.
j. Manufacturers : Carrier, Trane, York, Daikin or Owner approved equal.

END OF SECTION

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SECTION 15850 - AIR HANDLING

A. PROJECT INCLUDES

1. Fans, and air filters for building mechanical systems.

B. PRODUCTS

1. Centrifugal Fans:
   a. Inline and Ceiling Centrifugal Fans: Inline, direct driven with speed control with housing, wheel, motorized backdraft damper fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, accessories.

   b. Manufacturers : Greenheck or Owner approved equal

2. Air Filters:

a. Air Filters: ASHRAE 52, ARI 850, NFPA 90A, 90B.
b. Replaceable (Throwaway) Panel Filters: Flat panels, interlaced glass fiber media, 20 gage galvanized steel frame, 20 gage galvanized steel duct holding frame.
c. Front and Rear Access Filter Frames: Aluminum framing members, prefilters, sealers.

END OF SECTION

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SECTION 15890 - AIR DISTRIBUTION

A. PROJECT INCLUDES

1. Air distributions systems including ductwork, duct systems, HVAC casings, duct accessories, air outlets and inlets, and air terminals.

B. QUALITY ASSURANCE

1. Compliance: NFPA 90A, 96.

C. PRODUCTS

1. Metal Ductwork:

a. Types: Rectangular and round metal ducts and plenums for HVAC systems in pressure classes from Minus 2 inches to plus 10 inches water gage.
b. Galvanized Sheet Steel: Lock-forming quality, ASTM A 527 G90.
c. Sealing Materials: Joint and seam sealants, tapes and mastics.
d. Firestopping: Fire-resistant sealant.
e. Hangers and Supports: Concrete inserts, powder actuated fasteners, structural steel fasteners suitable for use; galvanized sheet steel hangers; duct attachments; trapeze and riser supports.
f. Fabrication: SMACNA HVAC Duct construction Standards.
g. Supports and Hangers: Concrete inserts, powder-actuated fasteners, structural steel fasteners suitable for use; galvanized sheet steel, hanger wire, and channel hanger materials.

2. Duct Accessories:

a. Backdraft Dampers: Galvanized steel frame, blades, blade seals, and axles.
b. Manual Volume Control Dampers: Galvanized steel standard volume, low-leakage volume control dampers; galvanized steel jackshaft; damper control hardware
c. Actuators: Damper motors for smooth modulating or 2-position action.
d. Turning Vanes: Manufactured and acoustic turning vanes.
e. Duct-Mounted Access Doors and Panels:
f. Flexible Connectors: UL 181, Class 1, flame-retardant or noncombustible fabrics.
g. Flexible Ducts: UL 181, Class 1, insulated types.
h. Accessory Hardware: Instrument test holes, splitter damper accessories, flexible duct clamps, adhesives.

3. Air Outlets and Inlets:

a. Ceiling Air Diffusers: Diffuser faces, mountings, patterns, dampers, accessories, and finishes suitable for service, use, and location.
b. Wall Registers and Grilles: Materials, faces, patterns, dampers, accessories, and finishes suitable for service, use, and location as selected.
Manufacturers include Price, Metalaire, Titus, and Tuttle and Bailey

END OF SECTION

SECTION 15970 - HVAC CONTROL SYSTEMS

A. PROJECT INCLUDES

1. Electric temperature control systems used for building HVAC systems.

2. Control System Operation: Control sequences and set points are listed in the plans.

3. The manufacturer of controls is listed as Automated Logic which has the local County contract.

B. PRODUCTS

1. Electric Control System Components:

a. Valves: Control valves, service valves, unit control valves.
b. Dampers: Automatic control dampers, frames, and damper and valve motors.
c. Thermostats: Room thermostats, remote-bulb thermostats, sensors, low-temperature protection thermostats. Guarded thermostats/sensors shall be installed in public areas.
d. Clocks: 7 day, 24 hour type with power backup.
e. Sensors: Electronic temperature and relative humidity sensors.
f. Controllers: Step controllers for control sequencing; electronic controllers; fan speed controllers; electric heat current controllers.
g. Control Panels: Local control panels, central control panels.
h. All wiring shall meet NEC for control wiring and be plenum rated.
i. Computer program control shall be provided as an option for the HVAC system. Software shall be supplied with the building control system.
k. The building computer can be monitored remotely from the main office .

END OF SECTION

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SECTION 15990 - TESTING, ADJUSTING, AND BALANCING

A. PROJECT INCLUDES

1. Total testing, adjusting, and balancing for mechanical systems to meet design specifications.
2. Verify building systems pressurize building spaces with dry conditioned air.
3. The balance contractor shall work directly for the General Contractor or Construction

Manager.

B. QUALITY ASSURANCE

1. Compliance: Associated Air Balance Council (AABC) requirements; National Environmental Balancing Bureau (NEBB) requirements.

B. PRODUCTS

1. Systems for Testing:

a. Supply air systems, all pressure ranges;
b. Return air systems.
c. Exhaust air systems.
d. Temperature control system.

END OF SECTION

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SECTION 16000 - ELECTRICAL SYSTEMS DESCRIPTIONS

A. PROJECT INCLUDES

1. Electrical Systems for the Following Applications:

   a. Power and distribution.
   b. Lighting.
   c. Fire alarm and life safety.
   d. Empty conduit system.
   e. Power connections for chiller and associated equipment.
   f. Modifications to existing systems.
   g. Variable frequency Drives.

2. Preliminary Connected Loads:

   a. Electric Room Lighting: 0.987 watts/sq.ft, .174 kVA.
   b. Load being deleted: N/A kVA.
   c. New load added: kVA.

3. Additional Requirements:

   a. New Under Ground (U/G) Service MSB: 277/480 Volts, three phase, 4000 Amps.
   b. On site factory training for all switchboards, motor control centers and variable frequency drives.

4. Additional information is included in the drawings.

B. PRODUCTS

1. Systems, products, and standards are listed in individual specification sections, which follow.

END OF SECTION 16000

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SECTION 16110 – ELECTRICAL RACEWAYS, CABLE TRAYS, AND BOXES

A. PROJECT INCLUDES

1. Electrical conduit, tubing, surface raceways, wireways, cable trays, boxes, and cabinets for electrical power and signal distribution.

B. PRODUCTS

1. Wiring Methods:

   a. Exposed Indoor Wiring: Electrical metallic tubing, rigid nonmetallic conduit, and/or galvanized steel conduit.
   b. Concealed Indoor Wiring: Electrical metallic tubing, electrical nonmetallic tubing, or rigid nonmetallic conduit.
   c. Exposed Outdoor Wiring: GRC steel conduit.
   d. Concealed Outdoor Wiring: GRC steel conduit.
   e. Underground Wiring, Single Run: Rigid nonmetallic conduit.
   f. Underground Wiring, Grouped: Rigid nonmetallic conduit.
   g. Connection to Vibrating Equipment: Flexible liquidtight conduit.

2. Metal Conduit and Tubing:

   a. Rigid Steel Conduit: ANSI C80.1.
   b. PVC Externally Coated Rigid Steel Conduit and Fittings: ANSI C80.1 and NEMA RN 1.
   c. Electrical Metallic Tubing (EMT) and Fittings: ANSI C80.3.
   d. PVC Externally Coated Electrical Metallic Tubing and Fittings: ANSI C80.3 and NEMA RN 1.
   e. Liquidtight Flexible Metal Conduit and Fittings: UL 360.

3. Nonmetallic Conduit and Ducts:

   a. Electrical Nonmetallic Tubing (ENT): NEMA TC 13.
   b. Rigid Nonmetallic Conduit (RNC): NEMA TC 2 and UL 651, Schedule 40 or 80 PVC.
   c. Underground PVC and ABS Plastic Utilities Duct: NEMA TC 6, Type I for encased burial in concrete, Type II for direct burial.
   d. PVC and ABS Plastic Utilities Duct Fittings: NEMA TC9.
   e. Liquidtight Flexible Nonmetallic Conduit and Fittings: UL 1660.

4. Raceway Accessory Materials:

   a. Conduit Bodies: NEC requirements.
   b. Wireways: NEC requirements.

c. Surface Raceways, Metallic: Galvanized steel, with snap-on covers.
d. Surface Raceways, Nonmetallic: Rigid PVC, UL 94.

5. Boxes and Fittings:

a. Cabinet Boxes: UL 50, sheet steel, NEMA 1.
b. Pull and Junction Boxes: UL 50, steel boxes.
c. Metal Outlet, Device and Small Wiring Boxes: UL 514A and OS 1.
d. Nonmetallic Outlet, Device and Small Wiring Boxes: NEMA OS 2.

END OF SECTION 16110

SECTION 16119 - UNDERGROUND DUCTS AND UTILITY STRUCTURES

A. PROJECT INCLUDES

1. Underground conduits and ducts, duct banks, pull boxes and handholes, manholes, and other underground utility structures.

B. PRODUCTS

1. Conduit and Duct:
   a. Rigid Steel Conduit: ANSI C80.1, galvanized.
   b. Plastic-Coated Rigid Steel Conduit and Fittings: NEMA RN 1.
   c. Rigid Plastic Conduit: NEMA TC 2, Schedule 40 PVC.
   d. PVC Conduit and Tubing Fittings: NEMA TC 3.
   e. Rigid Plastic Underground Conduit: UL 651A, Type A PVC.
   f. Rigid Plastic Underground Conduit: UL 651A, Type EB PVC.
   g. Rigid Plastic Underground Conduit: High-density polyethylene, Schedule
   h. Rigid Plastic Underground Conduit: Fiberglass-reinforced epoxy.
   i. Plastic Utilities Duct: NEMA TC 6.
   j. Plastic Utilities Duct Fittings: NEMA TC 9.
   k. Plastic Communication Duct and Fittings: NEMA TC 10.

2. Pull Boxes and Handholes
   a. Cast Metal Boxes: Cast aluminum with gasketed cover with nonskid finish.
   b. Fiberglass Handholes: Molded fiberglass with weatherproof cover with nonskid finish.
   c. Polymer Concrete: ANSI/SCTE 77-2002, class as applicable.

3. Precast Concrete Utility Structures:

   a. Precast Units: Interlocking, mating sections.
   b. Structural Design and Fabrication: ASTM C 858.
   c. Structural Design Loading: ASTM C 857, class as applicable.

4. Accessories:

   a. Duct Supports: Rigid PVC.
   b. Frames and Covers: Cast iron with cast-in legend.
   c. Sump Frame and Grate: FS RR-F-621, Type VII for frame and Type I for cover.
   d. Components: Pulling eyes in walls, pulling and lifting irons in floor, cable stanchions, arms and cable support insulators, ladder.

END OF SECTION 16119

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SECTION 16120 – ELECTRICAL WIRES AND CABLES

A. PROJECT INCLUDES

1. Wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts and less.

B. QUALITY ASSURANCE

2. Compliance: National Electrical Code; UL 4, 83, 486A, 486B, 854; NEMA/ICEA WC-5, WC-7, WC-8; IEEE 82.

C. PRODUCTS

1. Wire Components:

   a. Conductors for Power and Lighting Circuits: Solid or Stranded conductors for No. 10 AWG and smaller; stranded conductors for No. 8 AWG and larger.

   b. Conductor Material: Copper. .

   c. Insulation: THHN/THWN for conductors size 500MCM and larger and No. 8 AWG and smaller, THW, THHN/THWN or XHHW insulation for other sizes based on location.

   d. Jackets: Factory-applied nylon or PVC.

2. Cables:

   a. Portable Cord for Flexible Pendant Leads to Outlets and Equipment: UL Type SO.

   b. Control/Signal Transmission Media: Single conductor, coaxial type, or others as required by the equipment manufacture.

   c. Fiber Optic Cables: Single channel low-loss glass type, fiber optic multimode graded-index cables, including connectors, couples, transmitters, receivers, sources and detectors.

3. Connectors: UL listed connectors for the appropriate cable type with appropriate temperature ratings.

END OF SECTION 16120

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SECTION 16140 – ELECTRICAL WIRING DEVICES

A. PROJECT INCLUDES

1. Wiring devices for electrical service.

B. QUALITY ASSURANCE

1. Compliance: National Electrical Code, NEMA WD 1, and UL.

C. PRODUCTS

1. Wiring Devices and Components:

a. Receptacles: UL 498 and NEMA WD 1.

b. Industrial Receptacles: UL 498 pin and sleeve type; UL 1010 at hazardous locations.

c. Ground-Fault Interrupter (GFI) Receptacles: Feed-thru type ground-fault circuit interrupter with integral duplex receptacles.

d. Plugs: 15 amperes, 125 volts, 3 wire, grounding, armored cap plugs.

e. Plug Connectors: 15 amperes, 125 volts, bakelite-body armored connectors, 3 wire, grounding with cord clamp.

f. Snap Switches: UL 20 and NEMA WD 1, AC switches.

g. Combination Switch and Receptacles: 3-way switch, 20 amperes, AC with toggle switch handle, 3 wire grounding receptacle, 15 amperes, 120 volts.

h. Wall Plates: Single and combination types, stainless steel.

