**TECHNICAL SPECIFICATIONS FOR THE CONSTRUCTION OF THE**

# ARLINGTON EAST WATER RECLAMATION FACILITY SWITCHGEAR REPLACEMENT

**BID SET**

**HAZEN PROJECT NO. 42000-006**

**AUGUST 2017**

**HAZEN AND SAWYER, P.C.**

JOSEPH B. PICKETT, PE
No. 74106
ELECTRICAL

**JEA**
**ARLINGTON EAST WATER RECLAMATION FACILITY**
**SWITCHGEAR REPLACEMENT**
**BID SET**
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SUMMARY OF WORK

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Work to be performed under this Contract shall consist of furnishing and installation of all tools, equipment, materials, supplies, manufactured articles, transportation and services, including fuel, power, water, and essential communications, for the performance of all labor, work, and/or other operations as required at the Arlington East Reclamation Facility (WRF) in strict accordance with the Contract Documents. The Work shall be complete, and all work, materials, and services not expressly shown or called for in the Contract Documents which may be necessary for the complete and proper construction of the Work in good faith shall be performed, furnished, and installed by the CONTRACTOR as though originally so specified or shown, at no increase in cost to JEA.

B. Wherever the Contract Documents address a third party, i.e., subcontractor, manufacturer, etc., it is to be considered as the CONTRACTOR through the third party.

C. Wherever a reference to number of days is noted, it shall be construed to mean calendar days.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The principal features of the Work to be performed under this Contract include, but not limited to, the following:

1. Temporary installation of power distribution switchboards, portable generator, and cables.

2. Replacement of existing low voltage switchgear.

3. Installation of new power panel, conduit, and wire.

4. Qualified Contractor’s representative on site 24 hours a day during time period plant is utilizing temporary electrical equipment.

5. Testing of temporary equipment prior to energizing, and testing of new equipment.

B. The foregoing description(s) shall not be construed as a complete description of all work required.

C. The Work set forth within these bid documents includes the furnishing of all labor, materials, equipment, services and incidentals for the construction of the improvements, as noted in the total bid including all mechanical, electrical, structural, and all appurtenant work, complete, tested and ready for operation, including temporary facilities required, all in conformance with Contract Document requirements.

D. All work shall be in compliance with all applicable federal, state and local laws and regulations, including those for materials that contain lead. All work shall meet OSHA compliance.

E. The Work shall be performed at the Arlington East WRF located at 1555 Millcoe Road, Jacksonville, Florida.

1.03 ABANDONMENT AND SALVAGE OF EXISTING FACILITIES

A. The scope of work requires the CONTRACTOR to interface with existing structures, mechanical equipment, electrical facilities and piping which will be abandoned or otherwise removed as part of the work. Prior to beginning any work associated with existing facilities to be abandoned, salvaged, or otherwise removed, the CONTRACTOR shall inform JEA of his intent so that all arrangements can be made with JEA for disconnecting electrical service (where appropriate), isolating pipelines (where possible) or otherwise removing existing facilities from service to the extent possible. The CONTRACTOR shall not proceed without written authorization from JEA.

B. Salvage: JEA may desire to salvage certain items of existing equipment which are to be dismantled and removed during the course of construction. All other items of equipment shall be disposed of off-site by the CONTRACTOR at his expense, in accordance with applicable laws, ordinances and regulations. The disposition of salvable material shall be in accordance with the Contract, the JEA Water and Sewer Standards Manual (latest edition), and as specified herein.

1.04 CONTRACTOR'S USE OF PROJECT SITE

A. The CONTRACTOR's use of the project site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities as noted in the Contract Drawings.

B. Disposal of Debris: All debris shall be disposed of in accordance with the JEA Water and Sewer Standards Manual (latest edition). Debris shall be disposed of in accordance with applicable federal, state, and local regulations. The CONTRACTOR is responsible for determining these regulations and shall bear all costs or retain any profit associated with disposal of these items.

C. The CONTRACTOR shall provide a daily log of deliveries to the project site for the project as described in Section 01550, Site Access and Storage.

1.05 JEA USE OF THE PROJECT SITE

A. JEA may utilize all or part of the facilities during the entire period of construction for the conduct of JEA's normal operations. The CONTRACTOR shall cooperate with JEA to minimize interference with the CONTRACTOR's operations and to facilitate JEA's operations.

1.06 PROJECT MEETINGS

A. Pre-Construction Meeting: A Pre-Construction meeting shall be held in accordance with the Contract.

1. Unless previously submitted to JEA, the CONTRACTOR shall bring to the conference one copy each of the following:

   a. JEA-approved schedule, previously submitted in accordance with the Contract.

   b. Preliminary procurement schedule of major equipment and materials and items requiring long lead time.

   c. Preliminary Shop Drawing/Sample/Substitute or "Or Equal" submittal schedule.

   e. Schedule of Values (lump sum price breakdown) for progress payment purposes.

   f. Preliminary Cash flow.

2. The purpose of the meeting is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:

   a. CONTRACTOR's tentative schedules.

   b. Transmittal, review, and distribution of CONTRACTOR's submittals.

   c. Processing applications for payment.

   d. Maintaining record documents.

   e. Critical work sequencing.

   f. Field decisions and Change Orders.

   g. Use of project site, office and storage areas, security, housekeeping and JEA's needs.

   h. Major equipment deliveries and priorities.

3. JEA will preside at the Pre-Construction meeting and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

B. Progress Meetings: JEA will schedule and hold on-site progress meetings, conducted monthly and as necessary and/or requested by JEA. JEA designated representatives, CONTRACTOR, and all subcontractors active on the site shall be represented at each meeting. CONTRACTOR may at its discretion request attendance by representatives of its suppliers, manufacturers, and other subcontractors.

   1. JEA will preside at the meetings and provide for keeping and distribution of the minutes. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.

2. The CONTRACTOR shall attend meetings held to coordinate work between other contracts that may be on-going on the project site. The General Superintendent, Job Superintendent, and/or other key representatives of each prime CONTRACTOR shall attend these meetings, at JEA's request.

1.07 PERMITS

A. JEA operates this plant under FDEP Permit No: FL0026468.

B. The CONTRACTOR shall pay for and secure all other permits for the work including but not limited to the FDEP National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities.

C. Costs for obtaining permits shall be included in the bid price. JEA will not compensate the CONTRACTOR for permit fees charged by regulatory agencies having jurisdiction over the work.

D. The CONTRACTOR shall furnish to JEA copies of all permits prior to commencement of work requiring permits.

E. The CONTRACTOR shall obtain, keep current and pay all fees for any necessary construction permits from those authorities, agencies, or municipalities having jurisdiction over land areas, utilities, or structures which are located within the Contract limits and which will be occupied, encountered, used, or temporarily interrupted by the CONTRACTOR's operations unless otherwise stated. Record copies of all permits shall be furnished to JEA.

F. When construction permits are accompanied by regulations or requirements issued by a particular authority, agency or municipality, it shall be the CONTRACTOR's responsibility to familiarize himself and comply with such regulations or requirements as they apply to his operations on this Project.

G. CONTRACTOR shall obtain and comply with all trade permits and building permits required. CONTRACTOR will pay for trade and building permits.

H. The CONTRACTOR shall provide any required Performance and Indemnity Bond(s).

1.08 FIELD ENGINEERING

A. Provide Field Engineering Services: Establish elevations, lines, and levels, utilizing recognized engineering survey practices in accordance with Section 01541.

B. If dimensions of equipment or piping locations are not shown on the Drawings, the CONTRACTOR shall coordinate such accordingly with JEA.

1.09 SITE CONDITIONS

A. The CONTRACTOR acknowledges that it has investigated prior to bidding and satisfied itself as to the conditions affecting the Work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, river stages, tides, water tables or similar physical conditions at the site, the conformation and conditions of the

ground, the character of equipment and facilities needed preliminary to and during execution of the Work. The CONTRACTOR further acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, or any contiguous site, as well as from information presented by the Drawings and Specifications made a part of this Contract, or any other information made available to it prior to receipt of Bids. Any failure by the CONTRACTOR to acquaint itself with the available information will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the Work. JEA assumes no responsibility for any conclusions or interpretations made by the CONTRACTOR on the basis of the information made available by JEA.

1.10 DIMENSIONS OF EXISTING FACILITIES

A. Where the dimensions and locations of existing improvements are of critical importance in the installation or connection of new work, the CONTRACTOR shall verify such dimensions and locations in the field prior to the fabrication and/or installation of materials or equipment which are dependent on the correctness of such information.

1.11 CONTRACT DOCUMENTS

A. The Work to be done is shown on the Drawings entitled JEA Arlington East Water Reclamation Facility Switchgear Replacement. The numbers and titles of all Drawings appear on the Drawing Cover Page. All drawings so enumerated shall be considered an integral part of the Contract Documents as defined herein.

B. Certain Document Sections refer to Divisions of the Contract Specifications. Sections are each individually numbered portions of the Specifications (numerically) such as 08110, 13182, 15206, etc. The term Division is used as a convenience term meaning all Sections within a numerical grouping. For example, Division 16 would thus include Sections 16000 through 16999 and would mean all electrical specifications.

1.12 GENERAL ARRANGEMENT

A. Drawings indicate the extent and general arrangement of the work. If any departures from the Drawings are deemed necessary by the CONTRACTOR to accommodate the materials and equipment he proposes to furnish, details of such departures and reasons therefore shall be submitted as soon as practicable to JEA for approval. No such departures shall be made without the prior written approval of JEA. Approved changes shall be made without additional cost to JEA for this work or related work under other Contracts of the Project.

B. The specific equipment proposed for use by the CONTRACTOR on the project may require changes in structures, auxiliary equipment, piping, electrical, mechanical, controls or other work to provide a complete satisfactory operating installation. The CONTRACTOR shall submit to JEA, for approval, all necessary Drawings and details showing such changes to verify conformance with the overall project structural and architectural requirements and overall project operating performance. The Bid Price shall include all costs in connection with the preparation of new drawings and details and all changes to construction work to accommodate the proposed equipment, including increases in the costs of other Contracts.

1.13 ADDITIONAL ENGINEERING SERVICES

A. In the event that the Engineer is required to provide additional engineering services as a result of substitution of materials or equipment which are not "or equal" by the CONTRACTOR, or changes by the CONTRACTOR in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Engineer is required to examine and evaluate any changes proposed by the CONTRACTOR for the convenience of the CONTRACTOR, then the Engineer's charges in connection with such additional services shall be charged to the CONTRACTOR by JEA.

B. Structural design shown on the Contract Drawings is based upon typical weights for major items of equipment as indicated on the Contract Drawings and specified. If the equipment furnished differs from that specified in the Contract Documents such that actual weight exceeds the weight of specified equipment, the CONTRACTOR shall assume the responsibility for all costs of redesign and for any construction changes required to accommodate the equipment furnished, including the Engineer's expenses in connection therewith, provided that the original weight assumptions were correct.

C. In the event that the Engineer is required to provide additional engineering services as a result of CONTRACTOR’s errors, omissions, or failure to conform to the requirements of the Contract Documents, or if the Engineer is required to examine and evaluate any changes proposed by the CONTRACTOR solely for the convenience of the CONTRACTOR, then the Engineer's charges in connection with such additional services shall be charged to the CONTRACTOR by JEA.

1.14 SUBSURFACE DATA

A. Subsurface data are offered in good faith solely for placing the Bidder in receipt of all information available to JEA and in no event is to be considered as part of the Contract Documents.

B. The Bidder must interpret such subsurface data according to his own judgment and acknowledge that he is not relying upon the same as accurately describing the subsurface conditions, which may be found to exist.

1. The test boring logs present factual information of the subsurface conditions at the specific test boring location only. The Bidder should not consider, or conclude, that the subsurface conditions will be consistent between test boring locations.

C. In making this data available, JEA makes no guarantee, either expressed or implied, as to their accuracy or to the accuracy of any interpretation thereof.

1.15 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, or reactant of other classification, must show approval of either the EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with all applicable rules and regulations.

1.16 FIRST AID FACILITIES AND ACCIDENTS

A. First Aid Facilities: The CONTRACTOR shall provide at the site such equipment and facilities as are necessary to supply first aid to any of his personnel who may be injured in connection with the work.

B. Accidents

1. The CONTRACTOR shall promptly report, in writing, to JEA all accidents whatsoever out of, or in connection with, the performance of the work, whether on or adjacent to the site, which cause death, personal injury or property damage, giving full details and statements of witnesses.

2. If death, serious injuries, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to JEA.

3. If any claim is made by anyone against the CONTRACTOR or a Subcontractor on account of any accidents, the CONTRACTOR shall promptly report the facts, in writing, to JEA, giving full details of the claim.

1.17 WEATHER CONDITIONS

A. No work shall be done when the weather is unsuitable. The CONTRACTOR shall take necessary precautions (in the event of impending severe weather, including hurricanes, tropical storms or major rain/wind storms) to protect all work, materials, or equipment from damage or deterioration due to floods, driving rain, and/or wind. JEA reserves the right, to order that additional protection measures over and beyond those proposed by the CONTRACTOR, be taken to safeguard all components of the Project.

B. The mixing and placing of concrete or pavement courses, the laying of masonry, and installation of sewers and water mains shall be stopped during rainstorms, if ordered by JEA; and all freshly placed work shall be protected by canvas or other suitable covering in such manner as to prevent running water from coming in contact with it. Sufficient coverings shall be provided and kept ready at hand for this purpose. The limitations and requirements for mixing and placing concrete, or laying of masonry, in cold weather shall be as described elsewhere in these Specifications.

1.18 PERIODIC CLEANUP: BASIC SITE RESTORATION

A. During construction, the CONTRACTOR shall regularly remove from the site of the work all accumulated debris and surplus materials of any kind which result from his operations. Unused equipment and tools shall be stored at the CONTRACTOR's yard or base of operations for the Project.

B. When the work involves installation of sewers, drains, water mains, manholes, underground structures, or other disturbance of existing features in or across streets, rights-of-way, easements, or private property, the CONTRACTOR shall (as the work progresses) promptly backfill, compact, grade, and otherwise restore the disturbed area to the basic condition which will permit resumption of pedestrian or vehicular traffic and any other critical activity or functions consistent with the original use of the land. The requirements for temporary paving of streets, walks, and driveways are specified

elsewhere. Unsightly mounds of earth, large stones, boulders, and debris shall be removed so that the site presents a neat appearance.

C. The CONTRACTOR shall perform the cleanup work on a regular basis and as frequently as ordered by JEA. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore, such work shall also be accomplished, when ordered by JEA, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.

D. Upon failure of the CONTRACTOR to perform periodic cleanup and basic restoration of the site to JEA's satisfaction, JEA may, upon five days prior written notice to the CONTRACTOR, without prejudice to any other rights or remedies of JEA, cause such work for which the CONTRACTOR is responsible to be accomplished to the extent deemed necessary by JEA, and all costs resulting therefrom shall be charged to the CONTRACTOR and deducted from the amounts of money that may be due him.

1.19 USE OF FACILITIES BEFORE COMPLETION

A. JEA reserves the right to enter and use any portion of the constructed facilities before final completion of the whole work to be done under this Contract. However, only those portions of the facilities which have been completed to JEA's satisfaction, as evidenced by his issuing a Certificate of Substantial Completion to the CONTRACTOR covering that part of the work, shall be placed in service.

B. It shall be JEA's responsibility to prevent premature connections to or use of any portion of the installed facilities by private or public parties, persons or groups of persons, before JEA issues his Certificate of Substantial Completion covering that portion of the work to be placed in service.

C. Consistent with the approved progress schedule, the CONTRACTOR shall cooperate with JEA to accelerate completion of those facilities, or portions thereof, which have been designated for early use by JEA.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01020

CONSTRUCTION SEQUENCING/CONSTRAINTS

PART 1 -- GENERAL

1.01 RELATED WORK DESCRIBED ELSEWHERE

A. Section 01520 – Maintenance of Utility Operations During Construction

1.02 OVERALL SEQUENCE OF CONSTRUCTION

A. Work under the Contract shall be scheduled and performed in such a manner as to result in the least possible disruption to the operation of the existing treatment facilities. Process control modifications shall not be made without first obtaining written permission from the Engineer.

B. Critical events in the sequence of construction are specified herein. The outline sequence of construction does not include all items necessary to complete the work, but is intended to identify the sequence of critical events necessary to minimize disruption to the on-going treatment plant process and to ensure compliance with discharge requirements. It shall be understood by the CONTRACTOR that the critical events identified are not all inclusive and that additional items of work not shown may be required. The sequence of construction is a precedence requirement and does not attempt to schedule the CONTRACTOR's work. It is intended only to indicate which activities must precede other activities in order to minimize interferences and disruptions.

1. Stage I - Mobilization and Preliminary Site Work

a. Mobilize for work - set up field offices and staging area, obtain permits, develop and submit construction schedule, shop drawing schedule and begin shop drawing submittals.

b. Clear and grub areas and install temporary erosion control measures as identified in the contract documents.

2. Stage II – Construction and Start-Up of Facilities, in accordance with Section 01520, “Maintenance of Utility Operations During Construction”

3. Stage III - Project Closeout

a. Complete project closeout in accordance with Section 01700, "Project Closeout".

b. Final acceptance of the project.

C. The existing facilities shall be maintained in an operable condition by the CONTRACTOR during construction (excluded from this requirement are all normal and emergency maintenance functions normally performed by JEA with JEA's staff or by Contract.)

D. At no time shall the CONTRACTOR undertake to close off any pipelines, or open valves, or take any other action which would affect the operation of the existing treatment plant.

E. The following items are subject to construction sequence and time constraint in order to maintain a fully operational plant. The CONTRACTOR shall note that each item of work is subject to the Engineer's review and acceptance.

F. Temporary mechanical, electrical and instrumentation installations/connections may be required to complete a particular aspect of work. All such subject temporary installations shall be subject to review and acceptance by the Engineer. All such temporary work shall be provided at no change in the Contract time or price.

1.03 DETAILED SEQUENCE OF CONSTRUCTION AND CONSTRAINTS

A. The CONTRACTOR shall schedule and perform the work so that the plant and its individual process facilities are maintained in continuous operation during the construction period except during approved plant or process interruptions. All short-term system or partial system shutdowns or diversions shall be submitted to JEA/Engineer in writing. No shutdowns or diversions shall be allowed without written approval from JEA/Engineer.

B. The CONTRACTOR shall submit a detailed, written plan of operation for each work item related to proposed shutdowns to JEA/Engineer for their review and approval. The plan of operation shall be submitted at least 14 days prior to the scheduled commencement date for that work. JEA/Engineer will review and return the plan with comments within 7 days. The CONTRACTOR shall schedule a meeting between the CONTRACTOR, JEA and Engineer to incorporate JEA/Engineer comments and finalize scheduling of the work. A final (revised) written plan of operation shall then be submitted to JEA/Engineer. The final plan shall be submitted to JEA/Engineer at least 3 days prior to the scheduled commencement date for that work. All work shall then be conducted in accordance with this final written plan of operation, unless agreed to in writing between the CONTRACTOR, JEA and Engineer. The written plan of operation shall address the following items:

1. Step-by-step detailed sequence for performing the work.

2. Anticipated duration of each activity.

3. Documentation on all temporary flow diversion equipment to be utilized by the CONTRACTOR, including tapping saddles, line stops, temporary bypass pumps and piping.

4. For temporary bypass pumps, submit the following:

    a. Quantity, manufacturer and model. Provide sufficient number of pumps to provide standby capacity equal to at least 50 percent of required pumping capacity.

    b. System and certified performance curves to demonstrate that pumps are sized correctly. Where multiple pumps shall be operated simultaneously, provide combined pump curves.

c. Type of drive units. For electric drives, submit details on CONTRACTOR's temporary electrical power source. For gasoline-driven units, provide details on fuel storage and manpower to ensure that adequate fuel supply is maintained.

5. Plan and/or schematic drawings to clearly identify work to be performed. Sequence steps shall be identified on drawings using a keynote legend or similar means.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Payment for the various items in the Schedule of Payment items, as further specified herein, shall include all compensation to be received by the CONTRACTOR for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, taxes, materials, commissions, transportation and handling, bonds, permit fees, insurance, overhead and profit, and incidentals appurtenant to the items of Work being described, as necessary to complete the various items of the Work all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). Such compensation shall also include payment for any loss or damages arising directly or indirectly from the Work.

B. The CONTRACTOR's attention is called to the fact that the quotations for the various items of Work are intended to establish a total price for completing the Work in its entirety. Should the CONTRACTOR feel that the cost for any item of Work has not been established by the Schedule of Payment items or this Section, it shall include the cost for that Work in some other applicable bid item, so that its proposal for the project does reflect its total price for completing the Work in its entirety.

1.02 SCHEDULE OF VALUES

A. The CONTRACTOR shall submit a Schedule of Payment Values in accordance with the instructions to bidders and as specified in Section 01370 entitled “Schedule of Values”.

B. The schedule shall be given in sufficient detail for proper identification of Work accomplished. The Schedule of Values shall directly correlate to each activity outlined in the construction progress schedule (specified in the Section 01300, Submittals) unless otherwise specified by JEA to accurately relate construction progress to the requested payment. Each item shall include its proportional share of all costs including the CONTRACTOR's overhead, contingencies and profit. The sum of all scheduled items shall equal the total value of the Contract.

C. The CONTRACTOR shall submit monthly applications for payment using JEA’s prescribed forms and format in accordance with this contract.

1.03 UNIT QUANTITIES SPECIFIED

A. Any tabulated quantities for the various items of work and materials are approximate only and are given solely to be used as a uniform basis for the comparison of bids. JEA and Engineer make no guarantee that the estimated quantities listed are equal or will be equal to final accepted quantities.

B. Quantities actually required to complete the work will be calculated in accordance with applicable Sections of the Specifications for the specific work items. Payment will be made based on the acceptable quantities submitted by the CONTRACTOR and approved by the Engineer multiplied by the Contract Unit Price for each Item.

1.04 MEASUREMENT OF QUANTITIES

A. Measurement of quantities for the various items of work will be in the units found in the applicable or referenced Specification Sections.

PART 2 -- PRODUCTS

2.01 LUMP SUM CONTRACT ITEMS

A. Contract Payment Item Nos. 1, 2, 3 and 4 have been provided in the Proposal (Bid Form) for the Contract as a lump sum price bid as listed below.

B. Where the Specifications and/or Contract Drawings are silent on Payment for work specified under an individual Specification Section or on the Drawings, it is understood that Payment will be made as part of the lump sum price bid.

1. Contract Item No. 1 – Mobilization/Demobilization (Limited to 5% of Grand Total): Payment will be made at the aggregate sum price bid, which aggregate sum shall be full compensation for the CONTRACTOR'S mobilization on site, including but not limited to bonds, insurance, permit fees scheduling, temporary facilities and all other activities necessary to prepare to complete the Contract work.

2. Contract Item No. 2 – All Work associated with the Construction of the Arlington East Water Reclamation Facility Switchgear Replacement Project to make it ready for operation. Shall include, but not be limited to: cleaning, debris disposal, concrete, structural steel, metal fabrications and systems, equipment, temporary generators, temporary cables, electrical, piping, fittings, valves, and all other work necessary for a complete and fully functioning system, as specified and show in the Contract Documents whether specifically mentioned or implied, except that Work specifically included for payment under any other Bid Item.

3. Contract Item No. 3 – Supplemental Work Authorization (SWA): The JEA Representative will issue a written SWA to incorporate cost or schedule changes into the Contract. The SWA shall be used for increases and decreases in the Contract price, within the SWA amount set forth in the Bid, or to make changes in schedule for performance of the Work. An SWA work shall authorize the CONTRACTOR to perform changes in the Work. The CONTRACTOR shall not start on SWA work until the CONTRACTOR receives a fully authorized, written SWA form, signed by the appropriate JEA personnel – the CONTRACTOR shall not consider verbal statements as authorization to proceed with the changes. The CONTRACTOR should not expect that any SWAs will be issued. JEA shall have no obligation to pay for SWA work unless the same is performed pursuant to a written SWA form signed before the SWA work is commenced.

2.02 UNIT PRICE CONTRACT ITEMS

A. Not Applicable

PART 3 -- EXECUTION

3.01 PAYMENT

A. The Total Bid Price for the Contract shall include, as applicable, the following items:

1. Lump Sum Contract item as specified, Item Nos. 1 through 3.

B. Payment for the total bid price shall be in accordance with the requirements of the Contract Documents.

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SECTION 01035

MODIFICATION PROCEDURES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide all labor, materials, equipment and appliances required for the complete execution of additions, modifications and alterations to existing buildings and structures as shown on the Drawings and specified under the various Sections of the Contract Specifications and as required by conditions at the site.

B. The CONTRACTOR shall have examined all work to be performed to the existing buildings and familiarize himself with the nature and extent to which the existing buildings will be damaged, items removed or rearranged due to the work under his Contract and that of other Contracts.

1. Cutting and patching shall conform to the requirements of the General Conditions, Supplemental Conditions, and as specified herein.

2. Patching work shall be performed with similar materials and in the same manner as adjoining work. Joining between old and new work shall be perfect and practically invisible. All due caution shall be taken to obtain a bond between old and new work.

C. Major portions of the work are indicated on the Drawings and the accompanying Specifications thereto. All work must be complete in all respects and executed with high quality workmanship.