END OF SECTION 16140

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SECTION 16400 – ELECTRICAL SERVICE AND DISTRIBUTION

A. PROJECT INCLUDES

1. Electrical service and distribution including service entrance, switchboards, low-voltage power switchgear, grounding, transformers, busways, panelboards, overcurrent protective devices, and motor controllers.

B. PRODUCTS

1. Service Entrance: Service and Distribution Requirements: Refer to project “E” series drawings.

   a. Circuit Breakers: Solid-state trip circuit breakers.

   b. Meter Sockets: Acceptable to local utility company.

   c. Switches: Heavy-duty safety switches with NEMA Type 4X enclosure.

2. Switchboards:

   a. Refer to: SECTION 16402 – LOW VOLTAGE GROUP MOUNTED DISTRIBUTION

3. Low-Voltage Power Switchgear:

   a. Refer to: SECTION 16402 – LOW VOLTAGE GROUP MOUNTED DISTRIBUTION

4. Grounding:

   a. Grounding Equipment: UL 467; copper conductors; NEC Table 8, and article 250 wire and cable conductors; connectors.

   b. Grounding Electrodes: Copper-clad steel ground rods; copper plate electrodes.

5. Transformers:

   a. Control and Signal Transformers: NEMA ST 1, UL 506, self-cooled, two-winding dry type; continuous duty rating.

6. Busways if shown:

   a. Busways: General-purpose plug-in type, ANSI/UL 857, NEMA BU 1, enclosed, non-ventilated, suitable for indoor installation, copper conductors.

   b. Plug-In Devices: Circuit breaker plugs, fusible switch plugs, fuse plugs, combination starter plugs; compatible with connected busway.

7. Panelboards:

a. Panelboards: NEMA PB 1, UL 50, 61, with overcurrent protective devices, enclosure suitable for use, copper bus, compression type main and neutral lugs, IEEE C62.1 surge arresters.

b. Panelboard Type: Load-center-type panelboards; lighting and appliance branch circuit panelboards; distribution panelboards.

8. Overcurrent Protective Devices:

a. Overcurrent Protective Devices: Integral to panelboards, switchboards, and motor control centers.

b. Cartridge Fuses: NEMA FU 1, class suitable for use.

c. Fusible Switches: UL 98, NEMA KS 1, rating suitable for use.

d. Fused Power Circuit Devices: UL 977, operation suitable for use; ground fault protection; open fuse trip device; minimum fault current rating suitable for use.

e. Molded Case Circuit Breakers: UL 489, NEMA AB 1; combination circuit breaker and ground fault circuit interrupters type; current-limiting circuit breaker type; integrally fused circuit breaker type; solid-state trip device circuit breaker type; rating suitable for use.

f. Insulated Case Circuit Breakers: UL 489, NEMA AB 1; rating suitable for use.

9. Fuses:

a. Cartridge Fuses: ANSI/IEEE FU 1, nonrenewable cartridge type, non-interchangeable type.

10. Motor Controllers:

a. Refer to: SECTION 16482, MOTOR-CONTROL CENTERS and SECTION 16456, VARIABLE FREQUENCY DRIVES.

END OF SECTION 16400

SECTION 16402-LOW VOLTAGE SWITCHBOARDS GROUP MOUNTED DISTRIBUTION

A. SECTION INCLUDES

1. Low Voltage, Front-Accessible and Front/Rear-Accessible switchboards with circuit breaker for mains and feeders and/or fusible switches for mains as specified below and shown on the contract drawings.

B. RELATED SECTIONS

1. 16479 Transient Voltage Suppression Systems.

C. REFERENCES

1. The low voltage switchboards and protection devices in this specification are designed and manufactured according to latest revision of the following standards (unless otherwise noted).

   a. ANSI 61

   b. ANSI/NEMA PB 2, Deadfront Distribution Switchboards

   c. ANSI/NEMA PB 2.1, General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less

   d. ANSI/NFPA 70, National Electrical Code

   e. NEMA AB 1, Molded Case Circuit Breakers and Molded Case Switches

   f. NEMA KS 1, Fused and Non - fused Switches

   g. UL 489, Molded Case Circuit Breakers and Circuit Breaker Enclosures

   h. UL 891, Dead Front Switchboards

   i. UL 98, Enclosed and Dead Front Switches

   j. UL 977, Fused Power Circuit Devices

D. DEFINITIONS

1. Front-Accessible only shall be as defined by UL 891 standard which requires that all line and load connections for phase, neutral, and ground conductors can be

made and maintained from the front of the switchboard without access to the rear.

E. SYSTEM DESCRIPTION

1. The power system feeding Switchboard MDP#3 is 277/480 volts, 60 Hertz, 3 phase, 4-wire, solidly grounded Wye.

2. Switchboard(s) shall have front access and rear alignment for mounting against a wall.

F. SUBMITTALS

1. Manufacturer shall provide 3 copies of the following documents to owner for review and evaluation in accordance with general requirements of Division 16.

a. Product Data on specified product;

b. Shop Drawings on specified product;

c. Trip curves for each specified product.

G. INSTALLATION, OPERATION AND MAINTENANCE DATA

1. Manufacturer shall provide 3 copies of installation, operation and maintenance procedures to owner in accordance with general requirements of Division 16.

H. QUALITY ASSURANCE (QUALIFICATIONS)

1. Manufacturer shall have specialized in the manufacture and assembly of low voltage switchboards for 25 years or more.

2. Low voltage switchboards shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in Article C-1 of this specification.

3. Equipment shall be qualified for use in seismic areas as follows:

a. High seismic loading as defined in IEEE Std 693-1997, with 1.33 amplification factor.

I. DELIVERY, STORAGE, AND HANDLING

1. Contractor shall store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.

2. Ship each switchboard section in individual shipping splits for ease of handling. Each section shall be mounted on shipping skids and wrapped for protection.

3. Contractor shall inspect and report concealed damage to carrier within 48 hours.

4. Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation.

5. Contractor shall handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices, and finish.

J. PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

1. Follow (standards) service conditions before, during and after switchboard installation.

2. Low voltage switchboards shall be located in well - ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials. Ambient temperature of area will be between minus 30 and plus 40 degrees C. Indoor locations shall be protected to prevent moisture from entering enclosure.

K. WARRANTY

1. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of installation or 18 months from date of purchase, whichever occurs first.

L. FIELD MEASUREMENTS

1. Contractor shall make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in National Electrical Code.

M. MANUFACTURER

1. General Electric Company products have been used as the basis for design. Other manufacturers' products of equivalent quality, dimensions and operating features may be acceptable, at the Engineer's discretion, if they comply with all requirements specified or indicated in these Contract documents.

N. EQUIPMENT

1. The equipment shall contain the following components and features.

a. Refer to Contract Drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; interrupting and withstand ratings of devices, buses, and components; and other required details.

b. Furnish GE Type Spectra Bolt-On™ Switchboards (or approved equal).

c. Switchboards shall be fully self-supporting structures with 90 inch tall vertical sections (excluding lifting eyes and pull boxes) bolted together to form required arrangement.

d. Switchboard frame shall be die formed, 12 gauge steel with reinforced corner gussets. Frame shall be rigidly bolted to support cover plates (code gauge steel), bus bars and installed devices during shipment and installation.

e. All sections may be rolled, moved or lifted into position. Switchboards shall be capable of being bolted directly to the floor without the use of floor sills.

f. All switchboard sections shall have open bottoms and removable top plate(s) to install conduit.

g. Front-Access only switchboard sections shall be rear aligned for placement against a wall.

h. Switchboards shall be UL listed, and MSB-3 shall be Service Entrance rated.

i. Switchboards that are series rated to short circuit requirements shall be appropriately labeled. Tested UL listed combination ratings shall be included in UL recognized Component Directory (DKSY2).

j. All covers shall be fastened by hex or standard screw head bolts. No special tools shall be required to access this equipment.

k. Provide hinged doors over metering compartments and individually mounted device compartments. All doors shall have concealed hinges and be fastened by hex or standard screw head bolts.

l. Switchboard protective devices shall be furnished as listed on drawings and specified herein, including interconnections, instrumentation and

control wiring. Switchboards and devices shall be rated for the voltage and frequency listed on the drawings.

m. Switchboard current ratings, including all devices, shall be based on a maximum ambient temperature of 25 degree C per UL Standard 891. With no derating required, temperature rise of switchboards and devices shall not exceed 65 degrees C in a 25 degree C ambient environment.

n. Switchboard Service Entrance sections shall comply with UL Service Entrance requirements including a UL service entrance label, incoming line isolation barriers, and a removable neutral bond to switchboard ground for solidly grounded Wye systems.

o. The group mounted feeder breaker and/or main devices within switchboards shall be circuit breakers only. Mounting for the group mounted devices shall be by bolted connections. No plug-in type connections shall be used for current carrying components.

2. Incoming Section

a. Incoming section shall be direct cable connection to main breaker.

b. Furnish switchboard arranged for bottom entry of incoming cable.

c. Provide mechanical lugs in the quantity and size required per the contract drawings. All lugs shall be tin-plated aluminum and UL listed for use with copper cable. Lugs shall be rated for 75 degree C. Cable.

3. Bus Bars

a. All bus bars shall be silver plated copper. The bus bars shall have sufficient cross sectional area to meet UL 891 temperature rise requirements. Phase and neutral bus ampacity shall be as shown on the plans. The neutral bus shall have the same ampacity as the phase bus.

b. Bus bars shall be mounted on high impact, non-tracking insulated supports. Joints in the vertical bus are not permitted.

c. Bus bars shall be braced to withstand mechanical forces exerted during short circuit conditions as indicated in drawings, but in no case less than 100KA RMS SYM.

d. Bus joints shall be bolted with high tensile steel Grade 5 bolts. Belleville type washers shall be provided with aluminum bus. Welded connections are unacceptable.

e. Ground Bus shall be sized to meet UL 891. Ground bus shall extend full length of switchboard. Ground bus shall be copper.

f. A-B-C bus arrangement left to right, top to bottom, front to rear shall be used throughout to assure convenient and safe testing and maintenance. Where special circuitry precludes this arrangement, bus bars shall be labeled.

g. All feeder device line and load connection straps shall be rated to carry current rating of device frame (not trip rating).

h. The main incoming bus bars shall be rated for the main protection device frame size or main incoming conductors, if there is no main device.

i. Main horizontal bus bars shall be fully rated and arranged for future extensions.

4. Enclosure

a. Switchboard shall be NEMA 1 non walk-in deadfront construction or as indicated on drawings.

5. User Metering

a. Provide a UL listed and digital multifunction power monitor. The monitor case shall be fully enclosed and shielded

b. The monitor shall accept a voltage monitoring range of up to 600 volts, phase to phase. Monitor shall withstand 200% rated current continuously. It shall withstand 10X rated current for at least 3 seconds. Isolation shall be no less than 2500V AC. Surge withstand shall conform to IEEE C37.90.1,62.41 and IEEE 1000-4Shall have a standard ANSI C39.1 case mount.

c. The Monitor shall provide true RMS measurements of voltage, phase to neutral and phase to phase; current, per phase and neutral; real power, reactive power, apparent power, power factor and frequency. The Monitor must be capable of providing readings for both instantaneous and average readings.

1. The Monitor must also be capable of providing all single phase real, apparent, reactive power and power factor values.

2. The Monitor shall record and store total bi-directional energy. It shall include separate registers for positive and negative energy.

3. The Monitor shall record and store total bi-directional accumulated energy and total accumulated apparent energy.

4. The Monitor shall monitor max/min average demand values for all current and power readings. The demand interval shall be user programmable. Meter shall be model EPM6000 or approved equal.