D. Work not specifically indicated by details or general notes on the Drawings may include the following:

1. Re-pointing blockwork; removing and replacing broken, cracked, disintegrating and missing blockwork, utilizing mortar, block and finishes.

3. Removing loose rust, sealing or peeling paint from metal surfaces by scraping, sanding or wire brushing; priming and repainting metal surface (inside and outside).

7. Patching, cleaning, sealing and resurfacing concrete floors, walls, lintels, sills and trim and replacing lintels where broken.

8. Cutting and modifying existing openings as necessary to receive new work and providing new lintels, doors, frames, etc.

9. Patching existing doors and frames and refinishing as required.

10. Patching, refinishing and/or replacing ceilings.

1.02 SITE AND BUILDINGS

A. Site Visit: Prior to submission of Bids, the CONTRACTOR shall have visited the site and thoroughly acquainted himself with the exact nature of the work indicated on the Drawings and the Specifications requirements. Failure to comply with the aforementioned requirements shall not constitute a basis for claims for additional compensation.

B. Measurements: Prior to ordering any materials or doing any work, the CONTRACTOR shall verify all measurements, dimensions and other conditions of each building scheduled for work as may be necessary or required in connection with his work. The CONTRACTOR shall be responsible for the correctness of same.

1.03 MATERIALS

A. All materials to perform and complete the work shall be new. Salvaged materials, such as brick, stone copings, granite sills, may be used under certain conditions subject to the approval of JEA.

B. All salvaged materials shall be sound and undamaged. Materials to be reused shall be stored and protected as directed by JEA. Care shall be taken to prevent damage to materials or equipment to be reused.

1.04 SHORING, UNDERPINNING AND BRACING

A. When necessary and required, the CONTRACTOR shall provide underpinning and temporary shoring and bracings, all in accordance with code requirements, and as approved by JEA.

B. Shoring and bracing shall be of such form and so installed as to safely support the work and interfere as little as possible with the progress of the work. Suitable means shall be provided to adjust any settlement in the shoring supports. Temporary shoring shall consist of sound timbers or rolled shapes of required dimensions which shall be removed after necessity for same ceases to exist. All work removed or damaged through installation of temporary shoring or through improper shoring shall be replaced or repaired after the shoring is removed, at no additional cost to JEA.

1.05 WORK PREPARATION AND TEMPORARY ACCESS

A. The CONTRACTOR, before commencing work, shall prepare and submit for approval a progress schedule in accordance with the requirements of Section 01300 entitled "Submittals", in order to coordinate the work of all trades and to insure completion on or before the completion date. JEA reserves the right to revise or modify such schedules as required to expedite each phase of work and to coordinate such work with the partial use of the building for purposes as directed.

B. No facility such as toilets, corridors, etc., shall be barricaded or access restricted without providing other temporary or interim means of access. It is further required that no work specified hereinafter shall disturb or interfere with the operation of the existing mechanical installation until proposed new work has been completed or satisfactorily installed. Exception may be made to this requirement only by written approval from JEA.

C. Detailed sequence of availability of areas within the present buildings where work is to be performed under each Contract shall be in accordance with Section 01520 entitled "Maintenance of Utility Operations During Construction", but may be modified by the CONTRACTOR, upon authorization by JEA as the work progresses.

D. Existing built-in equipment to remain in the final work, but requiring temporary removal for the installation of new construction, alterations, repairs and/or renovations, shall be disconnected by the CONTRACTOR and removed to temporary storage areas designated by JEA. Resetting of existing equipment under this heading shall be performed by the CONTRACTOR including connecting to electric service lines.

E. The CONTRACTOR shall furnish and install all temporary fire exits, fire extinguishers, hose and safety devices as may be required by authorities having jurisdiction.

F. Work within existing buildings to be performed, once started, shall be completed as quickly as practicable and each trade shall determine before work is started that all required materials are at hand or readily obtainable to avoid delays.

G. Shutdowns of existing services within existing buildings which may be occupied during construction will be permitted only upon written approval by JEA subject to at least three weeks notice in writing to JEA in each case. Shutdowns will be limited to times which will result in the least interference with normal operations. Refer to Section 01520 entitled "Maintenance of Utility Operations During Construction" for additional requirements.

1.06 DUST-PROOF PARTITIONS

A. The CONTRACTOR shall furnish and erect all necessary temporary dust-proof partitions where required to protect unaltered portions of existing buildings and structures or as directed by JEA.

B. Partitions shall be constructed of wood studs with plywood on both sides. Partitions shall extend from floor to ceiling with a closure plate at floor and ceiling. The CONTRACTOR shall furnish and install one door in each enclosure complete with hardware attached and keyed as directed. Such enclosures will be required in areas of major demolition work and for protection of existing equipment.

1.07 WEATHER PROTECTION

A. Where exterior walls or roofs are being altered, or disturbed for any adjacent alteration, the CONTRACTOR shall provide temporary weather protection in those areas to keep interior of buildings absolutely dry and unaffected by the weather. The CONTRACTOR will be held responsible for any damage caused by improper protection against weather.

B. Where existing exterior walls or roofs are disturbed due to alterations, disturbances shall be kept to a minimum and walls or roofs shall be repaired and patched in such a manner that the buildings will be absolutely watertight and meet the conditions of the existing roofing flashing and waterproofing bonds and guarantees.

1.08 CUTTING, PATCHING, REPAIRING, AND REFINISHING

A. The CONTRACTOR shall be responsible for cutting all openings in walls, floors and ceilings (indicated to remain) to accommodate alteration work under his Contract in accordance with the requirements of the General Conditions, Supplemental Conditions, and as hereinafter specified. Rough patching and all finish patching shall be by the CONTRACTOR.

1. Where new openings are to occur in existing exterior and interior concrete and masonry bearing walls and structural concrete floor, the CONTRACTOR will be required to notify JEA in writing and shall obtain approval prior to cutting operations. JEA will determine whether such openings affect the structural stability or load bearing capacities of walls and floors.

2. All holes and openings to be cut in existing walls, floors and ceilings of any nature shall be geometrically correct and no larger than necessary to accommodate the new work.

3. No cutting of finished or structural work may be done without the approval of JEA.

B. Major demolition and removal work such as demolition of buildings and structures, complete or nearly complete removal of floors, walls and ceilings indicated on the Drawings, shall be performed by the CONTRACTOR. The CONTRACTOR shall also be responsible for all finish patching operations of holes and openings in existing floors, walls, ceilings and roofs to accommodate the alteration work under the Plumbing, HVAC and Electrical Sections as well as that required for the CONTRACTOR's work hereinafter specified.

C. Each CONTRACTOR and/or his Subcontractors shall provide sleeves, forms and inserts for installation by the CONTRACTOR.

1.09 EXISTING EQUIPMENT AND FURNISHINGS

A. Existing built-in equipment to remain in the final work and requiring temporary removal shall be as hereinbefore specified under Article 1.05, Paragraph D of this Section.

B. Existing appliances and portable equipment such as desks, chairs, tables, etc., shall remain the property of JEA and will be removed from rooms and spaces to be altered by the CONTRACTOR prior to construction and alteration operations, and stored where directed by JEA.

C. All unsalvageable equipment shall become the property of the CONTRACTOR in accordance with the requirements of Section 01540 entitled "Demolition and Removal of Existing Structures and Equipment", and shall be removed from each building and away from the site. Equipment to be retained, or relocated, shall be as shown on the Drawings or as specified.

1.10 SCHEDULE OF INTERIOR FINISHES FOR EXISTING BUILDINGS

A. Unless otherwise specified, all materials required for the work in the existing buildings shall be new, and where required shall match existing adjacent finishes.

B. As indicated on the Drawings, specified or otherwise required to complete the work, the CONTRACTOR shall cut new openings and block up existing openings in floors, walls, partitions and ceilings; remove existing floors; remove, relocate existing and/or install new windows, doors, frames, transoms, access doors, partition sash and trim.

C. The CONTRACTOR shall remove window sash, frame, sill, stool and trim at exterior door openings to be blocked up; remove door, frame and trim and, unless otherwise hereinafter specified or indicated on the Drawings to be blocked up with other materials, window and door openings shall be blocked up with brick and/or masonry block.

1. At door, sash and other openings in interior partitions and walls to be closed, block up such openings with same materials and construction as adjacent, unless otherwise indicated on the Drawings. Plaster and finishes applied at blocked up openings shall finish even and straight, flush with and of the same texture or other surface characteristics of existing adjacent finishes.

D. Existing finishes or subfloor surfaces which are scheduled to receive new floor finishes shall be repaired, patched with concrete, asphalt latex type emulsion and underlayment as required to suit existing surfaces or the new floor surfacing material to be applied.

E. Concrete and floors disturbed by alterations shall be patched to finish even, straight and flush with adjacent surfaces.

F. Where new ceramic tile flooring or base is to be installed over present concrete floors or base, and where a cove exists at the floor, the CONTRACTOR shall cut away part of the cove by grinding or other approved means to the extent required for installation of the new flooring or base.

G. Existing partitions to be removed shall be removed for their entire height.

H. Where existing bases and other trim are removed and grounds are exposed and will not be covered by new finishing materials such as resilient base, new trim, or wall covering, grounds shall be removed and wall surfaces patched with plaster to finished even, straight and flush with adjacent existing plaster surfaces. Where existing plaster ceilings are scheduled to be removed, the ceilings shall be replaced with new metal furring, lathing and plaster finish or acoustical ceilings or other ceiling system as indicated on the Drawings.

I. Where partitions or walls are removed and existing ceiling on each side of the partition or wall is to remain, the gap shall be patched; a vertical break shall be provided if the ceilings are at different levels. Where the ceiling on one side is to remain and a new ceiling is scheduled for the area on the other side, the new ceiling shall be constructed so that the new and existing finished ceiling areas will be at the same level.

J. Existing floors, walls and ceilings shall be cut as required for removal of existing services and for installation of new plumbing, heating, ventilating and air conditioning, and electrical work and related piping, duct work, conduits, fixtures and equipment.

K. In addition to work specifically called for in the finish schedule on the Drawings, all finishes disturbed in the performance of any alterations or new work by any CONTRACTOR shall be patched or repaired to match existing surfaces or finishes. Holes, slots, chases, etc., in floors, walls and ceilings left by the removal of existing, or installation of new piping,

plumbing fixtures, radiators, duct work, registers, grills, conduit, receptacles, switches, lighting fixtures and other items of the other Contracts shall also be patched or repaired by the CONTRACTOR.

L. Existing spaces not listed on the finish schedule on the Drawings may require no work other than complete painting and patching by the CONTRACTOR of surfaces damaged in performance of any work included under this Contract.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01040

COORDINATION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall allow JEA or their agents, and other project CONTRACTORS or their agents, to enter upon the work for the purpose of constructing, operating, maintaining, removing, repairing, altering, or replacing such pipes, sewers, conduits, manholes, wires, poles, or other structures and appliances which may be required to be installed at or in the work. The CONTRACTOR shall cooperate with all aforesaid parties and shall allow reasonable provisions for the prosecution of any other work by JEA, or others, to be done in connection with his work, or in connection with normal use of the facilities.

B. Each CONTRACTOR shall cooperate fully with JEA and all other CONTRACTORS employed on the work, to effect proper coordination and progress to complete the project on schedule and in proper sequence. Insofar as possible, decisions of all kinds required from JEA shall be anticipated by the CONTRACTOR to provide ample time for inspection, or the preparation of instructions.

C. Each CONTRACTOR shall assume full responsibility for the correlation of all parts of his work with that of other CONTRACTORS. Each CONTRACTOR's superintendent shall correlate all work with other CONTRACTORS in the laying out of work. Each CONTRACTOR shall lay out his own work in accordance with the Drawings, Specifications, and instructions of latest issue and with due regard to the work of other CONTRACTORS.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

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SECTION 01070

ABBREVIATIONS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Wherever in these specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these specifications, the following acronyms or abbreviations which may appear in these specifications shall have the meanings indicated herein.

1.02 ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AAMA | Architectural Aluminum Manufacturer's Association |
| AASHTO | American Association of the State Highway and Transportation Officials |
| ACI | American Concrete Institute |
| ACIFS | American Cast Iron Flange Standards |
| ACOE | Army Corps of Engineers |
| ACPA | American Concrete Pipe Association |
| AFBMA | Anti-Friction Bearing Manufacturer's Association, Inc. |
| AGMA | American Gear Manufacturer's Association |
| AHGDA | American Hot Dip Galvanizers Association |
| AI | The Asphalt Institute |
| AIA | American Institute of Architects |
| AISC | American Institute of Steel Construction |
| AISI | American Iron and Steel Institute |
| AITC | American Institute of Timber Construction |
| AMCA | Air Moving and Conditioning Association |
| ANSI | American National Standards Institute, Inc. |
| APA | American Plywood Association |
| API | American Petroleum Institute |
| APHA | American Public Health Association |
| APWA | American Public Works Association |
| ASA | Acoustical Society of America |
| ASAE | American Society of Agriculture Engineers |
| ASCE | American Society of Civil Engineers |
| ASHRAE | American Society of Heating, Refrigerating, and Air-Conditioning Engineers |

| | |
|---|---|
| ASLE | American Society of Lubricating Engineers |
| ASME | American Society of Mechanical Engineers |
| ASMM | Architectural Sheet Metal Manual |
| ASSE | American Society of Sanitary Engineers |
| ASTM | American Society for Testing and Materials |
| AWPA | American Wood Preservers Association |
| AWPI | American Wood Preservers Institute |
| AWS | American Welding Society |
| AWWA | American Water Works Association |
| CEMA | Conveyor Equipment Manufacturer’s Association |
| CMA | Concrete Masonry Association |
| CRSI | Concrete Reinforcing Steel Institute |
| DIPRA | Ductile Iron Pipe Research Association |
| EIA | Electronic Industries Association |
| ETL | Electrical Test Laboratories |
| FBC | Florida Building Code |
| FDEP | Florida Department of Environmental Protection |
| FDOT | Florida Department of Transportation |
| FS | Federal Specifications |
| IEEE | Institute of Electrical and Electronics Engineers |
| IES | Illuminating Engineering Society |
| IPCEA | Insulated Power Cable Engineers Association |
| ISA | Instrument Systems and Automation |
| ISO | International Organization for Standardization |
| MBMA | Metal Building Manufacturers Association |
| MMA | Monorail Manufacturers Association |
| MTI | Marine Testing Institute |
| NAAM | National Association of Architectural Metal Manufacturers |
| NACE | National Association of Corrosion Engineers |
| NBS | National Bureau of Standards |
| NEC | National Electrical Code |
| NEMA | National Electrical Manufacturer's Association |
| NFPA | National Fire Protection Association |
| NIOSH | National Institute of Occupational Safety and Health |
| NIST | National Institute of Standards and Testing |

| | |
|---|---|
| NRCA | National Roofing Contractors Association |
| NSF | National Science Foundation |
| OSHA | Occupational Safety and Health Administration |
| PCA | Portland Cement Association |
| PCM | Program Construction Manager |
| PMT | Program Management Team |
| SMACCNA | Sheet Metal and Air Conditioning Contractors National Association |
| SSPC | Steel Structures Painting Council |
| SSPWC | Standard Specifications for Public Works Construction |
| SFWMD | South Florida Water Management District |
| SJRWMD | St. Johns River Water Management District |
| UL | Underwriters Laboratories, Inc. |

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

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SECTION 01090

REFERENCE STANDARDS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Wherever reference is made to any published standards, codes, or standard specifications, it shall mean the latest standard code, specification, or tentative specification of the technical society, organization, or body referred to, which is in effect at the date of invitation for Bids.

B. All materials, products, and procedures used or incorporated in the work shall be in strict conformance with applicable codes, regulations, specifications, and standards.

C. A partial listing of codes, regulations, specifications, and standards includes the following:

Air Conditioning and Refrigeration Institute (ARI)

Air Diffusion Council (ADC)

Air Moving and Conditioning Association (AMCA)

The Aluminum Association (AA)

American Architectural Manufacturers Association (AAMA)

American Concrete Institute (ACI)

American Gear Manufacturers Association (AGMA)

American Hot Dip Galvanizers Association (AHDGA)

American Institute of Steel Construction, Inc. (AISC)

American Iron and Steel Institute (AISI)

American National Standards Institute (ANSI)

American Society of Civil Engineers (ASCE)

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)

American Society of Mechanical Engineers (ASME)

American Society for Testing and Materials (ASTM)

American Standards Association (ASA)

American Water Works Association (AWWA)

American Welding Society (AWS)

American Wood-Preserver's Association (AWPA)

Anti-Friction Bearing Manufacturers Association (AFBMA)

Building Officials and Code Administrators (BOCA)

Consumer Product Safety Commission (CPSC)

Factory Mutual (FM)

Federal Specifications

Florida Building Code

Instrument Society of America (ISA)

Institute of Electrical and Electronics Engineers (IEEE)

National and Local Fire Codes

Lightning Protection Institute (LPI)

National Electrical Code (NEC)

National Electrical Manufacturer's Association (NEMA)

National Electrical Safety Code (NESC)

National Electrical Testing Association (NETA)

National Fire Protection Association (NFiPA)

Regulations and Standards of the Occupational Safety and Health Act (OSHA)

Southern Building Code Congress International, Inc. (SBCCI)

Sheet Metal & Air Conditioning Contractors National Association (SMACCNA)

Standard Building Code

Standard Mechanical Code

Standard Plumbing Code

Uniform Building Code (UBC)

Underwriters Laboratories Inc. (UL)

D. Contractor shall, when required, furnish evidence satisfactory to the Engineer that materials and methods are in accordance with such standards where so specified.

E. In the event any questions arise as to the application of these standards or codes, copies shall be supplied on-site by the Contractor.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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SECTION 01300

SUBMITTALS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. This section specifies the means of all submittals. All submittals, whether their final destination is to JEA, or other representatives of JEA, shall be directed through JEA. A general summary of the types of submittals and the number of copies required is as follows:

| Hard Copies to JEA | Type of Submittal |
|---|---|
| 3* | Progress Schedule |
| 3* | Construction Schedule |
| See 01370 | Schedule of Values |
| 1 | Application for Payment |
| 10** | Shop Drawings |
| See 01730 | O&M Manuals |
| 2 | Certificates of Compliance |
| 2 | Warranties |
| 2*** | Product Samples |

** Unless otherwise required in the instructions to bidders.*
*** Unless electronically submitted.*
**** Unless otherwise required in the specific Section where requested.*

1.02 SUBMITTAL PROCEDURES

A. Transmit each submittal with a form acceptable to JEA, clearly identifying the project CONTRACTOR, the enclosed material and other pertinent information specified in other parts of this section. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

B. Revise and resubmit submittals as required, identify all changes made since previous submittals. Resubmittals shall be noted as such.

C. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.03 CONSTRUCTION PROGRESS SCHEDULE

A. The CONTRACTOR shall prepare the construction progress schedule in accordance with JEA standards. The schedule shall be developed in the Primavera P6 format. At least 10 days prior to the Preconstruction meeting, the proposed work schedule shall be submitted by the CONTRACTOR.

B. If the CONTRACTOR desires to make changes in its method of operating which affect the construction progress schedule and related items, it shall notify JEA in writing stating what changes are proposed and the reason for the change. If JEA accepts these changes, in writing, the CONTRACTOR shall revise and submit, without additional cost to JEA, all of the affected portions of the construction progress schedule and associated reports. The construction progress schedule and related items shall be adjusted by the CONTRACTOR only after prior acceptance, in writing by JEA. Adjustments may consist of changing portions of the activity sequence, activity durations, division of activities, or other adjustments as may be required. The addition of extraneous, nonworking activities and activities which add restraints to the construction progress schedule shall not be accepted.

C. Except where earlier completions are specified, schedule dates which show completion of all Work prior to the contract completion date shall, in no event, be the basis for claim for delay against JEA by the CONTRACTOR.

D. Construction progress schedules and related items which contain activities showing negative float or which extend beyond the contract completion date will be accepted only upon the condition that the CONTRACTOR will comply with recovery schedule requirements in accordance with the Contract.

E. If the completion of any activity, whether or not critical, falls more than 100 percent behind its previously scheduled and accepted duration, the CONTRACTOR shall submit for approval a schedule adjustment showing each such activity divided into two activities reflecting completed versus uncompleted work.

F. Shop drawings which are not approved on the first submittal or within the time scheduled, and equipment which does not pass the specified tests and certifications shall be immediately rescheduled.

G. From time to time it may be necessary for the contract schedule of completion time to be adjusted by JEA in accordance with the Contract and other portions of the Contract Documents as may be applicable. Under such conditions, JEA will direct the CONTRACTOR to reschedule the Work or contract completion time to reflect the changed conditions, and the CONTRACTOR shall revise the construction progress schedule and related items accordingly, at no additional cost to JEA.

H. Available float time may be used by JEA.

I. JEA controls the float time and, the before, without obligation to extend either the overall completion date or any intermediate completion dates, JEA may initiate changes that absorb float time only. JEA initiated changes that affect the critical path on the network diagram shall be the sole grounds for extending the completion dates. CONTRACTOR initiated changes that encroach on the float time may be accomplished only with JEA's

concurrence. Such changes, however, shall give way to JEA initiated changes competing for the same float time.

J. To the extent that the construction project schedule, or associated report or any revision thereof shows anything not jointly agreed upon or fails to show anything jointly agreed upon, it shall not be deemed to have been accepted by JEA. Failure to include on a schedule any element of Work required for the performance of this Contract shall not excuse the CONTRACTOR from completing all Work required within any applicable completion date, notwithstanding the review of the schedule by JEA.

K. Review and acceptance of the construction progress schedule, and related reports, by JEA is advisory only and shall not relieve the CONTRACTOR of the responsibility for accomplishing the Work within the contract completion date. Omissions and errors in the construction progress schedule, and related reports shall not excuse performance less than that required by the Contract and in no way make JEA an insurer of the CONTRACTOR's success or liable for time or cost overruns flowing from any shortcomings in the construction progress schedule, and related reports.

L. Three hard copies and one electronic copy shall be submitted with the Application for Payment.

1.04 SCHEDULE OF VALUES

A. The CONTRACTOR shall submit a Schedule of Values for review within the time frame referenced in the instructions to bidders and Section 01370. The schedule shall directly correlate on an item by item basis (unless otherwise accepted/directed by JEA) to each individual activity detailed in the construction progress schedule. The sum of all scheduled items shall equal the total value of the Contract. Reference Section 01025, Measurement and Payment, for further details.

B. The CONTRACTOR shall expand or modify the above schedule and materials listing as required by JEA's initial or subsequent reviews.

1.05 APPLICATION FOR PAYMENT

A. The CONTRACTOR shall submit Application for Payment to JEA monthly for review in accordance with the Contract. The Application shall be submitted on the day of the month directed by JEA for the preceding month’s work.

B. The Application for Payment shall include a listing of monthly labor hours spent on site in electronic format (pdf), updated as-built drawings, invoices for stored material, stored material log and updated EAM worksheets. JEA to provide Application for Payment excel workbook for to be used for compiling data necessary for each Application for Payment.

1.06 SHOP DRAWINGS

A. The CONTRACTOR shall submit for review shop drawings for concrete reinforcement, structural details, piping layout and appurtenances, wiring, color selection charts, materials and equipment fabricated especially for this Contract, and materials and equipment for which such Drawings are specified or specifically requested by JEA. Shop

drawings shall be submitted in accordance with the Contract, except where the number of shop drawings to be submitted is specifically stated in the technical specification.

B. Shop drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the Drawings.

C. When so specified, or if considered by JEA to be acceptable, the manufacturer's specifications, catalog data, descriptive matter, illustrations, etc. may be submitted for review in place of shop drawings. In such case, the requirements shall be as specified for shop drawings, insofar as applicable.

D. The CONTRACTOR shall be responsible for the prompt submittal of all shop drawings so that there shall be no delay to the Work due to the absence of such Drawings. JEA/Engineer will review the shop drawings within 21 calendar days of receipt of such Drawings. Reviewed shop drawings will be returned to the CONTRACTOR by electronic format, posted no later than 21 days after receipt.

E. Time delays caused by rejection of submittals are not cause for extra charges to JEA or time extensions.

F. Requirements: All shop drawings shall be submitted to JEA/Engineer through the CONTRACTOR. The CONTRACTOR is responsible for obtaining shop drawings from his subcontractors and returning reviewed shop drawings to them. All shop drawings shall be prepared on standard size, 18-inch by 24-inch sheets. JEA standard title block from the JEA website shall be used for all shop drawings. All Drawings shall be clearly marked with the name of the project, JEA project number, Engineer project number, JEA, CONTRACTOR, Engineer and building, equipment, or structure to which the drawing applies. Drawings shall be suitably numbered and contain the review stamp by the CONTRACTOR. Each shipment of shop drawings shall be accompanied by a letter of transmittal giving a list of the drawing/specification numbers and the names mentioned above. In addition to the number of copies specified, the CONTRACTOR shall submit one electronic copy in pdf format.

G. Product Data: Where manufacturer's publications in the form of catalogs, brochures, illustrations, or other data sheets are submitted in lieu of prepared shop drawings, such submission shall specifically indicate the particular item offered. Identification of such items and relative pertinent information shall be made with indelible ink. Submissions showing only general information will not be accepted. JEA will reject documents that are not legible copies shall be originals or legible for review.