6. Main Devices

a. Main device shall be individually mounted, draw out type, insulated case or AIR type circuit breaker, and 100% rated.

b. Tie device(s), if included, shall be the same as the main device.

c. Where indicated provide the following with the main device:

1. Electronic ground fault detection

2. Shunt trip

3. Undervoltage release

4. Auxiliary contacts

7. Feeder devices

a. Feeder devices shall be group mount molded case circuit breakers or when larger than 1200 amps shall be individually mounted insulated case circuit breakers. Provide devices as indicated on drawings.

b. All circuit protective devices shall have the following minimum symmetrical current interrupting capacity: 100kA, or as listed on the contract drawings.

c. Where indicated provide the following with the feeder device(s):

1. Shunt trip

2. Undervoltage release

3. Auxiliary contacts

4. Bell alarm

8. Molded Case Circuit Breakers

a. Furnish GE Spectra RMS™ Molded Case Circuit Breakers. Thermal magnetic molded case circuit breakers may be provided for trip ratings 150 amps and below.

b. Group mounted breakers shall be connected to the vertical bus by bolted connections.

c. Individually mounted molded case circuit breakers shall be stationary mounted.

d. Circuit breaker frames shall be constructed of a high-strength, molded, glass-reinforced polyester case and cover. Breakers shall have an overcenter, toggle handle-operated, trip free mechanism with quick make, quick break action independent of the speed of the toggle handle operation. The design shall provide common tripping of all poles. Breakers shall be suitable for reverse feeding.

e. Breakers shall have ON and OFF position clearly marked on escutcheon. Breakers shall include a trip-to-test means on the escutcheon for manually tripping the breaker and exercising the mechanism and trip latch.

f. Breakers shall include factory installed mechanical lugs. Lugs shall be UL listed and rated 75 or 60/75 degrees C as appropriate. Breakers shall be standard, or 80 percent rated.

g. Breakers larger than 400 amps shall use digital true RMS sensing trip units and a rating plug to determine the breaker trip rating.

h. Each main, feeder, and tie breaker with a frame size 400 amps and larger shall have digital electronic trip units.

i. Where indicated on the drawings, circuit breakers with trip ratings greater than 250 amperes to 1000 amperes shall be UL listed as 100 percent continuous duty rated.

9. Insulated Case Circuit Breakers

a. Insulated case circuit breakers shall be individually mounted.

b. Main and tie breakers shall be manually operated, draw out type mounting. Feeder breakers (larger than 1200 amps) shall be manually operated, stationary mounted.

c. Breakers shall be constructed of a high dielectric strength, glass reinforced insulating case. The interrupting mechanism shall be arc chutes. Steel vent grids shall be used to suppress arcs and cool vented gases. Interphase barriers shall be furnished as to isolate completely each pole.

d. Breakers shall contain a true two-step stored energy operating mechanism, which shall provide quick make, quick break operation with a maximum five-cycle closing time. Breakers shall be trip free at all times. Common tripping of all poles shall be standard.

e. Insulated Case circuit breakers shall be rated to carry 100 percent of their frame ampacity continuously.

f. A charging handle, close push-button, open push-button, and Off/On/Charge indicator shall be located on the breaker escutcheon and shall be visible with the breaker compartment door closed.

g. Where drawout breakers are specified, the drawout design shall permit the breaker to be withdrawn from an engaged position, to a test position, and to a disengaged position.

h. Breaker digital electronic trip units shall be as described in Article 10 below.

10. Digital Electronic Trip Unit For Circuit Breakers

a. Furnish GE MicroVersaTrip® Plus, or PM, or approved equal, digital electronic trip units as specified below.

b. Each main, feeder, and tie circuit breaker shall be equipped with a digital electronic trip unit. The trip unit shall provide protection from overloads, short circuits and ground faults (for Main circuit breaker). The protective trip unit shall consist of a solid state, microprocessor based programmer, tripping means, current sensors, power supply and other devices as required for proper operation.

c. As a minimum, the trip unit shall have the following protective functions:

1. Adjustable current setting or long time pickup;

2. Adjustable long time delay;

3. Adjustable instantaneous pickup;

4. Adjustable ground fault pickup and delay for main.

5. Adjustable short time pickup and delay.

d. As a minimum, the trip unit shall include the following features:

1. Long time and short time protective functions, if provided, shall have true RMS sensing technology.

2. Ground fault protective function, if provided, shall contain a memory circuit to integrate low level arcing fault currents with time, to sum the intermittent ground fault spikes.

3. High contrast liquid crystal display (LCD) unit shall display settings, trip targets, and the specified metering displays.

4. Multi-button keypad to provide local setup and readout of all trip settings on the LCD.

5. UL Listed interchangeable rating plug. It shall not be necessary to remove the trip unit to change the rating plug.

6. An integral test jack for testing via a portable test set and connection to a battery source.

7. A mechanism for sealing the rating plug and the trip unit.

8. Noise immunity shall meet the requirements of IEEE C37.90.

9. Display trip targets for long time, short time, and ground fault, if included.

10. The trip unit shall include the following metering functions, which shall be displayed on the LCD (if the manufacturers trip unit can not incorporate the specified functions, separate device(s) with equal function shall be provided for each breaker): Current, RMS, each phase.

11. Finish

a. All steel surfaces shall be chemically cleaned prior to painting.

b. Exterior paint color shall be ANSI 61 Light Gray over phosphate - type rust inhibitor.

12. Accessories

a. Provide the following UL listed accessories:

1. Integral, self-powered ground fault protection relay with mechanical ground fault indicator, test function, adjustable current pick - up and time delay, and current sensors as required. Ground fault relay shall have an internal memory circuit that integrates intermittent arcing ground faults with time.

2. Furnish nameplates for each device as indicated in drawings.
Color schemes shall be as indicated on drawings.

3. Provide Transient Voltage Surge Suppression system as specified in Section 16479.

13. EXAMINATION

a. The following procedures shall be performed by the Contractor.

1. Examine installation area to assure there is enough clearance to install switchboard.

2. Check concrete pads for uniformity and level surface.

3. Verify that Spectra Series™ switchboards are ready to install.

4. Verify field measurements that are as shown on Drawings and instructed by manufacturer.

5. Verify that required utilities are available, in proper location and ready for use.

6. Beginning of installation means installer accepts conditions.

14. INSTALLATION

a. Installation shall be performed by the Contractor.

1. Install per manufacturer's instructions.

2. Install required safety labels.

END OF SECTION 16402

Section 16430 – Uninterrupted Power Supply (UPS) Systems
Three-Phase Uninterruptible Power System

1.0 GENERAL

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for system components. Include dimensioned plans and elevations showing minimum clearances and installed features and devices.

1.1 SUMMARY

This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty three-phase, solid-state, scalable (field-upgradable) uninterruptible power system (UPS). The UPS shall provide high-quality AC power for sensitive electronic equipment.

1.2 STANDARDS

The UPS shall be designed in accordance with the applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.

- UL Standard 1778
- CSA 22.2, No. 107.1
- FCC Part 15, Class A
- IEC 61000-4-5
- National Electrical Code (NFPA-70)
- NEMA PE-1
- ISTA_1H

The UPS shall be UL and cUL listed per UL Standard 1778.

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements - UPS Module

A. Voltage. Input/output voltage specifications of the UPS shall be:
Rectifier Input: 480 volts, three-phase, 3-wire-plus-ground
Bypass Input: 480 volts, three-phase, 3-wire-plus-ground
Output: 480 volts, three-phase, 3-wire-plus-ground

B. Output Load Capacity. Specified output load capacity of the UPS shall be at least 150 kVA at 0.9 lagging power factor.

C. Scalable Output Capacity. UPS rated output capacity will be scalable by means of a software update; which will require no hardware modifications to the UPS. Models will be available in capacity ranges of 150 to 200kVA. 150kVA model will be scalable from 150kVA to 200kVA

D. Parallel Operation. Up to four (4) UPS module outputs may be connected together in parallel to provide up to 3X maximum output capacity with redundancy.
Current Sharing: When multiple UPS modules are connected in parallel and powering a common load, each UPS module output current will not differ by more than 5% of the rated full load current of one UPS module.

1.3.2

Design Requirements - Battery

A. Battery Cells: Valve-regulated, lead acid batteries.

B. Reserve Time: 20 minutes at 150 kVA, 0.9 power factor, with ambient temperature of 77°F (25°C). Unit shall provide terminal for connection of external batteries.

C. Recharge Time: to 95% capacity within ten (10) times discharge time.

1.3.3 Modes of Operation

The UPS shall be designed to operate as an on-line, double-conversion, reverse-transfer system with the following operating modes:

A. Normal - The critical AC load is continuously supplied by the UPS inverter. The rectifier/charger derives power from an AC source and supplies DC power to the inverter while simultaneously float-charging the reserve battery.

B. Emergency - Upon failure of utility AC power, the critical AC load is supplied by the inverter, which obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.

C. Recharge - Upon restoration of utility AC power after a utility AC power outage, the rectifier/charger shall automatically restart and assume the inverter and battery recharge loads.

D. Bypass - If the UPS must be taken out of service for maintenance or repair or if the inverter overload capacity is exceeded, the static transfer switch shall perform a reverse transfer of the load from the inverter to the bypass source with no interruption in power to the critical AC load.

E. Eco-Mode - When this mode is enabled by service personnel the UPS will power the critical load through the UPS static bypass. If the bypass source becomes unqualified the UPS will switch to Normal mode of operation as defined above. Utility power is considered unqualified when either the input voltage varies more than +10% of rated voltage or the input frequency varies beyond +10% of 60Hz. Ten (10) minutes after the bypass source becomes qualified the UPS will automatically transfer to Eco-Mode of operation.

1.3.4 Performance Requirements

1.3.4.1 AC Input to UPS

A. Voltage Configuration for Standard Units: 480V, three-phase, three-wire plus ground

B. Voltage Range: +15%, -20% of nominal without derating

C. Frequency: 57-66 Hz

D. Power Factor: >0.99 at nominal input voltage and full-rated UPS output load
>0.98 at nominal input voltage and half-rated UPS output load

E. Inrush Current: UPS inrush current not to exceed 1.5 times rated input current. Maintenance bypass and distribution cabinet inrush current not to exceed 8 times rated input current.

F. Current Limit: 140% of nominal AC input current maximum

G. Current Distortion: <3% reflected THD maximum at full load

H. Surge Protection: Sustains input surges without damage per criteria listed in IEC 1000-4-5

1.3.4.2 AC Output, UPS Inverter

A. Voltage Configuration: three-phase, 3-wire plus ground

B. Voltage Regulation:

±1% three-phase RMS average for a balanced three-phase load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature and load power factor

±2% three-phase RMS average for a 100% unbalanced load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature and load power factor.

Frequency: Nominal frequency ±0.05% for single unit
±0.25% for paralleled units

C. Frequency Slew Rate: Selectable from 0.1Hz/sec to 3.0Hz/sec maximum for single unit
Fixed maximum of 0.2Hz/sec for paralleled units

D. Phase Displacement:
±0.5 degree for balanced load
±1.0 degrees for 100% unbalanced load

E. Bypass Line Sync Range:
±2.0 Hz, field-selectable ±0.5 to 5.0 Hz

F. Voltage Distortion:
1% total harmonic distortion (THD) for linear loads
<5% THD for 100% nonlinear loads (3:1 crest factor) without kVA/kW derating

G. Load Power Factor Range: 0.7 lagging to 1.0 leading without derating

H. Output Power Rating: Rated kVA at 0.9 lagging power factor

I. Overload Capability:
110% for 1 hour
125% for 10 minutes
150% for 1 minute

J. Voltage Transient Response:
100% load step ±5.0%
Loss or return of AC input power ±1.0%

K. Transient Recovery Time: to within 2% of output voltage within one cycle

L. Voltage Unbalance: 100% unbalanced load, ±2%

1.4 ENVIRONMENTAL CONDITIONS

The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:

A. Operating Ambient Temperature
UPS Module: 32°F to 104°F (0°C to 40°C)
Battery: 77°F ±9°F (25°C ±5°C)

B. Storage/Transport Ambient Temperature
UPS Module: -13°F to 158°F (-25°C to 70°C)
Battery: -4°F to 92°F (-20°C to 33°C)

C. Relative Humidity
0 to 95%, non-condensing

D. Altitude
Operating: to 6,562 ft. (2000m) above mean sea level without derating. Linearly derated from 100% load at 6,562 ft. (2000m) to 88% load at 9,843 ft. (3000m).
Storage/Transport: to 40,000 ft. (12,200m) above mean sea level.

E. Audible Noise
Less than 69dB for 150-200kVA model

1.5 SUBMITTALS

1.5.1 Proposal Submittals

Submittals with the proposal shall include:

- System configuration with single-line diagrams
- Functional relationship of equipment including weights, dimensions and heat dissipation
- Descriptions of equipment to be furnished, including deviations from these specifications
- Size and weight of shipping units to be handled by installing contractor
- Detailed layouts of customer power and control connections
- Detailed installation drawings including all terminal locations

1.5.2 UPS Delivery Submittals

Submittals upon UPS delivery shall include a complete set of submittal drawings and one (1) set of instruction manuals that shall include a functional description of the equipment with block diagrams, safety precautions, instructions, step-by-step operating procedures and routine maintenance guidelines, including illustrations.

1.6 WARRANTY

1.6.1 UPS Module

The UPS manufacturer shall warrant the UPS module against defects in materials and workmanship for 12 months after initial startup or 18 months after ship date, whichever period expires first.

1.6.2 Battery

The battery manufacturer’s standard warranty shall be passed through to the end user.

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer Qualifications

A minimum of 20 years’ experience in the design, manufacture and testing of solid-state UPS systems is required. The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001:2000 certified.

1.7.2 Factory Testing

Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification.