H. Product data shall include materials of construction, dimensions, performance characteristics, capacities, wiring diagrams, piping and controls, etc.

I. Warranties: When warranties are called for, a sample of the warranty shall be submitted with the shop drawing. The sample warranty shall be the same form that will be used for the actual warranty. Actual warranties shall be originals and notarized. Warranty shall commence at JEA acceptance and shall be in effect for one year unless otherwise specified.

J. Work Prior to Review: No material or equipment shall be purchased, fabricated especially for this Contract, or delivered to the project site until the required shop drawings have been submitted, processed and marked either "FURNISH AS SUBMITTED" or "FURNISH AS CORRECTED". All materials and Work involved in the construction shall be as represented by said Drawings.

K. The CONTRACTOR shall not proceed with any portion of the Work (such as the construction of foundations) for which the design and details are dependent upon the design and details of equipment for which submittal review has not been completed.

L. CONTRACTOR's Review: Only submittals which have been checked and corrected should be submitted to the CONTRACTOR by its subcontractors and vendors. Prior to submitting shop drawings to JEA/Engineer, the CONTRACTOR shall check thoroughly all such shop drawings to satisfy itself that the subject matter thereof conforms to the Drawings and Specifications in all respects. Shop drawings which are correct shall be marked with the date, checker's name and indications of the CONTRACTOR's approval, and then shall be submitted to JEA/Engineer. Other Drawings submitted to JEA/Engineer will be returned to the CONTRACTOR unreviewed.

M. CONTRACTOR's Responsibility: JEA's review of shop drawings will be general and shall not relieve the CONTRACTOR of the responsibility for details of design, dimensions, etc., necessary for proper fitting and construction of the Work required by the Contract and for achieving the specified performance.

N. CONTRACTOR's Modifications: For submissions containing departures from the Contract Documents, the CONTRACTOR shall include proper explanation in his letter of transmittal and shall identify in the relevant specification to which the exception is taken. Should the CONTRACTOR submit for review equipment that requires modifications to the structures, piping, layout, etc. detailed on the Drawings, he shall also submit for review details of the proposed modifications. If such equipment and modifications are accepted, the CONTRACTOR, at no additional cost to JEA, shall do all Work necessary to make such modifications.

O. Substitutions: Substitutions may be submitted in accordance with the Contract.

P. Complete Submittals: Each submittal shall be complete in all aspects incorporating all information and data required to evaluate the products' compliance with the Contract Documents. Partial or incomplete submissions shall be returned to the CONTRACTOR without review.

1.07 WARRANTIES

A. Warranties called for in the Contract Documents shall be originals and submitted to JEA. When warranties are required they shall be submitted prior to request for payment. Warranties shall be original copies and shall be notarized.

1.08 CERTIFICATES

A. Two hard copies and one electronic copy of certificates of compliance and test reports shall be submitted for requested items to JEA prior to request for payment.

1.09 PRODUCT SAMPLES

A. CONTRACTOR shall furnish for review all product samples as required by the Contract Documents or requested by JEA to determine compliance with the specifications.

B. Samples shall be of sufficient size or quantity to clearly illustrate the quality, type, range of color, finish or texture and shall be properly labeled to show complete project identification, the nature of the material, trade name of manufacturer and location of the Work where the material represented by the sample will be used.

C. Samples shall be checked by the CONTRACTOR for conformance to the Contract Documents before being submitted to JEA and shall bear the CONTRACTOR's stamp certifying that they have been so checked. Transportation charges on samples submitted to JEA shall be prepaid by the CONTRACTOR.

D. JEA's review will be for compliance with the Contract Documents, and its comments will be transmitted to the CONTRACTOR with reasonable promptness.

E. Acceptable samples will establish the standards by which the completed Work will be judged.

1.10 OPERATION AND MAINTENANCE MANUALS

A. General: In accordance with Section 01730, the CONTRACTOR shall furnish and deliver to JEA complete Operation and Maintenance (O&M) Manuals for the substantial, complete systems including instructions, technical bulletins, and any other printed matter such as diagrams, prints or drawings, containing full information required for the proper operations, maintenance, and repair of all CONTRACTOR furnished equipment. These requirements are a prerequisite to the operation and acceptance of equipment. Ten (10) weeks prior to the CONTRACTOR's substantial completion date, all O&M manuals shall be submitted in its final form.

B. All O&M manuals shall also be furnished in an electronic file format suitable for downloading into JEA's O&M database system. All manuals and drawings for the vendor provided equipment, sub-system or system shall be in Adobe Portable Document Format (PDF) format, in conformance with the latest version. They shall be PDF Formatted Text and Graphics (formerly Normal) or PDF Searchable Image (formerly Image+Text). If submitted in Searchable Image format, they shall be Optical Character Recognized (OCR'ed) at a 95% confidence level, using Adobe Acrobat Capture or an equivalent product. There shall be links from all Table of Contents entries to the actual occurrence in the body of the manual. Bookmarks shall be created for all linked Table of Contents entries. This requirement applies to all equipment to be furnished on this project.

1.11 RECORD DRAWINGS

A. Record drawings shall be prepared in accordance with "As-Built Drawings" as detailed in the Contract and the JEA Water and Sewer Standards Section 501 and Section 01720 of the Contract Documents.

B. The CONTRACTOR shall mark all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Said Record Drawings shall be supplemented by detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These master Record Drawings of the CONTRACTOR's representation of as-built conditions, including all revisions made necessary by addenda and change orders shall be maintained up-to-date during the progress of the Work.

C. At a minimum the Record Drawings shall be reviewed on the 20th working day of every third month after the month of Award, as well as on completion of Work. Failure to maintain the Record Drawings up-to-date shall be grounds of withholding monthly progress payments until such time as the Record Drawings are brought up-to-date.

D. Record Drawings shall be accessible to JEA/Engineer at all times during the construction period.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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SECTION 01370

SCHEDULE OF VALUES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The apparent low bidder will prepare and submit a preliminary schedule of values within the time frame referenced in the instructions to bidders. Each item in the schedule includes the complete structure; piping and valves; equipment furnished by equipment manufacturers. All electrical work will be included in the electrical item unless noted otherwise. All field instruments will be included in the instrumentation item unless noted otherwise.

B. Upon request of the Engineer, the apparent low bidder will prepare and submit supporting data which will substantiate the correctness of the Schedule of Values.

C. The Schedule of Values, unless objected to by the Engineer, shall be used as the basis for the CONTRACTOR's Applications for Payment.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Type Schedule of Values on 8-1/2 inch x 11 inch or 8-1/2 inch x 14 inch white paper furnished by JEA, CONTRACTOR's standard forms and automated printout will be considered for approval by the Engineer upon CONTRACTOR's request. Identify schedule with:

1. Title of Project and Location.

2. Engineer and Project number.

3. Name and Address of CONTRACTOR.

4. Contract Designation.

5. Date of Submission.

B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. For each major line item list sub-values of major products or operations under the item and include material and equipment costs. Identify each line item with the number and title of the respective major section of the specifications. The breakdown shall be done in accordance with a form established by the CONTRACTOR and acceptable to the JEA.

D. For the various portions of the Work:

1. Each item shall include a directly proportional amount of the CONTRACTOR's overhead and profit.

2. For items on which progress payments will be requested for stored materials, break down the value into:

   a. The cost of the materials, delivered and unloaded, with taxes paid. Paid invoices are required for materials upon request by the Engineer.

   b. The total installed value.

E. The sum of all values listed in the schedule shall equal the total Contract Sum.

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

A. The attached Table 01370-1 includes the assets to be accounted for in the Schedule of Values.

B. For each asset or group of assets listed, provide a constructed cost which will include an allocation of construction activities including but not limited to, demolition, sitework, specialties, materials, labor, general conditions, and overhead and profit associated with the construction of the asset.

C. The combined value of the assets will equal the bid price for the project and will require adjustments as necessary due to change orders. The schedule of values will be updated on a monthly basis and will be included in the monthly pay request application for approval.

D. JEA reserves the right to edit this list prior to the first pay application and may add up to 10 percent more items than have been identified in the list.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

**(Continued on Next Page)**

**Table 01370-1 Schedule of Assets**

| |
|---|
| Switchgear SWGR-E |
| Power Panel PP-EPS |
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SECTION 01400

QUALITY CONTROL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall develop and maintain a Quality Control Program in accordance with the Contract and as specified herein to ensure that the Work strictly conforms to all requirements of the Contract Documents. CONTRACTOR shall submit a weekly conformance report on quality control to JEA. The non-conformance report shall indicate deviations of the quality of work from the Quality Control program.

B. The CONTRACTOR shall be responsible for and shall supervise the work of all subcontractors, providing instructors to each when their work does not conform to the requirements of the Quality Control Program and the Contract Documents.

1.02 OBSERVATION AT PLACE OF MANUFACTURE

A. Unless otherwise specified, all products, materials, and equipment shall be subject to observation by JEA at the place of manufacture.

B. The presence of JEA at the place of manufacture however, shall not relieve the CONTRACTOR of the responsibility for furnishing products, materials, and equipment which comply with all requirements of the Contract Documents. Compliance is a duty of the CONTRACTOR, and said duty shall not be avoided by any act or omission on the part of JEA.

1.03 SAMPLING AND TESTING

A. Unless otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered; however, JEA reserves the right to use any generally-accepted system of sampling and testing which, in the opinion of JEA will insure that the quality of the workmanship is in full accord with the Contract Documents.

B. Any waiver by JEA of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial Work, shall not be construed as a waiver of any requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, JEA reserves the right to make independent investigations and tests and failure of any portion of the Work to meet any of the requirements of the Contract Documents, shall be reasonable cause for JEA to require the removal or correction and reconstruction of any such Work in accordance with the Contract.

1.04 SITE INVESTIGATION AND CONTROL

A. The CONTRACTOR shall verify all dimensions in the field and shall check field conditions continuously during construction. The CONTRACTOR shall be solely responsible for any inaccuracies built into the Work due to its failure to comply with this requirement.

B. The CONTRACTOR shall inspect related and appurtenant Work and shall report in writing to JEA any conditions which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the CONTRACTOR within the scope of the Contract.

1.05 INSPECTION AND TESTING

A. Unless otherwise specified, the CONTRACTOR shall employ and pay for the services of an independent testing laboratory for inspection and testing specified in the Contract Documents and for all other inspections and tests required by any permits, codes, or regulations. Copies of all test reports shall be submitted to JEA by the CONTRACTOR within 7 days of receipt of such reports from the testing lab.

B. The work or actions of the testing laboratory shall in no way relieve the CONTRACTOR of its obligations under the Contract. The laboratory testing work will include such inspections and testing required by the Contract Documents, existing laws, codes, ordinances, etc. The testing laboratory will have no authority to change the requirements of the Contract Documents, nor perform, accept or approve any of the CONTRACTOR's Work.

C. The CONTRACTOR shall allow JEA ample time and opportunity for field inspection and testing materials and equipment to be used in the Work. The CONTRACTOR shall advise JEA promptly upon placing orders for materials and equipment so that arrangements may be made, if desired, for inspection before shipment from the place of manufacture. The CONTRACTOR shall at all times furnish JEA and its representatives, facilities including labor, and allow proper time for inspecting and testing materials, equipment, and workmanship. The CONTRACTOR must anticipate that possible delays may occur in the execution of its work due to the necessity of materials and equipment being inspected and accepted for use. The CONTRACTOR shall furnish, at its own expense, all samples of materials required by JEA for testing, and shall make its own arrangements for providing water, electric power, or fuel for the various inspections and tests of structures and equipment.

D. JEA will provide funds as specified on the bid sheet to reimburse the CONTRACTOR at cost to perform all tests, inspections, or investigations undertaken by the order of JEA for the purpose of determining conformance with the Contract Documents if such tests, inspections, or investigations are not specifically required by the Contract Documents, and if conformance is ascertained thereby. Whenever nonconformance is determined by JEA as a result of such tests, inspections, or investigations, the CONTRACTOR shall bear the full cost of any additional tests, inspections, and investigations, which are ordered by JEA to ascertain subsequent conformance with the Contract Documents.

1.06 RIGHT OF REJECTION

A. JEA shall have the right, at all times and places, to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the site. If JEA or its representative, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such materials, no matter in what stage or condition of manufacture, delivery, or erection, may be subsequently rejected by JEA.

B. The CONTRACTOR shall promptly remove rejected articles or materials from the site of the Work after notification of rejection. All costs of removal and replacement of rejected articles or materials as specified herein shall be borne by the CONTRACTOR.

C. An inspection protocol shall be developed between the CONTRACTOR and JEA which shall include inspection criteria, equipment to be inspected, at which point to be inspected, notification time to JEA inspection, etc.

1.07 OTHER CONSTRUCTION CONSIDERATIONS

A. Cutting and Patching: The CONTRACTOR shall perform all cutting and patching of the Work that may be required to make its several parts come together properly and fit it to receive or be received by such other work. The CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and shall only cut or alter work with the written consent of JEA and of the other CONTRACTOR's whose work will be affected.

B. Sleeves and Openings: The CONTRACTOR shall provide all openings, chases, etc., to fit its own work and that of any other subcontractors and CONTRACTOR's. All such openings or chases shown on the Contract Drawings, or reasonably implied thereby, or as confirmed or modified by acceptable shop, setting or erecting drawings, shall be provided by the CONTRACTOR.

C. The CONTRACTOR shall in consultation with JEA develop an inspection protocol which shall include but not be limited to inspection criteria, equipment/work element to be inspected, schedule for inspections, notification schedule to JEA inspectors and other inspection related protocol necessary for the acceptance of the work by JEA.

D. Where pipes or conduits are to pass through slabs or walls, or where equipment frames or supports are to be installed as integral part of an opening, the sleeves, openings, forms or frames shall be furnished by the installer of the pipes, conduits or equipment, but shall be placed by the CONTRACTOR. Where hanger inserts, anchor bolts and similar items are to be embedded in concrete as an integral part of a slab or wall, they shall be furnished by the installer of the pipe or other equipment requiring the hanger, etc, but shall be placed by the CONTRACTOR.

E. Any cost resulting from correction of defective, ill-timed, or mislocated work or for subsequent work which becomes necessary because of omitted openings, chases, sleeves, frames, inserts, etc., shall be borne by the CONTRACTOR or subcontractor responsible therefore. The CONTRACTOR shall not arbitrarily cut, drill, alter, damage,

or otherwise endanger the work of another contractor. In no case shall beams, lintels, or other structural members be cut without the proper authorization of JEA. The nature and extent of any corrective or additional work shall be subject to the acceptance of JEA following consultation with the affected parties.

F. Weather Conditions: Weather protection and storm preparedness shall be undertaken in accordance with the Contract.

G. Fire Protection: The CONTRACTOR shall take all necessary precautions to prevent fires at or adjacent to the Work, including its own buildings and trailers. Adequate fire extinguisher and hose line stations shall be provided throughout the work area. The CONTRACTOR shall procure Burning Permits when required.

## PART 2 -- PRODUCTS

(NOT USED)

## PART 3 -- EXECUTION

### 3.01 BUOYANCY

A. The CONTRACTOR shall be completely responsible for any tanks, pipelines, manholes, foundations or similar improvements that may become buoyant during the construction operations due to groundwater levels. Should there be any possibility of buoyancy, the CONTRACTOR shall take the necessary steps to prevent damage due to floating or flooding, and shall repair or replace said improvements at no additional cost to JEA.

- END OF SECTION -

SECTION 01510

TEMPORARY UTILITIES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. It shall be the CONTRACTOR's responsibility to provide equipment that is adequate for the performance of the Work under this Contract within the time specified. All equipment shall be kept in satisfactory operating condition, shall be capable of safely and efficiently performing the required Work, and shall be subject to review by JEA at any time within the duration of the Contract. All Work hereunder shall conform to the applicable requirements of the OSHA Standards for Construction.

B. The CONTRACTOR shall provide for utilities and services for its own operations, in accordance with the Contract. The CONTRACTOR shall furnish, install and maintain all temporary utilities during the contract period including removal upon completion of the Work.

1.02 POWER AND LIGHTING

A. Power: The CONTRACTOR shall provide all necessary power required for its operations under the Contract at no additional cost to JEA, and shall provide and maintain all temporary power lines required to perform the Work in a safe and satisfactory manner.

B. Construction Lighting: All Work conducted at night or under conditions of deficient daylight shall be suitably lighted to insure proper Work and to afford adequate facilities for inspection and safe working conditions. Temporary lighting shall be maintained during nonworking periods if the area is subject to access by the public or JEA's personnel.

C. Electrical Connections: All temporary connections for electricity shall be subject to review by JEA and shall be removed in like manner at the CONTRACTOR's expense prior to final acceptance of the Work.

D. Separation of Circuits: Unless otherwise permitted by JEA, circuits separate from lighting circuits shall be used for all power purposes.

E. Construction Wiring: All wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. All electrical facilities shall conform to the requirements of Subpart K of the OSHA Safety and Health Standards for Construction.

1.03 WATER SUPPLY

A. General: Except as noted otherwise, the CONTRACTOR shall make arrangements for and pay for all costs for all water used for construction and testing. The CONTRACTOR shall provide and maintain all meters, piping, fittings, adapters, and valving required in accordance with the Contract.

B. Water Connections: The CONTRACTOR shall not make connection to, or draw water from, any fire hydrant or pipeline without first obtaining permission from JEA. For each such connection made, the CONTRACTOR shall first attach to the fire hydrant or pipeline a valve and a meter, of a size and type acceptable to JEA.

C. Removal of Water Connections: Before Final Acceptance of the Work on the project, all temporary connections and piping installed by the CONTRACTOR shall be entirely removed, and all affected improvements shall be restored to their original condition, or better, to the satisfaction of JEA and to the agency owning the affected utility.

D. Fire Protection: The construction and all other parts of the Work shall be connected with the CONTRACTOR's water supply system and shall be adequately protected against damage by fire. Hose connections and hose, water casks, chemical equipment, or other sufficient means shall be provided for fighting fires in the temporary structures and other portions of the Work, and responsible persons shall be designated and instructed in the operation of such fire apparatus so as to prevent or minimize the hazard of fire. The CONTRACTOR's fire protection program shall conform to the requirements of Subpart F of the OSHA Standards for Construction and all local Fire Department Requirements.

1.04 TEMPORARY SANITARY FACILITIES

A. The CONTRACTOR shall provide and maintain adequate and clean sanitary facilities for the construction work force and visitors. The facilities shall comply with local codes and regulations and be situated in an acceptable location.

B. Fixed or portable chemical toilets shall be provided by the CONTRACTOR wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.

C. Such facilities shall be made available when the CONTRACTOR’s first employees arrive on the Work, shall be properly secluded from public observation, and shall be constructed and maintained in suitable numbers and at such points and in such manner as may be required.

D. The CONTRACTOR shall maintain the sanitary facilities in a satisfactory and sanitary condition at all time and shall enforce their use. It shall rigorously prohibit the committing of nuisances on the site of the Work, on the property of JEA, or on adjacent property.

E. JEA shall have the right to inspect any building or other facility erected, maintained, or used by the CONTRACTOR, to determine whether or not the sanitary regulations have been complied with.

F. Sanitary and Other Organic Wastes: The CONTRACTOR shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR's operations shall be disposed of away from the site in a manner satisfactory to the JEA REPRESENTATIVE and in accordance with all laws and regulations pertaining thereto.

1.05 CONFINED SPACES

A. The CONTRACTOR shall provide and maintain a safe working environment in confined spaces. The CONTRACTOR shall follow the applicable requirements of the OSHA Standards for Construction and NIOSH Publications for working in confined spaces.

1.06 TEMPORARY VENTILATION

A. The CONTRACTOR shall provide and maintain adequate ventilation for a safe working environment. In addition, forced air ventilation shall be provided for the curing of installed materials, humidity control and the prevention of hazardous accumulations of dust, gases or vapors.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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SECTION 01520

MAINTENANCE OF UTILITY OPERATIONS DURING CONSTRUCTION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The existing plant will be maintained in continuous operation by JEA during the entire construction period of the Contract as hereinafter specified. The intent of this Section is to outline the minimum requirements necessary to provide continuous treatment, disinfection and disposal of the full effluent flow throughout the construction period.

B. Work shall be scheduled and conducted by the CONTRACTOR so as not to impede any treatment process, reduce the quality of the plant effluent or cause odor or other nuisance except as explicitly permitted hereinafter. In performing the work shown and specified, the CONTRACTOR shall plan and schedule his work to meet the plant and collection system operating requirements, and the constraints and construction requirements as outlined in this Section. No discharge of raw or inadequately treated wastewater shall be allowed. The CONTRACTOR shall pay all civil penalties, costs, assessments, etc., associated with any discharge of raw or inadequately treated wastewater associated with the CONTRACTOR's work.

C. The CONTRACTOR shall be responsible for coordinating the general construction and the schedules of electrical and related trades and for ensuring that permanent or temporary power and controls are available for all existing, proposed, and temporary facilities that are required to be on line at any given time.

D. The CONTRACTOR has the option of providing additional temporary facilities that can eliminate a constraint, provided it is done without cost to JEA and provided that all requirements of these Specifications are fulfilled. Work not specifically covered in the following paragraphs may, in general, be done at any time during the contract period, subject to the operating requirements and constraints and construction requirements outlined hereinafter. All references to days in this Section shall be consecutive calendar days.

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. Section 01010 – Summary of Work

B. Section 01020 – Construction Sequencing/Constraints

1.03 GENERAL CONSTRAINTS

A. The CONTRACTOR shall schedule the Work so that the plant is maintained in continuous operation. All treatment processes shall be maintained in continuous operation during the construction period except during approved process interruptions. All short-term system or partial systems shutdowns shall be approved by JEA. Long-term process shutdowns and diversions shall conform to the requirements hereinafter

specified and shall be minimized by the CONTRACTOR as much as possible. If in the judgment of JEA, a requested shutdown is not required for the CONTRACTOR to perform the Work, the CONTRACTOR shall utilize approved alternative methods to accomplish the Work. All shutdowns shall be coordinated with and scheduled at times suitable to JEA. Shutdowns shall not begin until all required materials are on hand and ready for installation. Each shutdown period shall commence at a time approved by JEA, in writing. Where required in the Construction Sequence, the CONTRACTOR shall proceed with the Work continuously, (24 hours/day, 7 days/week) start to finish, until the Work is completed and normal plant operation is restored. The CONTRACTOR shall be responsible for, and include in its contract bid amount, all costs associated with necessary work to isolate the existing piping, utilities or facilities to complete the required connections and/or modifications. Necessary work required by the CONTRACTOR shall include, but shall not be limited to, temporary pumping and piping, wet taps, line stops, line plugs, and temporary bulkheads and/or stop logs.

B. The CONTRACTOR shall review all bidding documents and shall be responsible to determine all such connections or modifications, and the scope and cost of all temporary measures required to isolate the work area without the need for a shutdown of the affected facility, process area, piping or utility.

C. Any temporary work, facilities, roads, walks, protection of existing structures, piping, blind flanges, valves, equipment, etc. that may be required within the CONTRACTOR's work limits to maintain continuous and dependable plant operation shall be furnished by the CONTRACTOR.

D. JEA shall have the authority to order Work postponed, stopped or prohibited that would, in his opinion, unreasonably result in interrupting the necessary functions of the plant operations.

E. If the CONTRACTOR impairs performance or operation of the plant as a result of not complying with specified provisions for maintaining plant operations, then the CONTRACTOR shall immediately make all repairs or replacements and do all work necessary to restore the plant to operation to the satisfaction of JEA. Such work shall progress continuously to completion on a 24-hours per day, seven work days per week basis.

F. The CONTRACTOR shall provide the services of emergency repair crews on call as required.

1.04 GENERAL OPERATING REQUIREMENTS, CONSTRAINTS, AND CONSTRUCTION REQUIREMENTS

A. Access to Plant Site, Roadways, and Parking Areas

1. An unobstructed traffic route through the Main Gate shall be maintained at all times for JEA's operations personnel and maintenance equipment. The CONTRACTOR shall be responsible for providing access to and for preparing and maintaining/approved parking areas.

2. An unobstructed traffic route around the plant site shall be maintained at all times for JEA's operations personnel and maintenance equipment. Vehicular access to the treatment units and buildings for JEA personnel shall be maintained at all times by the CONTRACTOR.

3. The CONTRACTOR shall provide temporary measures to protect the existing pavement by filling over with earthen material or supplying other measures acceptable to JEA, and he shall repair any damage to existing paved surfaces that occurs during the construction period. Any areas disturbed along the shoulders of the access road and interior roads and elsewhere inside and outside of the plant shall be repaired, graded, seeded, etc. as necessary to match pre-existing conditions.

4. The CONTRACTOR shall not undertake the restoration/construction of new roadway (paved, gravel, or asphalt overlay) shown on the Contract Drawings, until all other work on the plant improvements has been completed.

5. It shall be the responsibility of the CONTRACTOR to obtain any permits required from the Florida Department of Transportation and pay all associated fees.

B. Personnel Access: Treatment plant personnel shall have access to all areas which remain in operation throughout the construction period. The CONTRACTOR shall locate stored material, dispose of construction debris and trash, provide temporary walkways, provide temporary lighting, and other such work as directed by JEA to maintain personnel access to areas in operation. Access and adequate parking areas for plant personnel must be maintained throughout construction.