2.0

PRODUCT

2.1 FABRICATION

2.1.1 Materials

All materials of the UPS shall be new, of current manufacture and high grade and shall not have been in prior service except as required during factory testing. All active electronic devices shall be solid-state. All power semi-conductors shall be sealed. Control logic and fuses shall be physically isolated from power train components to ensure operator safety and protection from heat. All electronic components shall be accessible from the front without removing sub-assemblies for service access.

2.1.2 Wiring

Wiring practices, materials and coding shall be in accordance with the requirements of the National Electrical Code, OSHA and applicable local codes and standards. All bolted connections of busbars, lugs and cables shall be in accordance with requirements of the National Electrical Code and other applicable standards. All electrical power connections shall be torqued to the required value and marked with a visual indicator.

Provisions shall be made in the cabinets to permit installation of input, output and external control cabling, using raceway or conduit. Provision shall be made for top and bottom access to input, output, bypass and DC connections. In conformance with NEC, connection cabinets shall provide for adequate wire bend radius. All copper busbars for customer power connections shall be tin plated for connection integrity.

2.1.3 Construction and Mounting

The UPS shall be in NEMA Type 1 enclosures, designed for floor mounting. The UPS shall be structurally adequate and have provisions for hoisting, jacking and forklift handling. Maximum cabinet height shall be 78.7 in. (2000mm).

2.1.4 Cooling

Cooling of the UPS shall be by forced air using a redundant fan configuration. Fan power shall be provided by the UPS.

The thermal design, along with all thermal and ambient sensors, shall be coordinated with the protective devices before excessive component or internal cabinet temperatures are exceeded. Air filters shall be located at the point of air inlet and be changeable.

2.2 COMPONENTS

2.2.1 Rectifier/Charger

2.2.1.1 General

The term rectifier/charger shall denote the solid-state equipment and controls necessary to convert AC to regulated DC for input to the inverter and for charging the battery.

2.2.1.2 AC Input Current Limiting

The rectifier/charger unit shall be provided with AC input current limiting whereby the maximum input current shall be limited to 140% of the full input current rating. Input current limit will be adjustable by service personnel to allow the UPS to be used with undersized feeder breakers.

2.2.1.3 DC Filter

The rectifier/charger shall have an output filter to minimize ripple current into the battery. The AC ripple voltage of the rectifier DC output shall not exceed 1% RMS of the float voltage. The filter shall be adequate to ensure that the DC output of the rectifier/charger will meet the input requirements of the inverter without the battery connected.

2.2.1.4 Automatic Rectifier Restart

Upon restoration of utility AC power, after a utility AC power outage and prior to a UPS automatic end-of-discharge shutdown, the rectifier/charger shall automatically restart and assume the inverter and battery recharge loads.

2.2.1.5 Battery Recharge

In addition to supplying power for the inverter load, the rectifier/charger shall be capable of producing battery charging current sufficient to replace 95% of the battery discharge power within ten (10) times the discharge time. After the battery is recharged, the rectifier/charger shall maintain the battery at full charge until the next emergency operation.

2.2.1.6 Overvoltage Protection

There shall be DC overvoltage protection so that if the DC voltage rises to the preset limit, the UPS will shut down automatically and initiate an uninterrupted load transfer to the static bypass line.

2.2.2 Inverter

2.2.2.1 General

The term inverter shall denote the equipment and controls to convert DC from the rectifier/charger or battery to precise AC to power the load. The inverter shall be solid-state, capable of providing rated output power, and for increased performance the inverter shall be a pulse-width-modulated design and utilize insulated gate bipolar transistors (IGBTs).

2.2.2.2 Overload Capability

The inverter shall be capable of supplying current and voltage for overloads exceeding 100%. The inverter is to provide 150% of full load for 1 minute, 125% of full load for 10 minutes and 110% of full load for 1 hour. A status indicator and audible alarm shall indicate overload operation. The UPS shall transfer the load to bypass when overload capacity is exceeded.

2.2.2.3 Fault Clearing and Current Limit

The inverter shall be capable of supplying an overload current of 150% of its full-load rating for one minute. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The critical load will be transferred to the static bypass automatically and uninterrupted. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective fuses.

2.2.2.4 Step Load Response

2.2.2.5 Voltage Distortion

Total harmonic distortion in the output voltage will not exceed 1% for 0% to 100% linear loads.

Total harmonic distortion in the output voltage will not exceed 4% for 0% to 100% non-linear loads.

Total harmonic distortion in the output voltage will not exceed 5% for 0% to 100% non-linear, unbalanced loads.

2.2.2.6 Phase Balance

Electronic controls shall be provided to regulate each phase so that an unbalanced loading will not cause the output voltage to go outside the specified voltage unbalance or phase displacement. With 100% load on one phase (and 0% load on the other two phases) or 100% load on two phases (and 0% load on the other phase), the voltage balance is to be within 2% and the phase displacement is to be 120 degrees within ±1.5 degrees.

2.2.2.7 Inverter Shutdown

For rapid removal of the inverter from the critical load, the inverter control electronics shall instantaneously turn off the inverter transistors. Simultaneously, the static transfer switch shall be turned on to maintain continuous power to the critical load.

2.2.2.8 Inverter DC Protection

The inverter shall be protected by the following disconnect levels:

- DC Overvoltage Shutdown
- DC Undervoltage Warning (Low Battery Reserve)—pre-warning time is adjustable
- DC Undervoltage Shutdown (End of Discharge)

2.2.2.9 Output Frequency

The output frequency of the inverter shall be controlled by a high-speed DSP capable of holding the inverter output frequency to within ±0.05% during steady state and transient conditions. Total deviation from the rated frequency, including short time fluctuations and drift, shall not exceed 0.05%.

2.2.3 Display and Controls

2.2.3.1 Monitoring and Control

The UPS shall be provided with a microprocessor-based unit status display and controls section designed for convenient and reliable user operation. A graphical liquid crystal display (LCD) shall be used to show a single-line diagram of the UPS and shall be provided as part of the monitoring and controls sections of the UPS. All operator controls and monitors shall be located on the front of the UPS cabinet. Monitoring functions such as metering, status and alarms shall be displayed on the graphical LCD. Additional features of the monitoring system shall include:

- Menu-driven display with pushbutton navigation
- Real-time clock (time and date)
- Alarm history with time and date stamp
- Memory with battery backup

2.2.3.2 Metering

The following parameters shall be displayed:

- Input AC voltage line-to-line
- Input AC current for each phase
- Input frequency
- Battery voltage
- Battery charge/discharge current
- Output AC voltage line-to-line
- Output AC current for each phase
- Output frequency
- Apparent power
- Active power
- Battery time left during battery operation

2.2.3.3

Alarm Messages

The following alarm messages shall be displayed:

Mains Voltage Abnormal
Mains Undervoltage
Mains Freq. Abnormal
Charger Fault
Battery Reversed
No Battery
Control Power 1 Fail
Parallel Comm. Fail
Bypass Unable To Track
Bypass Abnormal
Inverter Asynchronous
Fan Fault
Control Power 2 Fail
Unit Over Load
System Over Load
Bypass Phase Reversed
Transfer Time-Out
Load Sharing Fault
Parallel Connect Fault
Bypass Over Current
Output Ground Fault

2.2.3.4 Status Messages

The following UPS status messages shall be displayed:

Rectifier (Off / Soft Start / Main Input On / Battery Input On)
Input Supply (Normal Mode / Battery Mode / All Off)
Battery Self Test (True / False)
Input Disconnect (Open / Closed)
EPO (True / False)
Charger (On / Off)
Output Disconnect (Open / Closed)
Maint. Disconnect (Open / Closed)
Bypass Disconnect (Open / Closed)
Inverter (Off / Soft Start / On)
Bypass (Normal / Unable To Trace / Abnormal)
Output Supply (All Off / Bypass Mode / Inverter Mode / Output Disable)
Inverter On (Enable / Disable)

2.2.3.5 Controls

UPS startup, shutdown and maintenance bypass operations shall be accomplished through pushbutton controls on the front panel. Menu-driven user prompts shall be provided to guide the operator through system operation without the use of additional manuals. Pushbuttons shall be provided to display the status of the UPS and to test and reset visual and audible alarms. A mimic screen shall be available on the LCD to depict a single-line diagram of the UPS with switch positions and power flow.

2.2.3.6 On-Line Battery Test

The UPS shall be provided with a menu-driven On-Line Battery Test feature. The test shall ensure the capability of the battery to supply power to the inverter while the load is supplied power in the normal mode.

2.2.4 Static Transfer Switch

2.2.4.1 General

A static transfer switch and bypass circuit shall be provided as an integral part of the UPS. The static switch shall be a naturally commutated high-speed static (SCR-type) device rated to conduct full load current continuously. The switch shall have an overload rating to clear a 20-ampere load branch circuit breaker.

The static transfer switch control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals and operating and alarm conditions. This control circuit shall provide an uninterrupted transfer of the load to an alternate bypass source without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS or to bypass the UPS for maintenance.

2.2.4.2 Uninterrupted Transfer

The transfer control logic shall automatically turn on the static transfer switch, transferring the critical AC load to the bypass source, after the transfer logic senses any of the following conditions:

- Inverter overload capacity exceeded
- Critical AC load overvoltage or undervoltage
- UPS fault condition

The transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if any of the following conditions are present:

- Bypass frequency out of limits
- Bypass out-of-synchronization range with inverter output

2.2.4.3 Uninterrupted Retransfer

Retransfer of the critical AC load from the bypass source to the inverter output shall be automatically initiated unless inhibited by manual control. The transfer control logic shall inhibit an automatic retransfer of the critical load to the inverter if one of the following conditions exists:

- Bypass out of synchronization range with inverter output
- Inverter/bypass voltage difference exceeding preset limits
- Overload condition exists in excess of inverter full load rating
- UPS fault condition present

2.2.5 Maintenance Bypass Switch

2.2.5.1 General

A manually operated maintenance bypass switch shall be incorporated into the UPS cabinet to directly connect the critical load to the bypass AC input power source, bypassing the rectifier/charger, inverter and static transfer switch.

2.2.6 Battery Cabinet

The battery cabinet shall include ten (10) year design life, valve-regulated, lead-acid battery cells housed in a separate cabinet that matches the UPS cabinet styling to form an integral system lineup. All battery cell inter-connects shall utilize bolted connections, and all batteries shall include copper, inserted terminal posts allowing connector torque of 110 in-lb (12.4 Nm). Battery cells shall be mounted on slide-out trays for ease of maintenance. A battery disconnect circuit breaker shall be included for isolation of the battery pack from the UPS module. Casters and leveling feet shall also be provided with the battery cabinet for ease of installation. When the application calls for the battery cabinet to be bolted to the UPS cabinet, an interconnecting cable kit will be available, precut and pre-lugged.

2.2.7 Optional Accessories

2.2.7.1 Web Card

Provides communication outputs to indicate a change of status of the UPS. Outputs are provided for:

- SNMP
- HTML - Web page
- Allow use of network management systems

2.2.7.2 Matching Maintenance Bypass and Distribution Cabinet

A make-before-break maintenance bypass with Solenoid Key Release Unit (SKRU) interlock shall be available in a cabinet that matches and may be bolted up to the UPS. Installation of the cabinet shall not affect the cooling ability of the UPS. Thermal-magnetic breakers shall be provided for bypass and maintenance isolation.

2.2.7.3 Remote Alarm Panel

The remote alarm panel shall have LED alarm lights. An audible alarm shall sound upon any alarm condition. The surface- or flush-mounted NEMA 1 enclosed panel shall indicate:

- Load on UPS LED
- Load on Bypass LED
- Battery Discharging LED
- Low Battery Warning LED
- UPS Alarm Condition LED
- New Alarm Condition LED (For a Second UPS Alarm Condition)
- Audible Alarm with Reset pushbutton
- Lamp Test/Reset pushbutton
-
- EXECUTION

2.3 FIELD QUALITY CONTROL

The following inspections and test procedures shall be performed by factory-trained field service personnel during the UPS startup.

2.3.1 Visual Inspection

- Inspect equipment for signs of damage.
- Verify installation per drawings.
- Inspect cabinets for foreign objects.
- Verify neutral and ground conductors are properly sized and configured.
- Inspect battery cases.
- Inspect battery for proper polarity.
- Verify all printed circuit boards are configured properly.

2.3.2 Mechanical Inspection

- Check all control wiring connections for tightness.
- Check all power wiring connections for tightness.
- Check all terminal screws, nuts and/or spade lugs for tightness.

2.3.3 Electrical Inspection

- Check all fuses for continuity.
- Confirm input and output voltage and phase rotation is correct.
- Assure connection and voltage of the battery string(s).

MANUFACTURER'S FIELD SERVICE

2.3.4 Service Personnel

The UPS manufacturer shall directly employ a nationwide service organization consisting of factory-trained field service personnel dedicated to the startup and maintenance of UPS and power equipment.