C. Plumbing Facilities: Unless otherwise allowed by JEA, sanitary facilities in the existing structures shall be operational at all times for plant operating personnel. All other building plumbing systems such as roof and floor drains, pumping, etc., shall be maintained for all structures.

D. Building Heating and Ventilating: Building heating and ventilating for the existing plant structures shall be in service for the entire construction period. Additional temporary heating and ventilation shall be provided as required to maintain facilities under construction adequately heated and vented. The temperatures to be maintained in any areas occupied by plant operating personnel such as offices, lunchrooms, locker rooms, bathrooms, etc., shall be at least 65 degrees Fahrenheit. The temperatures to be maintained in all other interior plant areas, whether new, existing or temporary, shall be maintained at a minimum of 55 degrees Fahrenheit.

E. Power, Light and Communications Systems (General): Electric power, lighting service and communications systems shall be maintained in uninterrupted operation in all areas which remain in operation. Individual units may be disconnected as required for replacement, but service shall be available at all times including periods when plant elements are out of service. Shutdown of electrical facilities shall be limited to not more than thirty (30) minutes. JEA may allow longer outages under conditions determined by JEA. All costs associated with use of temporary services or standby engine generators shall be paid by the CONTRACTOR. The Electrical CONTRACTOR shall coordinate shutdowns required with the CONTRACTOR to minimize the total number of shutdowns

required to complete construction. JEA's phone service to and within the plant shall be maintained in continuous operation during construction.

F. Draining Process Pipes and Conduits (General): The contents of all pipes and conduits to be removed, replaced or relocated (or dewatered for a specific purpose) shall be transferred to a suitable facility in a manner approved by JEA through hoses or piping, or by using pumps if hydraulic conditions so require them. The CONTRACTOR shall provide the pumps, piping and hoses at no additional cost to JEA. No uncontrolled spillage of a pipe or conduit shall be permitted. Any spillage, other than potable water, shall be immediately washed down and flushed into the appropriate process flow train.

G. Potable Water System: Potable water service shall be maintained in continuous service at all times during construction except for short term interruptions required for tie-ins. Shutdown of the potable water system shall be fully planned and coordinated with the Plant Superintendent and shall be limited to not more than two (2) hours. Existing fire hydrants within the plant site shall be operational at all times, unless otherwise approved by JEA.

H. Sump Pumps and Sumps: All existing sumps shall be maintained in an operable condition with either existing pumps or temporary pumps. Interim piping, power and controls shall be provided as required by the staged construction sequence.

I. Seal Water and Service Water Piping: A supply of service and seal water and the necessary connections to existing equipment shall be maintained during construction. Interim piping shall be provided as required.

1.05 ELECTRICAL REQUIREMENTS

A. The CONTRACTOR shall maintain operation of existing plant facilities during construction and pay close attention to electrical construction sequencing constraints described or implied in the process requirements.

B. The CONTRACTOR shall comply with, but not be limited to, the following electrical requirements:

1. Coordinate all power shutdowns with JEA and provide temporary equipment to maintain plant operation as required.

2. The following Effluent Pump Station loads shall be operational at all times:

   a. Two (2) of Three (3) Effluent Pumps.
   b. Three (3) of Three (3) Reuse Pumps
   c. MCC-CH in its entirety.
   d. MCC-E in its entirety.

3. A temporary portable generator (1100kW minimum) shall be provided by the Contractor during construction.

4. A new, temporary switchboard lineup shall be installed by the Contractor as indicated herein. The temporary switchboard shall be provided as part of the Southwest WRF Main Breaker Replacement Project.

1.06 PREFERRED SEQUENCE OF CONSTRUCTION:

A. Furnish and Install temporary generator and install temporary switchboard.

B. Furnish and install new power panel PP-EPS.

C. Connect all existing loads listed required to be operational (listed above) to temporary sources of power (including MCC-CH).

D. Transfer Reuse Pump VFD loads to PP-EPS.

E. Remove and install new Switchgear SWGR-E, including new overhead feeders to MCC-E and PP-EPS.

F. Remove all temporary connections and restore permanent connections.

1. Coordinate all details of the sequence of construction with JEA and the ENGINEER prior to starting any work.

2. Maximum Shutdown length to install and remove temporary facilities shall be two (2) hours, during 6am – 8am. Exact day(s) shall be coordinated with JEA.

3. **A qualified person shall be on-site 24 hours a day for all times in which the plant is running on the temporary electrical system.** This individual shall be qualified to complete a transfer from the electrical utility to the Contractor-provided portable generator in the event of a loss of utility power.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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SECTION 01530

PROTECTION OF EXISTING FACILITIES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. CONTRACTOR shall be responsible for the preservation and protection of property adjacent to the work site against damage or injury as a result of his operations under this Contract. Any damage or injury occurring on account of any act, omission or neglect on the part of the CONTRACTOR shall be restored in a proper and satisfactory manner or replaced by and at the expense of the CONTRACTOR to an equal or superior condition than previously existed.

B. CONTRACTOR shall comply promptly with such safety regulations as may be prescribed by JEA or the local authorities having jurisdiction and shall, when so directed, properly correct any unsafe conditions created by, or unsafe practices on the part of, his employees. In the event of the CONTRACTOR's failure to comply, JEA may take the necessary measures to correct the conditions or practices complained of, and all costs thereof will be deducted from any monies due the CONTRACTOR. Failure of JEA to direct the correction of unsafe conditions or practices shall not relieve the CONTRACTOR of his responsibility hereunder.

C. In the event of any claims for damage or alleged damage to property as a result of work under this Contract, the CONTRACTOR shall be responsible for all costs in connection with the settlement of or defense against such claims. Prior to commencement of work in the vicinity of property adjacent to the work site, the CONTRACTOR, at his own expense, shall take such surveys as may be necessary to establish the existing condition of the property. Before final payment can be made, the CONTRACTOR shall furnish satisfactory evidence that all claims for damage have been legally settled or sufficient funds to cover such claims have been placed in escrow, or that an adequate bond to cover such claims has been obtained.

D. The CONTRACTOR shall verify the exact locations and depths of all utilities shown and the CONTRACTOR shall make exploratory excavations of all utilities that may interfere with the Work. All such exploratory excavations shall be performed as soon as practicable after award of Contract and, in any event, a sufficient time in advance of construction to avoid possible delays to the CONTRACTOR's Work. When such exploratory excavations show the utility location as shown to be in error, the CONTRACTOR shall so notify JEA.

E. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.

1.02 PROTECTION OF WORK AND MATERIAL

A. During the progress of the work and up to the date of final payment, the CONTRACTOR shall be solely responsible for the care and protection of all work and materials covered by the Contract.

B. All work and materials shall be protected against damage, injury or loss from any cause whatsoever, and the CONTRACTOR shall make good any such damage or loss at his own expense. Protection measures shall be subject to the approval of JEA.

1.03 BARRICADES, WARNING SIGNS AND LIGHTS

A. The CONTRACTOR shall provide, erect and maintain as necessary, strong and suitable barricades, danger signs and warning lights along all roads accessible to the public, as required by the authority having jurisdiction, to insure safety to the public. All barricades and obstructions along public roads shall be illuminated at night and all lights for this purpose shall be kept burning from sunset to sunrise.

B. The CONTRACTOR shall provide and maintain such other warning signs and barricades in areas of and around their respective work as may be required for the safety of all those employed in the work, JEA's operating personnel, or those visiting the site.

C. In the case of a conflict between this Specification Section and the CONTRACTOR's Safety Plan, the more stringent requirement of the two documents shall govern.

1.04 EXISTING UTILITIES AND STRUCTURES

A. The term existing utilities shall be deemed to refer to both publicly-owned and privately-owned utilities such as electric power and lighting, telephone, water, gas, storm drains, process lines, sanitary sewers and all appurtenant structures.

B. Where existing utilities and structures are indicated on the Drawings, it shall be understood that all of the existing utilities and structures affecting the work may not be shown and that the locations of those shown are approximate only. It shall be the responsibility of the CONTRACTOR to ascertain the actual extent and exact location of existing utilities and structures. In every instance, the CONTRACTOR shall notify the proper authority having jurisdiction and obtain all necessary directions and approvals before performing any work in the vicinity of existing utilities.

C. Prior to beginning any excavation work, the CONTRACTOR shall, through field investigations, determine any conflicts or interferences between existing utilities and new utilities to be constructed under this project. This determination shall be based on the actual locations, elevations, slopes, etc., of existing utilities as determined in the field investigations, and locations, elevation, slope, etc. of new utilities as shown on the Drawings. If an interference exists, the CONTRACTOR shall bring it to the attention of JEA as soon as possible. If JEA agrees that an interference exists, he shall modify the design as required. Additional costs to the CONTRACTOR for this change shall be processed through a Change Order as detailed elsewhere in these Contract Documents.

D. The work shall be carried out in a manner to prevent disruption of existing services and to avoid damage to the existing utilities. Temporary connections shall be provided, as required, to insure uninterruption of existing services. Any damage resulting from the work of this Contract shall be promptly repaired by the CONTRACTOR at his own expense in a manner satisfactory to JEA or the respective authority having jurisdiction over such work. Where it is required by the authority having jurisdiction that they perform their own repairs or have them done by others, the CONTRACTOR shall be responsible for all costs thereof.

E. Where excavations by the CONTRACTOR require any utility lines or appurtenant structures to be temporarily supported and otherwise protected during the construction work, such support and protection shall be provided by the CONTRACTOR. All such work shall be performed in a manner satisfactory to JEA or the respective authority having jurisdiction over such work. In the event the CONTRACTOR fails to provide proper support or protection to any existing utility, JEA may, at his discretion, have the respective authority to provide such support or protection as may be necessary to insure the safety of such utility, and the costs of such measures shall be paid by the CONTRACTOR.

1.05 RESTORATION OF PAVEMENT

A. General: All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents. All pavements which are subject to partial removal shall be neatly saw cut in straight lines.

B. Temporary Resurfacing: Wherever required by JEA, the CONTRACTOR shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time required by JEA before proceeding with the final restoration of improvements.

C. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the CONTRACTOR shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.

1.06 EXISTING UTILITIES AND IMPROVEMENTS

A. General: The CONTRACTOR shall protect all underground utilities and other improvements which may be impaired during construction operations. It shall be the CONTRACTOR's responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The CONTRACTOR shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

B. Where the proper completion of the Work requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is shown, the CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to JEA. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by the CONTRACTOR in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

C. Underground Utilities Shown or Indicated: Existing utility lines that are shown or the locations of which are made known to the CONTRACTOR prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired by the CONTRACTOR.

D. Underground Utilities Not Shown or Indicated: In the event that the CONTRACTOR damages any existing utility lines that are not shown or the locations of which are not made known to the CONTRACTOR prior to excavation, a written report thereof shall be made immediately to JEA. If directed by JEA, repairs shall be made by the CONTRACTOR under the provisions for changes and extra Work contained in the Contract.

E. Maintaining in Service: All oil and gasoline pipelines, power, and telephone or other communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered within the limits of construction shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to JEA are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, wire or cable. The CONTRACTOR shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

1.07 TREES WITHIN PROJECT LIMITS

A. General: The CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs on the project site, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or JEA. All existing trees and shrubs which are damaged during construction shall be replaced by the CONTRACTOR or a certified tree company to the satisfaction of JEA.

B. Protection: The CONTRACTOR shall protect all trees in accordance with the Contract.

C. Trimming: Where required, trim trees in accordance with the Contract.

D. Replacement: The CONTRACTOR shall immediately notify if any tree is damaged by the CONTRACTOR's operations. If, in the opinion of JEA, the damage is such that replacement is necessary, the CONTRACTOR shall replace the tree at its own expense. The tree shall be of a like size and variety as the tree damaged, or, if of a smaller size, the CONTRACTOR shall pay to JEA compensatory payment acceptable to JEA.

1.08 NOTIFICATION BY THE CONTRACTOR

A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way the CONTRACTOR shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than three days nor more than seven days prior to excavation so that a representative of said owners or agencies can be present during such Work if they so desire.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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SECTION 01540

DEMOLITION AND REMOVAL OF EXISTING STRUCTURES AND EQUIPMENT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall furnish all labor, materials and equipment to demolish buildings and structures and to remove fixtures, anchors, supports, piping and accessories designated to be removed on the Drawings.

1.02 SUMMARY

A. This section covers the demolition, removal, and disposal of existing buildings, structures, pavement, curbs, and sidewalk, removal and disposal of asbestos materials, and any existing equipment including electrical, plumbing, heating and ventilating equipment and piping not required for the operation of the rehabilitated plant as indicated on the Drawings and as specified hereinafter.

1.03 SUBMITTALS

A. The CONTRACTOR shall submit for review, in accordance with Section 01300 entitled "Submittals" the proposed methods, equipment and operation sequence. Include coordination for shut-off, temporary services, continuation of service and other applicable items to ensure no interruption of plant operations except as hereinbefore specified.