The manufacturer shall provide a national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours a day, 7 days a week, 365 days a year. If emergency service is required, on-site response time shall be four hours or less within 150 miles of a Services center.

Two local customer engineers shall be assigned to the site with a regional office as a backup. Escalation procedures shall be in place to notify Power Technical Support if a site is not functioning within 24 hours.

2.3.5 Replacement Parts Stocking

Parts shall be available through an extensive network to ensure round-the-clock parts availability throughout the country.

Spare parts shall be stocked by local field service personnel with backup available from national parts center and the manufacturing location. A national parts center Customer Support Parts Coordinator shall be on call 24 hours a day, 7 days a week, 365 days a year for immediate parts availability.

2.3.6 Maintenance Contracts

A complete offering of preventive and full-service maintenance contracts for both the UPS system and battery system shall be available.

2.3.7 Automated Site Monitoring

The UPS manufacturer shall provide as an option an automated site-monitoring service. This service shall be staffed by a qualified support person 24 hours a day, 7 days a week, 365 days a year. At the detection of an alarm within the UPS, the controls shall initiate communications with the monitoring service. The monitoring service shall be capable of interpreting the communicated alarms to allow dispatch of a service engineer.

End of Section

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Division 16440 Section Automatic Transfer Switches

PART 1 GENERAL

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 16 (26).

1.01 Scope

Furnish and install automatic transfer switches (ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

1.02 Acceptable Manufacturers

Automatic transfer switches shall be ASCO, General Electric, Liebert/Emerson, Siemens, or Square D. See general and supplementary conditions and Division-1 Specification sections for the way to provide alternates and the way to provide documentation for approvals.

1.03 Codes and Standards

The automatic transfer switches and accessories shall conform to the requirements of:
A. UL 1008 - Standard for Automatic Transfer Switches
B. NFPA 70 - National Electrical Code
C. NFPA 110 - Emergency and Standby Power Systems
D. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
E. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
F. NEC Articles 700, 701, 702
G. International Standards Organization ISO 9001

PART 2 PRODUCTS

2.01 Mechanically Held Transfer Switch

A**.** The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.

B**.** The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C**.** All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.

E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

F. Where neutral conductors must be switched, the ATS shall be provided with fully rated neutral transfer contacts.

G. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated Copper pressure connectors shall be provided.

2.02 Microprocessor Controller with Membrane Interface Panel

A. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent serial communications capability. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

B. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.

C. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
1. ANSI C37.90A/IEEE 472 Voltage Surge Test
2. NEMA ICS – 109.21 Impulse Withstand Test
3. IEC801-2 Electrostatic discharge (ESD) immunity
4. ENV50140 and IEC 801 – 3 Radiated electromagnetic field immunity
5. IEC 801 – 4: Electrical fast transient (EFT) immunity
6. ENV50142: Surge transient immunity
7. ENV50141: Conducted radio-frequency field immunity
8. EN55011: Group 1, Class A conducted and radiated emissions
9. EN61000 –4 – 11 Voltage dips and interruptions immunity

2.03 Enclosure

A. The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.

B. Provide strip heater with thermostat for Type 3R enclosure requirements.

C. Controller shall be flush-mounted display with LED indicators for switch position and source availability. It shall also include test and time delay bypass switches.

PART 3 OPERATION

3.01 Voltage and Frequency Sensing

A. The voltage of each phase of the normal source shall be monitored, with pickup adjustable to 95% of nominal and dropout adjustable from 70% to 90% of pickup setting.

B. Single-phase voltage and frequency sensing of the emergency source shall be provided.

C. All settings shall be adjusted prior to final review of ATS.

3.02 Time Delays

A. An adjustable time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.

B. An adjustable time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.

C. An adjustable time delay shall be provided on retransfer to normal, adjustable to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.

D. A 5-minute cooldown time delay shall be provided on shutdown of engine generator.

E. All adjustable time delays shall be field adjustable without the use of tools.

3.03 Additional Features

A. A set of gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

B. A push-button type test switch shall be provided to simulate a normal source failure.

C. A push-button type switch to bypass the time delay on transfer to emergency, the engine exerciser period on the retransfer to normal time delay whichever delay is active at the time the push-button is activated.

D. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal.

E. Auxiliary contacts, rated 10 amps, 480 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact, closed, when the ATS is connected to the emergency source.

F. Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red). Also provide indicating lights for both normal and emergency source availability.

G. Terminals shall be provided to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.

H. Engine Exerciser - An engine generator exercising timer shall be provided, including a selector switch to select exercise with or without load transfer.

I. Phase Monitor - A Phase monitor shall be inherently built into the controls. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The phase monitor shall be specifically designed for and be the product of the ATS manufacturer.

J. Selective Load Disconnect - A double throw contact shall be provided to operate after a time delay, adjustable to 20 seconds prior to transfer and reset 0 to 20 seconds after transfer. This contact can be used to selectively disconnect specific load(s) when the transfer switch is transferred. Output contacts shall be rated 6 amps at 28 VDC or 120 VAC.

Optional Accessories (Options have to be approved by Owner's Representative)
K. Communications Interface - A full duplex RS485 interface to provide remote monitoring and control by communications products.

L. Programmable Engine Exerciser - A seven day electronic time switch for automatic weekly testing of the engine - generator set. The exerciser shall be fully programmable and backed up by a permanent battery.

M. Enclosure Heater - A 125 watt enclosure heater with transformer and thermostat (adjustable from 30° to 140 ° F).

N. Networked Computer Monitoring System
A PC based Automatic Transfer Switch (ATS) monitoring system designed to communicate with other ATSs located in remote locations shall be provided. System shall utilize serial communications capability inherent with the ATS microprocessor-based control panel product offering.

PART 4 ADDITIONAL REQUIREMENTS

4.01 Withstand and Closing Ratings

A. The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. WCR ATS ratings as be as follows when used with specific circuit breakers:

	ATS Size Withstand & Closing	
Rating MCCB	AIC Rating	W/CLF
30 – 200A	22,000A	200,000
225 – 400A	42,000A	200,000
600 – 1200A	65,000A	200,000
1600 – 2000A	85,000A	200,000
2600 – 3000 A	100,000A	200,000

4.02 Tests and Certification

A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.

4.03 Service Representation

A. The ATS manufacturer shall maintain a national service organization of company employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

C**.** For ease of maintenance and parts replacement, the switch nameplate shall include drawing numbers, part numbers for main coil and control.

End of Section

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SECTION 16441 QUICK-CONNECT GENERATOR DOCKING STATIONS

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the low-voltage docking station as specified herein and as shown on the contract drawings.

1.02 RELATED SECTIONS

1.03 REFERENCES

A. The switches and all components shall be designed, manufactured and tested in accordance with the latest applicable standards:
   1. NEMA KS-1
   2. UL 98

1.04 SUBMITTALS – FOR REVIEW/APPROVAL

A. The following information shall be submitted to the Engineer:
   1. Dimensioned outline drawing
   2. Conduit entry/exit locations
   3. Switch ratings including:
      a. Short-circuit rating
      b. Voltage
      c. Continuous current
   4. Cable terminal sizes
   5. Product data sheets

1.05 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:
   1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process

1.06 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of three (3) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.07 REGULATORY REQUIREMENTS

A. The connection docking system shall bear a UL label.

1.08 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton / Cutler-Hammer products

B. ✎Trystar

C. ✎Siemens

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer and Owner's Representative ten (10) days prior to bid date.

2.02 HEAVY-DUTY DOCKING STATION

A. Provide switches as shown on drawings, with the following ratings:
   1. 1600 amperes
   2. 250 volts ac, dc; 600 volts ac
   3. 4 poles.
   4. Mechanical lugs suitable for aluminum or copper conductors.

B. Construction
   1. Docking Station shall be equipped with a separate interlocked receptacle compartment containing receptacles for quick-connection and disconnection of portable cord-connected equipment.
      a. Interlock shall prevent the lower generator switch from being closed while cable compartment door is open, and shall prevent the door from being opened while the switch is closed.
      b. Compartment shall be equipped with a spring-assisted door to allow portable cords to exit the compartment while in use, but shall close when not in use to effectively seal the compartment to prevent insects and small animals from entry.
      c. Compartment shall be equipped with receptacles for sufficient cable connection for the ampacity of the switch.
      d. Receptacles for switches 200 amps and greater shall be of the single cable per phase design – utilizing quarter turn cam type connections.

e. Receptacles shall be: Either *Posi-Lok* or *Cam-Lok* type. 1600 amp switches shall employ parallel receptacles.

2. Renewal parts data shall be shown on the inside of the door

C. Enclosures

1. All enclosures shall be NEMA 3R rainproof
2. Paint color shall be ANSI 61 gray or “Owner’s Representative’s” Choice.

D. The following factory modifications are to be included:

1. *Plastic* or *Phenolic* nameplates
2. Special paint color as request by “Owner’s Representative.”
3. Lock ON provisions
4. Key interlock system
5. Factory installed neutral assemblies
6. Factory installed copper lugs
7. Factory installed auxiliary contacts
8. Cover mounted controls indicating lights, selector switches, or pushbuttons.
9. Factory installed UL listed switching neutral bonding kit for 3 or 4pole systems that require a switching neutral.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

3.02 INSTALLATION

A. The equipment shall be installed per the manufacturer’s recommendations and all NEC and local code requirements.

3.03 WARRANTY

A. The equipment and installation shall have a fully comprehensive 3 year warranty which includes all labor, materials, travel expenses, and training.

End of Section

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Division 16443 Disconnect Switches

Introduction
Disconnect switches shall be used where required to meet OSHA standards for a disconnecting means within line of sight and no more than fifty feet of the actual piece of equipment being controlled.
1. All disconnect switches shall be heavy duty motor rated switches.
2. All disconnect switches required for compliance with OSHA shall be lockable.
3. A disconnect switch is not to be used as a substitute for a motor starter but should be used in conjunction with all motor starters where required as a disconnecting means.

Part 1 - General
• Acceptable manufacturer's should include GE, Square D, Cutler Hammer, Allen Bradley and approved equal. Try to accommodate the County by matching existing manufactured products.

Part 2 - Products
• Safety switches shall be heavy-duty motor rated with fuses provided to protect downline equipment where required.
• Switches shall be fused, if required.
• The extra fuses (minimum of 2 per phase) shall be supplied by the contractor.
• The neutral shall be switched.
• NEMA 3R Environments shall be specified as NEMA 3R/12 gasketed.

Part 3 - Execution
• The maximum mounting height for safety switches should be 6'0" to the top. Safety switches should be rigidly mounted in place.
• Must be readily accessible per NEC
• Label per NEC Requirements and specification documents.

End of Section

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SECTION 16456 - VARIABLE FREQUENCY DRIVES

A. SECTION INCLUDES

1. This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.

2. Qualifications:

   a. VFDs and options shall be UL listed as a complete assembly. VFD's that require the customer to supply external fuses for the VFD to be UL listed are not acceptable. The base VFD shall be UL listed for 100 KAIC without the need for input fuses.

3. Submittals shall include the following information;

   a. Outline dimensions, conduit entry locations and weight.
   b. Customer connection and power wiring diagrams.
   c. Complete technical product description and include a complete list of options provided.

4. The VFD package as specified herein shall be enclosed in a UL Listed Type 12 enclosure, completely assembled and tested by the manufacturer in an ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.

   a. Environmental operating conditions: 0 to 40 C continuous. VFD's that can operate at 40 C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.

5. All VFDs shall have the following standard features:

   a. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.

   b. The backlit LCD display keypad shall include Hand-Off-Auto selections and manual speed control. The display shall be in complete English

words for programming and fault diagnostics (alpha-numeric codes are not acceptable), and shall display: Output Frequency, Motor Speed (RPM, %, or Engineering units), Motor Current, Calculated Motor Torque, Calculated Motor Power (kW), DC Bus Voltage and Output Voltage. The drive shall incorporate “bumpless transfer” of speed reference when switching between “Hand” and “Auto” modes. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.

c. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.

d. The VFD’s shall utilize pre-programmed application macro’s specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.

e. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required. To extend the fan and bearing operating life, operating temperature will be monitored and used to cycle the fans on and off as required.

f. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).

g. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.

h. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The

minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.

i. The VFD shall have an integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD's with only one DC reactor shall add AC line reactors.

j. The input current rating of the VFD shall be no more than 3% greater than the output current rating. VFD's with higher input current ratings require the upstream wiring, protection devices and source transformers to be oversized per NEC 430-2.

k. The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.

l. The VFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

m. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.

n. The VFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.

6. All VFD's to have the following adjustments:

a. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.

b. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering

a transmitter supplied by others. The PID setpoint shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process (ie. valves, dampers, etc.). All setpoints, process variables, etc. to be accessible from the serial communication network. The setpoints shall be set in Engineering units and not require a percentage of the transducer input.

c. Two (2) programmable analog inputs shall accept current or voltage signals.

d. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.

e. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices.

f. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. Default settings shall be for run, not faulted (fail safe), and run permissive. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true form C type contacts; open collector outputs are not acceptable.

g. Seven (7) programmable preset speeds.

h. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.

i. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.

j. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows the highest carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.

k. The VFD shall include password protection against parameter changes.

7. Serial Communications

a. The VFD shall have an RS-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2 bus, and be capable of communicating with the existing building control systems.

b. The VFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface.

c. The VFD shall include an independent PID loop for customer use.

8. EMI/RFI Filters.

a. All VFD's shall include EMI/RFI filters. All VFD's through 50HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad.

9. If shown in drawings, optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.

a. A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor. Overload protection and shall be provided in both drive and bypass modes.

b. Door interlocked, padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.

c. Fused VFD only disconnect (service switch). Fast acting fuses exclusive to the VFD – fast acting fuses allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability.

d. The drive / bypass shall provide single-phase motor protection in both the VFD and bypass modes.

e. The following operators shall be provided: Bypass Hand-Off-Auto, Drive mode selector, Bypass mode selector, and Bypass fault reset.

f. The following indicating lights (LED type) shall be provided. A test mode or push to test feature shall be provided: Power-on (Ready), Run enable (safeties) open, Drive mode select damper opening, Bypass mode selected, Drive running, Bypass running, Drive fault, Bypass fault, Bypass H-O-A mode, Automatic transfer to bypass selected, Safety open, Damper opening, Damper end-switch made.

g. The following relay (form C) outputs from the bypass shall be provided: System started, System running, Bypass override enabled, Drive fault, Bypass fault (motor overload or underload (broken belt)), Bypass H-O-A position.

h. The digital inputs for the system shall accept 24V or 115VAC (selectable). The bypass shall incorporate internally sourced power supply and not require an external control power source.

i. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, or Bypass modes. The remote start/stop contact shall operate in VFD and bypass modes.

j. The VFD shall include a “run permissive circuit” that will provide a normally open contact whenever a run command is provided (local or remote start command in VFD or bypass mode). The VFD system (VFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch. When the VFD system safety interlock (fire detector, freezestat, high static pressure switch, etc) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the damper or valve.

k. Class 20 or 30 (selectable) electronic motor overload protection shall be included.

l. There shall be an internal switch to select manual or automatic bypass.

10. Installation and power wiring shall be completed by the electrical contractor. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

11. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

12. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll free phone number.

13. Acceptable Manufacturer is ABB.

END OF SECTION

SECTION 16479 – TRANSIENT VOLTAGE SURGE SUPPRESSION

A. SECTION INCLUDES

1. Transient voltage surge suppression systems integrated into electrical distribution equipment.

B. RELATED SECTIONS

1. 16400 Low Voltage Switchgear

2. 16402 Low Voltage Group Mounted Switchboards

3. 16482 Motor Control Centers.

C. REFERENCES

1. The equipment and components in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted).

   a. ANSI/IEEE C62.41.1-2002, Guide on the Surge Environment in Low Voltage AC Power Circuits.

   b. ANSI/IEEE C62.41.2-2002, Recommended Practice on Characterization of Surges in Low Voltage AC Power Circuits.

   c. ANSI/IEEE C62.45-2002, Recommended Practice on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits.

   d. UL 1449, Third Edition - Transient Voltage Surge Suppressors

   e. UL 1283, Electromagnetic Interference Filters

   f. UL 67, Panelboards

   g. UL 891, Dead-Front Switchboards

   h. NEMA LS-1 (1992), Low Voltage Surge Protective Devices

   i. NFPA 70 National Electrical Code – Article 285

D. SYSTEM DESCRIPTION

1. Transient voltage surge suppression devices shall be applied on a 277/ 480 volt, 60 Hertz, 3 phase, 4- wire, solidly grounded WYE system, as indicated on drawings.

E. SUBMITTALS

1. Manufacturer shall provide 3 copies of the following documents to owner for review and evaluation.

   a. Product Data on specified product:

      1. Maximum surge current rating
      2. Repetitive surge current rating
      3. UL1449 Third Edition Suppressed Voltage Ratings

   b. Upon request, provide copies of third party test reports for maximum surge current rating and repetitive surge current rating.

F. INSTALLATION, OPERATION AND MAINTENANCE DATA

1. Manufacturer shall provide 3 copies of installation, operation and maintenance procedures to owner.

2. Transient voltage surge suppression systems shall be listed/or recognized by Underwriters Laboratories in accordance with the applicable standards found in Section C-1 of this specification. UL recognized TVSS assemblies are allowed provided they have been investigated by UL as suitable for use within the specified electrical panel or gear and do not require additional testing or field investigation to maintain the equipment’s UL listing.

3. Manufacturer warrants equipment to be free from defects in materials and workmanship for 5 years from date of purchase.

G. PRODUCTS

1. General Electric Company products have been used as the basis for design. Other manufacturers' products of equivalent quality, dimensions and operating features may be acceptable, at the Engineer's discretion; if they comply with all requirements specified or indicated in these Contract documents.

2. Furnish General Electric internally or external mounted TVSS systems as indicated in drawings.

3. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; and other required details.

   a. Electrical Requirements

      1. The maximum surge current rating shall be based on testing of a complete TVSS unit including fuses and all components that make up the TVSS system. Devices that derive a maximum surge current rating by adding test results of individual components are not acceptable.

      2. The TVSS device repetitive surge current capacity shall be tested utilizing an 8x20us, 10kA short circuit Category C High test waveform (as defined by ANSI/IEEE C62.41.2-2002) at one-minute intervals. A failure is defined as either performance degradation or more than 10% deviation of clamping voltage at the specified surge current

      3. Maximum surge current and repetitive surge current ratings shall be as follows:

         For Switchgear and switchboards rated 1600A and greater:
         a. Maximum surge current rating: 150/300kA per mode.
         b. Repetitive surge current rating: 20,000 C High impulses.

         For Motor Control Centers rated 1200A and below:
         a. Maximum surge current rating: 150 kA SCCR.
         b. Repetitive surge current rating: 5,000 C High impulses

         For Lighting panels rated 1200A and below:
         a. Maximum surge current rating: 65 kA per mode.
         b. Repetitive surge current rating: 5,000 C High impulses

      4. The Suppression Voltage Rating (SVR) shall be tested in accordance with UL-1449, Third Edition. Where an integral disconnect is provided, the TVSS SVR shall be determined with the integral disconnect. The SVR values shall not exceed the following: L-N, N-G, L--G-800; L-L--1500.

      5. The TVSS fault current rating shall be marked on the TVSS in accordance with the requirements of UL1449 and NEC Article 285.

6. The use of electronic grade MOV's is not acceptable. Systems using gas tubes, silicon avalanche diodes, selenium rectifiers, or printed circuit board technology in surge current path are not acceptable.

7. The TVSS shall provide protection in each of the following modes: L-N, L-G, N-G, and L-L for WYE Systems. L-G and L-L for Delta Systems.

8. The Maximum Continuous Operating Voltage (MCOV) for all voltage configurations shall be at least 115% of nominal on 480/277 volt systems and 125% of nominal on 240-208/120 volt systems.

9. The fusing system shall be capable of allowing the rated maximum surge current to pass through without fuse operation. Systems utilizing a fusing system that opens below the maximum surge current level are unacceptable. The complete TVSS fusing system shall be included in the surge current testing.

10. TVSS systems shall include integral fusing for all suppression components. TVSS designs that rely solely on an electrical panel's main breaker to interrupt phase currents resulting from a shorted suppression component are not allowed.

11. Use of plug-in modules, gas discharge devices or selenium rectifiers is unacceptable.

12. TVSS installed in switchgear, switchboards, and power panels shall have an integral non-fused disconnect, tested to the maximum surge current rating of the device. TVSS installed in lighting panels shall be direct connected to the main bus.

13. Standard Monitoring features

    a. One operational status indicating light per each protected phase.
    b. Audible alarm and alarm indicating light and test switch, enabled via a front panel pushbutton switch.
    c. Dry contacts for remote monitoring purposes, 1NO & 1NC contact. Change in state on MOV failure.
    d. Transient voltage surge counter with battery backup.

b. Mounting

1. TVSS shall be mounted integral or external, and shall not violate the equipment manufacturer's UL label.

END OF SECTION

SECTION 16500 STANDBY GENERATOR SETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The Conditions of the Contract and applicable requirements of Divisions 0 and 1 and Section, “Electrical General Provisions”, govern this Section.

1.2 DESCRIPTION OF WORK:

A. Work Included: Provide standby engine-driven generator set work as shown, scheduled,
indicated, and as specified.

B. Type: The type of standby engine-driven generator set**[s]** required for the project include, but are not limited to, diesel engine-driven generator sets.

1.3 STANDARDS:

A. Equipment shall comply with applicable sections of the latest edition of the following standards:

1. NEC.
2. NFPA 37 and NFPA 110.
3. IEEE.
4. NEMA.
5. ANSI.
6. TCEQ Requirements (EPA Tier Levels for Non-Road Engines) Latest effective requirements.

1.4 QUALITY ASSURANCE:

A. Manufacturers: Provide products complying with these specifications and produced by one
of the following:

1. Caterpillar Tractor Company.
2. Cummins Power Generation/Onan Corporation..
3. Detroit Diesel Allison Division.
4. Kohler Company.
5. Stewart & Stevenson.

6. Waukesha-Pearce Industries.

B. NEC and NFPA Compliance: Comply with applicable portions of the NEC (NFPA 70) including, but not limited to, emergency and standby power generation systems and with NFPA 37, "Installation and Use of Stationary Combustion Engines and Gas Turbines", and
NFPA 110, "Emergency and Standby Power Systems".

C. IEEE Compliance: Comply with applicable Institute of Electrical and Electronics Engineers,
Inc. (IEEE) standards pertaining to generator construction.

D. Emissions Compliance: The generator set engine shall comply with all applicable Florida Department of Environmental Affairs Regulations and Requirements for Bradenton and shall comply with all applicable EPA Tier Levels for Non-Road Engines that is currently in effect for the Sarasota-Bradenton area.

E. Testing:

1. The entire generator system shall be assembled on the

factory test bed and shall be submitted to the full factory standard test to demonstrate automatic operation, start time, full capacity acceptance, regulation, motor starting capability and function of all system safeties, prior to shipping to the job site. System shall be tested at 0.8 pf. A strip chart recording shall be made of each unit to verify frequency, voltage transient, and output power.
2. The reporting form for the factory test shall be submitted to the Engineer for review with the Shop Drawings submittal and the Engineer shall be notified a minimum of one month prior to the factory test so that an Owner's Representative can witness the test. The factory shall perform the test in the Tampa Bay area or shall provide lodging and air-fare to accomidate the Owner's Representative to view the test.
F. Performance Tests: The performance tests of the generating set series shall be in accordance with procedures certified by an independent testing laboratory. The manufacturer shall have successfully tested a prototype of the generating set series offered which shall include:
1. Maximum power level.
2. Maximum motor starting capacity.
3. Structural soundness.
4. Torsigraph analysis per MIL-STD-705B, Method 504.2.
5. Fuel consumption.
6. Engine-alternator cooling airflow.
7. Transient response and steady state governing.
8. Alternator temperature rise per NEMA MG1-22.40.
9. Single step load pickup per NFPA 76A-822.
10. Harmonic analysis and voltage waveform deviation per MIL-STD-705B, Method 601.4.
11. Three-phase short circuit test for mechanical and electrical strength.
G. Manufacturer: The system shall be built, tested, and shipped by the manufacturer of the
Standby Electric Power System, who has been engaged in the production of enginealternator
sets and associated controls for a minimum of 10 years, so there is one source of supply and responsibility.
H. Warranty: All equipment bearing a manufacturer's guarantee, such as electrical equipment, devices, components, and similar items, shall be construed to have a 5 year parts, travel, and labor guarantee to the Owner by the manufacturer. Any such equipment that proves
defective in materials or workmanship within the guarantee period is to be replaced by the Contractor in accordance with the manufacturer's guarantee.

1.5 SUBMITTALS:
A. Shop Drawing submittals shall include, but not be limited to, the following:
1. A written description of the system operation (written the this specification format) with all
exceptions and/or deviations clearly hi-lited or identified.
2. Completely identified and marked catalog cuts of all associated equipment and devices, with all non-applicable items crossed out, and applicable equipment or devices clearly hi-lited or identified.
3. A written description of the maximum "starting" and "running" kVAs and kWs of the system equipment (charts and graphs will not be acceptable).

4. A floor plan sketch complete with a dimensional description of the standby electric power system and associated equipment, locating the system equipment and accessories within the allotted space.
5. Interconnection wiring diagrams to indicate terminal connections between the remote alarm annunciator panel and the electric set.
6. Complete bill of material for all equipment.
7. Complete warranty information as specified.
8. A notarized letter from the system supplier certifying compliance with all requirements of this Specification.
9. Performance test as specified in Paragraph 1.04/E of this Section.
10. Additional information as required in Section 16002.

1.6 STORAGE AND HANDLING:
A. The standby generator set(s) shall be stored at the factory until they must be shipped to the job site to prevent building construction delay.
B. The standby generator set(s) shall be crated and covered to protect it from damage during shipment and subsequent storage at the job site.

PART 2 - PRODUCTS

2.1 ENGINE-GENERATOR SETS:
A. General: Provide a new natural gas outdoor rated engine-driven generator set, complete with safety devices**,**main output breaker, weatherproof enclosure and vibration isolators. Installation shall be complete with all necessary fuel connections, radiator cooling and engine exhaust from the building. Supply, return and vent line, natural gas piping are specified under plumbing, Engine exhaust piping, silencer and exhaust system installation, cooling air supply and exhaust ductwork and dampers. Unit shall be capable of continuous standby service.
B. Design Basis: The standby generator set(s) specified and shown on the Drawings is based on a Caterpillar generator and selected from data derived from manufacturer's engineering manuals.
C. System Capacity: The engine-generator set, as a unit, shall be rated for a continuous standby capacity of 350 kW and 479 kVA at 0.8-PF, with an output of 1214 amperes while generating **[**208Y/120] volt, 3-phase, 4-wire, 60 Hz power, and with performance as specified herein.
1. The engine generator set short circuit current response shall be adequate for first cycle tripping of circuit breakers and clearing of fuses, and the motor generator set shall be capable of developing 350 kW and 479 kVA for motor starting with a maximum voltage dip of **15%** and while complying with the performance requirements specified herein.

2. A permanent magnet generator (PMG) or equal shall provide excitation power to the automatic voltage regulator for immunity from voltage distortion caused by nonlinear SCR controlled loads on the generator. The PMG shall sustain main field excitation power for optimum motor starting and to sustain short circuit current for selective operation and coordination of system overcurrent devices. Alternator rating with PMG: With ( ) motor starting kVA applied to the alternator, the maximum voltage dip shall be 30%, and comply with the performance requirements specified herein.

D. Natural Gas Engine: Engine shall be a 4 cycle, turbocharged/aftercooled or normally aspirated engine, water-cooled with mounted water pump. Following items shall be included:
1. Valves: Intake and exhaust valves shall be heat-resisting alloy steel, free rotating. Exhaust valve seat inserts shall be replaceable.
2. Battery Charging: Belt-driven engine alternator; 24 volt negative ground 35 amp dc, with
transistorized voltage regulator.
3. Governor: Hydraulic or electronic speed-sensing governor capable of
isochronous frequency regulation from no load to full rated load. Speed droop shall be externally adjustable from isochronous to 5%.
4. Filters: Air cleaner**,** fuel and lube oil filters shall have replaceable elements + clear glass.
5. Starting System: Remote 24 volt, 2-wire, negative ground, starting system, positive shift, gear engaging electric starter, cranking limiter.
6. Lubrication System: Forced feed gear design lube oil pump; full pressure lubrication to all bearings; dual, full flow oil filters; oil level indicator; low oil pressure shutdown; lube oil cooler; and oil pressure gauge.

2. Cooling System: The cooling system shall be [unit mounted] radiator cooled, selfsealing prelubricated coolant pump; belt driven pusher fan with wire guard; thermostat temperature control; high coolant temperature shutdown; low coolant level shutdown; intercooler. The cooling system shall be tested for leaks. As soon as the system has been tested, it shall be filled with ethylene glycol rust inhibiting and antifreeze solution sufficient to protect the system to -10°F. Engine-driven pusher type cooling fan shall be sized to maintain safe operation at 122°F maximum ambient temperature. Airflow restriction from static pressure at the radiator discharge shall not be more than 0.5" of water.
3. Emissions Compliance: The generator set engine shall comply with all applicable Florida Department of Environmental Affairs Regulations and
Requirements for Bradenton and shall comply with all applicable EPA Tier
Levels for Non-Road Engines that is currently in effect for the Sarasota-Bradenton area at the time of installation.
E. Set Characteristics: Set manufacturer shall certify that reserve horsepower is available from
the engine with all accessories operating in the ambient conditions hereinbelow. The natural gas
engine-generator set shall be capable of picking up 100% of nameplate kW and power factor,
less applicable derating factors, in one step with the engine-generator set at operating temperature, in accordance with NFPA 110, Paragraph 5.13.2.6, and including the following
constraints:
1. Ambient conditions of 50' altitude and an ambient temperature of
10 to 122°F.
2. The BMEP of a turbocharged engine producing rated generator capacity shall not exceed 306 psi for four cycle engines and 225 psi for two cycle engines.
3. The rpm of the engine shall not exceed 1800 rpm and the engine piston speed shall not exceed 2000'per minute.
F. Engine Protective Devices:

1. The engine protective devices shall provide automatic shutdown for overcrank, overspeed, high coolant temperature and low oil pressure. A low coolant level protective device shall be provided but shall alarm only and not initiate engine shutdown
2. The high coolant temperature and low oil pressure shall have pre-shutdown signals.
3. The overcrank alarm shall be the output of a solid-state cranking device preset at a 10 second cranking cycle and a 15 second rest cycle. If the engine fails to start on the third cranking cycle, the overcrank alarm shall sound and cranking shall stop. Unit shall be capable of repeating the above cranking cycle after the trouble has been cleared.
G. Generator: Generator shall be 4-pole, revolving field type, brushless, dynamically balanced,
skewed laminated, two thirds pitch wound, rotating rectifier exciter, temperature compensated solid-state voltage regulator, open dripproof, single bearing, permanently aligned generator connected to engine with flexible disc coupling, including the following:
1. NEMA Class F or better insulation as defined by NEMA MG1.65.
2. Temperature rise at rated load within NEMA MG1-22.40 definition.
3. Double-sealed ball bearings, lubricated for life.
4. Direct-drive centrifugal blower cooling.
5. A 120 volt, single phase space heater shall be provided to prevent condensation in the generator.
6. AC output leads shall be brought out to field connection busbars accessible through removable plates in the generator output junction box.
7. The automatic voltage regulator shall be a solid state design and include overvoltage and undervoltage protection functions. The voltage regulator shall be equipped with 3-phase RMS sensing. The regulator shall control buildup of ac generator voltage to provide a linear rise and limit overshoot. Overvoltage protection shall sense the ac generator output voltage and in the event of regulator failure or loss of reference, shutdown regulator output on a sustained overvoltage of one second duration. Over excitation protection shall sense regulator output and shutdown regulator output if overloads exceed 10 seconds duration. Both overvoltage and over excitation protection shutdowns shall be latched, requiring generator set shutdown to reset.

H. Generator Output Circuit Breaker(s): Generator set shall have 3 pole output circuit breaker(s) with solid state trip units as shown on the drawings. Breaker frame and trip ratings shall be as shown on the drawings. Breakers serving emergency and standby loads shall have breaker position indicating contacts. Breaker position indicating contacts shall be wired to initiate a generator control panel alarm when the breaker is open or tripped. Circuit breaker manufacturer and type for all breakers serving emergency and standby loads shall
match the project electrical gear package to provide compatibility for selective coordination required by the NEC.

I. Engine/Generator Set Performance:
1. Frequency Regulation: Isochronous from no load to full rated load.
2. Voltage Regulation: Plus 2% no load to rated load; rheostat for _5% voltage adjustment.
3. Voltage Dip: Instantaneous voltage dip shall be less than 15% of rated voltage when full, 3-phase load and rated power factor is applied to the generator. Recovery to stable operation shall occur within 5 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant with _1% of rated voltage. All unit performance characteristics shall be verified using an oscilloscope.

4. Total Harmonic Distortion (THD): The sum of ac voltage waveform harmonies, from no load to full linear load shall not exceed 5% of the rated voltage (L-N, LL, L-L-L) and no single harmonic shall exceed 3% of rated voltage. Telephone Influence Factor (TIF) shall be less than 50 per NEMA MG1-22.43. Temperature rise at rated load and powerfactor shall be within NEMA MG1-22.40 definition.
input current to 100 amps when operating on generator power.
7. Voltage Dip Performance: A light beam oscilloscope test for the specific generator set, by model and serial number shall be provided for the **[**four] step loads listed hereinbelow. Certified test results shall be reported via a strip chart recorder and submitted with generator factory test results.
a. 0% to 25% kW load at 0.4 lagging PF.
b. 0% to 50% kW load at 0.4 lagging PF.
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c. [0% to 75% kW load at 0.4 lagging PF.]
d. [0% to 100% kW load at 0.4 lagging PF.]
J. Engine-Generator Instrument Panel: The instrument panel shall be mounted on vibration
isolators and shall have dc controls, ac controls, and panel lighting. The top of the instrument
panel shall not be more than 6'-6" above finished floor.
1. DC engine controls (2-wire, 24 volt system) including but are not limited to run-stopautomatic
test-manual switch, remote start-stop terminals, oil pressure gauge, coolant temperature gauge, charge rate ammeter and running time hour meter.
2. Solid state engine monitoring system with monitors in accordance with NEC Section 700,
NFPA 110 and local code requirements with lamps, audible alarm**,**lamp test switch, individual alarm contacts and a common alarm contact for:
a. Overcrank shutdown
b. Low coolant temperature warning
c. Pre-warning for high engine temperature
d. High engine temperature shutdown
e. Pre-warning for low lube oil pressure
f. Low lube oil pressure shutdown
g. Overspeed shutdown
i. Low coolant level warning
j. Generator (EPS) supplying load.
k. Generator control switch not in auto position warning
l. High battery voltage warning
m. Low cranking voltage warning
n. Low battery voltage warning
o. Battery charger failure
p. Generator output breaker(s) open warning
q. [Motorized damper(s) not open warning (Level 2 only)]
r. [Customer alarm]
s. [Customer alarm]
t. [Customer alarm]
3. [Provide two dry auxiliary contacts one for common alarm and one for engine

running to be monitored by the BAS.]
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4. AC output controls include, but are not limited to, an ac voltmeter; ac ammeter; voltmeter-ammeter phase selector with an "off" position; voltage adjusting rheostat; frequency meter; manual reset exciter circuit breaker and fine speed control potentiometer.
5. Two sets of double pole auxiliary contacts shall change state when engine starts; [both
sets shall be spare] [one set shall be monitored by the BAS and on set is spare] [one set shall de-energize damper motor operators (Level 2 only) and one set is spare.]
K. Accessories:
1. Remote Annunciator(s): **[**Flush] [Surface] mounted remote annunciators shall be [hardwired] [microprocessor based annunciator with network communication] type, located as shown on the Drawings, and shall have audible and LED visual signal devices, powered by the electric set lead acid battery set, to provide a warning of derangement or alarm conditions in the electric set in compliance with the National Electrical Code Section 700, NFPA 110 level 1, 20 lamp and the requirements of these Specifications. The enclosure shall be constructed of sturdy sheet steel with white finish, and shall have removable front panel and adapter ring for flush mounting. The face of the front panel shall contain LED's (visual signals), and audible alarm, an alarm silence push button, and a LED test push button. The internal wiring, terminal block, and battery voltage sensors shall be accessible by removing the front panel of the enclosure. Remote annunciators shall indicate the following conditions:
a. Visible and audible alarm for:
1) Overcrank shutdown
2) Low coolant temperature warning
3) Pre-warning for high engine temperature
4) High engine temperature shutdown
5) Low lube oil pressure shutdown
6) Overspeed shutdown
7) Low coolant level warning
8) Generator control switch not in auto position warning
9) Low cranking voltage warning
10) Low battery voltage warning
11) Generator output breaker(s) open warning
12) Generator power available
13) [Spare/Customer alarm] [Low fuel in main tank warning]
14) [Spare/Customer alarm] [Fuel in outer tank]
University of Houston Master Construction Specifications
Insert Project Name
AE Project Number: Engine Generators 26 32 13 – 10
Revision Date: 1/29/2014
15) [Spare/Customer alarm] [Motorized damper(s) not open warning (Level 2 only)]
16) Spare/Customer alarm
17) Spare/Customer alarm
18) Spare/Customer alarm

19) Spare/Customer alarm
b. Visible indicator for:
1) Battery voltage okay.

2. Jacket-Water Heater: The engine shall have **[**one] [two] [KIM #Hotstart (480 volt, 1-phase)] [KIM #Hotstart (208 volt, 1-phase)] or approved equal, **[**5000W] jacket-water heater**[s]** supplied from a "normal" branch circuit. The jacket-water heater shall be complete with a thermostat capable of maintaining a water temperature of 25°C, with an ambient temperature of 0°C. A water temperature alarm, consisting of a contact closed when the jacket water temperature is below 20°C, shall be supplied.
3. Exhaust System: Exhaust silencer(s) of the ["critical"] type, with side or end inlet as [required shall be shipped pre-installed and piped on top of the generator enclosure.] [shown on the Electrical Drawings, shall be provided by this Contractor for installation by the Electrical Contractor as recommended by the generator set manufacturer.] The exhaust silencer(s) shall be of chambered construction and shall provide maximum degree silencing, and shall be sized to assure proper operation without excessive back pressure when installed in the exhaust system. The exhaust silencer(s) shall be supplied with condensation drains, flexible exhaust tubing, wall thimbles and rain caps, as required.
4. Starting Batteries: Furnish and install fully charged 24 volt lead acid, impact resistant, storage batteries mounted on the unit or on a separate rack. Batteries shall have sufficient capacity for 60 seconds of continuous cranking per NFPA 99. Provide all required battery cables, connections, electrolyte and a battery hydrometer.
5. Solid-State Battery Float Charger: A suitable 120 volt automatic SCR voltage regulated
battery charger with a maximum charge rate, as recommended by the manufacturer, but not less than 10 amperes shall be provided to maintain each set of batteries at full capacity during standby conditions The maximum charging time to bring the batteries up to full charge shall not exceed 12 hours. The charger shall be provided with a remote alarm contact to indicate a charger failure condition. An ammeter shall indicate the charge rate and the circuit shall be protected by either fuses or circuit breakers. The charger shall be so designed that it will not be damaged during the engine cranking and shall be interlocked such that it is not damaged during generator set operation. The charger may be furnished as a separate item with necessary cables and leads.
6. Skid Base: The entire packaged unit shall be mounted on a skid base of welded structural steel, of box type construction suitable for mounting on spring vibration isolators. A sloped drip pan shall be provided for containing engine fluid spills. Provisions for stub up of electrical and fuel connections shall be within the footprint of the generator set base rails.
8. Painting: The entire engine generator set shall have all exposed metal surfaces primed
with a rust inhibiting primer and multiple finish coats of the manufacturer's standard machinery enamel finish.
9. [Generator Outdoor Housing: Provide a weatherproof and rodent-proof outdoor shelter to entirely enclose each generator set, including batteries. Silencers shall be installed [on] [inside] enclosure. Enclosure shall have a fixed intake louver with bird screen [and motorized damper (Level 2 only)] and a grill protected radiator discharge opening. [Motor-operated intake dampers shall be interlocked to open on unit start-up and close on unit shutdown (Level 2 only).] Enclosure shall have hinges and gasketed access doors and access panels to allow complete unit operation and maintenance without removal of the enclosure. All

doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted [in a color selected by the Architect] [in the manufacturer's standard color.]
10. [Generator Set Mounted Load Bank: Provide a factory installed load bank in the radiator discharge airstream and factory wired to a separate generator output breaker for generator load testing. Protective screening/enclosure for the load bank shall be provided as required to suit the project generator installation. Load bank kW and circuit breaker frame and trip shall be as shown on the drawings.]
PART 3 - EXECUTION
3.1 INSTALLATION OF ENGINE-DRIVEN GENERATOR SETS:
A. General: Install standby engine-driven generator sets where shown, in accordance with the
equipment manufacturer's written instructions and recognized industry practices, to ensure
that the sets comply with the specified requirements and serve the intended purposes.
B. Standards: Comply with NEMA standards, requirements of the NEC and applicable portions
of NECA's "Standard of Installation" pertaining to installation of standby engine-driven generator sets and accessories.
C. Vibration Mounts: Install units on properly sized inertia base **with** spring type vibration mounts and ribbed neoprene vibration isolators; comply with manufacturer's indicated installation method as applicable.
D. Concrete Pad: Install generator set inertia base on at least a 6" reinforced concrete pad. The generator pad shall extend 6" beyond the generator set [inertia] base, unless shown otherwise. Furnish the exact position of any block-outs, mounting bolts, and the dimensions and location of the generator pad in a timely manner so as to prevent delay of the concrete work. Refer to Section 26 05 01, "Basic Materials and Methods", for additional requirements.]
E. Steel Frame: Install generator set on a steel frame, refer to structural drawings. Furnish the exact position of any block-outs, mounting bolts, and the dimensions and location of the generator with general contractor in a timely manner so as to prevent delay of the frame work installation. Refer to Section 26 05 01, "Basic Materials and Methods", for additional requirements.

F. Wiring: All feeders/conduits for generator and emergency power feeders shall be installed as follows:
1. Horizontal feeder/conduits shall be installed below grade, below a slab on grade, be enclosed in an approved 2 hour enclosure or utilize UL listed 2 hour rated conductors. Where a 2 hour enclosure is required, coordinate enclosure with the General Contractor.
2. Vertical feeders/conduits shall be installed in a 2 hour rated chase or room, be enclosed in an approved 2 hour enclosure or utilize UL listed 2 hour rated conductors.. Where a 2 hour enclosure is required, coordinate enclosure with the General Contractor.

3.2 GROUNDING:
A. General: Install the generator(s) as a separately derived system. Do
not ground the generator neutral to the generator frame. Ground the generator frame through the feeder grounding conductor. Refer to Section 26 05 26, "Grounding and Bonding for Electrical Systems", for additional requirements.

3.3 CONTROL WIRING:

A. General: Provide generator [start-up] control wiring from each [automatic transfer switch to each standby generator set.
B. Annunciators: Provide control wiring to remote generator annunciators in locations specified and as shown on the Drawings.
C. Fuel Oil Control Wiring: Provide all control wiring from generator/day tank to remote fuel transfer pump control panel as shown on the drawings and as required. Verfiy if natural gas genset is ordered.
3.4 COORDINATION:
A. Exhaust: Exhaust piping shall be furnished, installed and insulated with the generator.This division shall furnish a ventilated wall thimble, exhaust flex connection(s), condensation trap, rain cap, and critical type silencer for installation and insulation under Division 23. All exhaust piping shall be routed away from windows, no less than 25 ft. from air intakes.
B. Cooling Air: Cooling air supply and exhaust air ductwork and dampers shall be furnished and installed under electrical.

3.5 INITIAL START-UP AND SYSTEM CHECKOUT:
A. A complete installation shall be initially inspected, adjusted and started and checked out for operational compliance by representatives of the manufacturer. All start-up documentation shall be turned over to UH Utility Services.
B. The engine lubrication oil and antifreeze shall be provided by the supplier of the electric set for operation under environmental conditions as recommended by the manufacturer.

3.6 TESTING:
A. General: Upon completion of installation of engine-driven generator set(s**),** transfer switches and after building circuitry has been energized with normal
power source, test emergency power system to demonstrate standby capability and compliance with specified requirements, including automatic start-up, controls, and full load acceptance. Tests shall include operation of standby power system with voltage check while
the system is loaded to ensure proper operation of the emergency generator, transfer switches, and other system components. Operation of
the system shall simulate standby power conditions, that is, loss of main electrical power to the building. Test period shall be a minimum of 4 hours continuous troublefree operation with at least four automatic transfer switch operations for each switch within the period of operation.
B. Test Load: Testing shall be performed at 0.8 PF with loads as specified hereinbelow. Where the specific set has been factory tested at 0.8 PF as specified hereinbelow, field-testing may be performed at 1.0 PF. The supplier of the engine-generator set shall provide a load bank of sufficient capacity to complement the available building load for testing. The field test shall
include running the emergency power system under loads as specified below:
1. 30 minutes at 25% of rated load (field load bank).
2. 1hour at 50% of rated load (field load bank).
3. 4 hours at 75% of rated load (field load bank).
4. 4 hourss at 100% of rated load (field load bank).
5. Miscellaneous building loads may be used to supplement load bank.
C. Test Readings: The voltage current and frequency readings shall be recorded at 15 minute intervals throughout the test. Each automatic transfer switch shall automatically operate a minimum of four times during the test. There shall be a 15 minute unloaded

run at the conclusion of the test to allow engine to cool before shutdown. The Contractor shall make all necessary hook-ups to facilitate field-test and shall furnish all fuel necessary for field-testing.
Refer to Section 16020, "Electrical Testing", for additional testing requirements. UH Utility Services must be present during load testing.
D. Submittals: Contractor shall furnish all instruments and personnel required for tests. Submit four copies of certified test results to Architect for review. Test reports shall include date and time of test, relative humidity, temperature, and weather conditions. Contractor shall provide minimum 15% of replacement parts plus 3 spare filters.

3.7 OPERATOR TRAINING:
A. The manufacturer's start-up representative shall provide a minimum of 4 hours of operating and maintenance training to the Owner's maintenance personnel. Training shall be provided at times convenient to the Owner. Approved Operating and Maintenance Manuals shall be available to the Owner prior to the training session.
B. Instructions and Drawings: Complete instructions, consisting of operating and maintenance manuals, parts book, dimensional drawings, separate unit wiring diagrams and schematics and interconnecting wiring diagrams shall be provided as part of the project operating and maintenance manuals.

3.8 IDENTIFICATION:
A. General: Refer to Section , "Identification for Electrical Systems", for requirements concerning painting, nameplates, and labeling.

END OF SECTION

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SECTION 16515 - INTERIOR LIGHTING

A. PROJECT INCLUDES

1. Interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

B. QUALITY ASSURANCE

1. Compliance: NFPA 70 “National Electrical Code.”

C. PRODUCTS

1. Interior Lighting Components:

a. Fluorescent Fixtures: Fixtures, UL 1570; ballasts, UL 935, energy-saving, electronic, non-dimming type.

D. SCHEDULE

1. Interior Lighting Fixture Schedule: Refer to drawings for Fixture Schedule.

END OF SECTION

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SECTION 16520 - EXTERIOR LIGHTING

A. PROJECT INCLUDES

1. Exterior lighting, mounting heights, wind rated poles as recommended by manufacturer and signed and sealed by manufacturer's structural engineer.

B. QUALITY ASSURANCE

1. Compliance: NFPA 70 "National Electrical Code."

C. PRODUCTS

1. Exterior Lighting Components:

a. Exterior lighting, high-pressure sodium or HID, LED options, electronic ballast.

D. SCHEDULE

1. Exterior Lighting Fixture Schedule: Refer to drawings for Fixture Schedule.

END OF SECTION 16520

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SECTION 16660 - GROUND-FAULT PROTECTION SYSTEMS

A. PROJECT INCLUDES

1. Ground-fault sensing, relaying, tripping, and alarm devices for installation in distribution switchboards and panelboards rated 600 volts and less.

B. PRODUCTS

1. Ground-Fault Sensing Devices:

   a. Outgoing-Circuit Current Sensors: Current transformer with circuits requiring outgoing-circuit sensing method.
   b. Ground-Return Current Sensors: Current transformer for encircling main bonding jumper connection.
   c. Short Circuit Rating: 200,000 amperes RMS symmetrical.
   d. Outputs: Compatible with relay inputs.

2. Ground-Fault Relays and Monitors:

   a. Ground-Fault Relay: Solid-state type without external electrical power supply required for relay.
   b. Monitor Panels: Ground-fault indicators, control-power indicators, test and reset buttons.

END OF SECTION 16660

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SECTION 16721 - FIRE ALARM SYSTEMS

A. PROJECT INCLUDES

1. New Fire Alarm System for the Building.

B. QUALITY ASSURANCE

1. Compliance: NFPA 70, 71, 72, 72E, 72G, 72H.

C. PRODUCTS

1. Fire Alarm System Characteristics:

   a. Signal Transmission: Hard-wired individual circuits.
   b. Signal Transmission: Dedicated multiplex signal transmission.
   c. Audible Alarm Indication: Horns, bells, tone signals on loudspeakers, or voice alarm messages.

2. Fire Alarm System Components:

   a. Manual Pull Stations: Double-action type, metal or plastic.
   b. Smoke Detectors: UL 268, self-restoring type with visual indicator, photoelectric and ionization-types.
   c. Thermal Detectors: Fixed-temperature and rate-of-rise type.
   d. Fire Alarm Horns: Electric vibrating polarized type.
   e. Visual Alarm Devices: Dual-voltage strobe lights.

3. Voice/Tone Speakers: UL 1480 type.

   a. Device Location-Indicating Lights: System-voltage-indicating light.
   b. Fire Alarm Control Panel: UL 864 with lockable steel enclosure and alphanumeric display and system controls. (Existing)
   c. Graphic Annunciator: LED indicators on graphic building floor plan. (Existing)
   d. System Printer: Dot-matrix type.
   e. Transmitter: Auto-dialer type.
   f. Emergency Power Supply: Battery operated, 24-hour operation capacity.
   g. Line-Voltage and Low-Voltage Circuits: Solid copper conductors with rated insulation color-coded, installed in conduit.
   h. Conduit: Rigid steel, EMT type in interiors, galvanized rigid steel in exterior locations.

END OF SECTION