1.04 TITLE TO EQUIPMENT AND MATERIALS

A. CONTRACTOR shall have no right or title to any of the equipment, materials or other items to be removed from the existing buildings or structures unless and until said equipment, materials and other items have been removed from the premises. The CONTRACTOR shall not sell or assign, or attempt to sell or assign any interest in the said equipment, materials or other items until the said equipment, materials or other items have been removed.

B. CONTRACTOR shall have no claim against JEA because of the absence of such fixtures and materials.

1.05 CONDITION OF STRUCTURES AND EQUIPMENT

A. JEA does not assume responsibility for the actual condition of structures and equipment to be demolished and removed.

B. Conditions existing at the time of inspection for bidding purposes will be maintained by JEA so far as practicable.

C. The information regarding the existing structures and equipment shown on the Drawings is based on visual inspection and a walk-through survey only. JEA will not be responsible for interpretations or conclusions drawn therefrom by the CONTRACTOR.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

3.01 DEMOLITION AND REMOVALS

A. The removal of all equipment and piping, and all materials from the demolition of buildings and structure shall, when released by JEA, shall be done by the CONTRACTOR and shall become the CONTRACTOR's property, unless otherwise noted, for disposition in any manner not contrary to the Contract requirements and shall be removed from the site to the CONTRACTOR's own place of disposal.

B. The Electrical Subcontractor specifically, shall de-energize all panelboards, lighting fixtures, switches, circuit breakers, electrical conduits, motors, limit switches, pressure switches, instrumentation such as flow, level and/or other meters, wiring, and similar power equipment prior to removal. Any electric panels or equipment which are to be retained shall be relocated or isolated by the Electrical Subcontractor specifically, prior to the removal of the equipment specified herein. All existing electrical equipment to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to keep the integrity of the grounding systems.

C. Conduits and wires shall be abandoned or removed where noted or as shown on the Drawings. All wires in abandoned conduits shall be removed. Abandoned conduits concealed in floor or ceiling slabs or in walls, shall be cut flush with the slab or wall at the point of entrance. The conduits shall be suitably plugged and the area repaired in a flush, smooth, approved manner. Exposed conduits and their supports shall be disassembled and removed from the project site. Repair all areas of removal to prevent rust spots on exposed surfaces.

D. The CONTRACTOR shall proceed with the removal of the equipment, piping and appurtenances in a sequence designed to maintain the plant in continuous operation as described in Section 01520 entitled "Maintenance of Utility Operations During Construction", and shall proceed only after approval of JEA.

E. Any equipment piping and appurtenances removed without proper authorization, which are necessary for the operation of the existing facilities, shall be replaced to the satisfaction of JEA at no cost to JEA.

F. Excavation caused by demolitions shall be backfilled with fill free from rubbish and debris.

G. At least 48 hours prior to commencement of a demolition or removal, the CONTRACTOR shall notify JEA in writing of the proposed schedule. No removals shall be started until it is acceptable to JEA.

3.02 PROTECTION

A. Demolition and removal work shall be performed by competent experienced workmen for the various type of demolition and removal work and shall be carried out through to completion with due regard to the safety of JEA employees, workmen on-site and the public. The work shall be performed with as little nuisance as possible.

B. The work shall comply with the applicable provisions and recommendation of ANSI A10.2, Safety Code for Building Construction, all governing codes, and as hereinafter specified.

C. The CONTRACTOR shall make such investigations, explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. The CONTRACTOR shall give particular attention to shoring and bracing requirements so as to prevent any damage to new or existing construction.

D. The CONTRACTOR shall provide, erect, and maintain catch platforms, lights, barriers, weather protection, warning signs and other items as required for proper protection of the public, occupants of the building, workmen engaged in demolition operations, and adjacent construction.

E. The CONTRACTOR shall provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.

F. The CONTRACTOR shall provide and maintain temporary protection of the existing structure designated to remain where demolition, removal and new work is being done, connections made, materials handled or equipment moved.

G. The CONTRACTOR shall take necessary precautions to prevent dust from rising by wetting demolished masonry, concrete, plaster and similar debris. Unaltered portions of the existing buildings affected by the operations under this Section shall be protected by dust-proof partitions and other adequate means. Existing electrical and mechanical equipment to remain shall be protected from damage, dust, and debris.

H. The CONTRACTOR shall provide adequate fire protection in accordance with local Fire Department requirements.

I. The CONTRACTOR shall not close or obstruct walkways, passageways, or stairways and shall not store or place materials in passageways, stairs or other means of egress. The CONTRACTOR shall conduct operations with minimum traffic interference.

J. The CONTRACTOR shall be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided.

3.03 WORKMANSHIP

A. The demolition and removal work shall be performed as described in the Contract Documents. The work required shall be done with care, and shall include all required shoring, bracing, etc. The CONTRACTOR shall be responsible for any damage which may be caused by demolition and removal work to any part or parts of existing structures or items designated for reuse or to remain. The CONTRACTOR shall perform patching, restoration

and new work in accordance with applicable Technical Sections of the Specifications and in accordance with the details shown on the Drawings.

B. All supports, pedestals and anchors shall be removed with the equipment and piping unless otherwise specified or required. Concrete bases, anchor bolts and other supports shall be removed to approximately 1-inch below the surrounding finished area and the recesses shall be patched to match the adjacent areas. Superstructure wall and roof openings shall be closed, and damaged surfaces shall be patched to match the adjacent areas, as specified under applicable Sections of these Specifications, as shown on the Drawings, or as directed by JEA. Wall sleeves and castings shall be plugged or blanked off, all openings in concrete shall be closed in a manner meeting the requirements of the appropriate Sections of these Specifications, as shown on the Drawings, and as directed and approved by JEA.

C. Materials or items designated to remain the property of JEA shall be as hereinafter tabulated. Such items shall be removed with care and stored at a location at the site to be designated by JEA.

D. Where equipment is shown or specified to be removed and relocated, the CONTRACTOR shall not proceed with removal of this equipment without specific prior approval of JEA. Upon approval, and prior to commencing removal operations, the equipment shall be operated in the presence of representatives of the CONTRACTOR and JEA. Such items shall be removed with care, under the supervision of the trade responsible for reinstallation and protected and stored until required. Material or items damaged during removal shall be replaced with similar new material or item. Any equipment that is removed without proper authorization and is required for plant operation shall be replaced at no cost to JEA.

E. Wherever piping is to be removed for disposition, the piping shall be drained by the CONTRACTOR and adjacent pipe and headers that are to remain in service shall be blanked off or plugged and then anchored in an approved manner.

F. Materials or items demolished and not designated to become the property of JEA or to be reinstalled shall become the property of the CONTRACTOR and shall be removed from the property and legally disposed of.

G. The CONTRACTOR shall execute the work in a careful and orderly manner, with the least possible disturbance to the public and to the occupants of the building.

H. In general, masonry shall be demolished in small sections, and where necessary to prevent collapse of any construction, the CONTRACTOR shall install temporary shores, struts, and bracing.

I. Where alterations occur, or new and old work join, the CONTRACTOR shall cut, remove, patch, repair or refinish the adjacent surfaces to the extent required by the construction conditions, so as to leave the altered work in as good a condition as existed prior to the start of the work. The materials and workmanship employed in the alterations, unless otherwise shown on the Drawing or specified, shall comply with that of the various respective trades which normally perform the particular items or work.

J. The CONTRACTOR shall finish adjacent existing surfaces to new work to match the specified finish for new work as shown in the Contract Documents. The CONTRACTOR shall clean existing surfaces of dirt, grease, loose paint, etc., before refinishing.

K. The CONTRACTOR shall cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the respective finishes.

L. The CONTRACTOR shall confine cutting of existing roof areas designated to remain to the limits required for the proper installation of the new work. The CONTRACTOR shall cut and remove insulation, etc., and provide temporary weather tight protection as required until new roofing and flashings are installed.

M. The CONTRACTOR shall remove temporary work, such as enclosures, signs, guards, and the like when such temporary work is no longer required or when directed at the completion of the work.

3.04 MAINTENANCE

A. The CONTRACTOR shall maintain the buildings, structures and public properties free from accumulations of waste, debris and rubbish, caused by the demolition and removal operations.

B. The CONTRACTOR shall provide on-site dump containers for collection of waste materials, debris and rubbish, and he shall wet down dry materials to lay down and prevent blowing dust.

C. At reasonable intervals during the progress of the demolition and removal work or as directed by JEA, the CONTRACTOR shall clean the site and properties, and dispose of waste materials, debris and rubbish.

3.05 EQUIPMENT AND MATERIALS RETAINED BY JEA

A. Equipment and materials to be retained by JEA shall include but may not be limited to:

1. Temporary Switchboard provided by this project.

B. The equipment and materials shall be moved by the CONTRACTOR to storage areas, on the site, to be designated by JEA.

3.06 CLEANUP

A. The CONTRACTOR shall, promptly and on a regular basis, remove from the project site all debris resulting from the demolition and removal operations as it accumulates. Upon completion of the demolition work, all materials, equipment, waste and debris of every sort shall be removed and the premises shall be left clean, neat and orderly.

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SECTION 01541

FIELD ENGINEERING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surveying services required for proper layout of work and record information.

1.02 RELATED SECTIONS

A. Section 01300 – Submittals

B. Section 01400 – Quality Control

C. Section 01700 – Project Closeout

C. Section 01720 – Project Record Drawings

1.03 QUALITY CONTROL

A. A Land Surveyor Registered in the State of Florida shall be used for verifying existing control points and establishing new control points. CONTRACTOR shall be responsible to verify the accuracy of the established control points prior to performing layout.

1.04 SUBMITTALS

A. Submit name, address, and telephone number of Registered Land Surveyor to the Engineer before starting work.

B. On request, submit documentation verifying accuracy of survey work for project boundary and vertical and horizontal control.

C. Submit certificate signed by Surveyor with Project Record Documents certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.

1.05 PROJECT RECORD DOCUMENTS

A. Maintain complete, accurate log of control and survey work as it progresses.

B. Maintain one set of plans that all record drawing information is kept on. These plans shall show the record information within one week of installation of work or information being made available. CONTRACTOR's record drawing markups will be available for review by JEA at any time during the normal workday.

C. Submit record drawing markups as specified in Section 01700 entitled "Contract Closeout" and Section 01720 entitled "Record Drawings".

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

3.01 INSPECTION

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

B. Promptly notify JEA of any discrepancies discovered.

3.02 SURVEY REFERENCE POINTS

A. Protect survey control points prior to starting site work; preserve permanent reference points during construction. Make no changes without prior written notice to JEA.

B. Promptly report to JEA the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Replace dislocated survey control points based on original survey control.

3.03 SURVEY REQUIREMENTS

A. JEA shall provide one bench mark for vertical and horizontal control during construction. CONTRACTOR shall be responsible for laying out the work, shall protect and preserve the established bench mark and shall make no changes or relocations without prior approval of JEA. CONTRACTOR shall report to JEA whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

B. CONTRACTOR shall establish line and levels, locate and lay out by instrumentation and similar appropriate means:

1. Site improvements, including pavements, stakes for grading, fill and topsoil placement, utility locations, slopes, and invert, or centerline, elevations. Submit cut sheets for gravity sewers to JEA three days prior to construction.

2. Grid or axis for structures.

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

4. Piping locations, slopes, and invert, or centerline, elevations.

C. Periodically verify layouts by same means.

D. CONTRACTOR shall provide and incorporate into record drawing markups the horizontal and vertical record locations of improvements, including the following:

1. Corner coordinates of rectangular or square buildings, structures, and tanks.

2. Center coordinates of circular buildings, structures, and tanks.

3. Building floor elevations.

4. Floor elevations of structures and tanks as required to define floor slope.

5. Top elevations of structures and tanks.

6. Channel floor elevations at each change in slope.

7. Channel top elevations.

8. Manhole center coordinates for sanitary sewers, storm sewers, and electrical duct banks.

9. Pipe coordinates at changes in direction.

10. Coordinates of buried valves, tees and fittings.

11. All underground piping invert or centerline elevations including at changes in slope.

12. All underground pipe invert or centerline elevations at tees and crosses.

13. Pipe invert, or centerline, elevations at crossing with other pipe.

14. Invert, or centerline, elevations and coordinates of existing pipe at crossing with underground pipe installed under this project.

15. Invert elevations of manhole pipe inlets and outlets.

16. Duct bank coordinates at changes in direction.

17. Top and bottom elevations of duct banks at manholes and handholes.

18. Other horizontal and vertical record data pertinent to completed Work.

E. Ground surface record/information shall include the following:

1. Spot elevations should be shown at a minimum 100-foot rectangular grid, sufficient to show all the important topographic features.

2. All elevations shown on the construction drawings shall be confirmed or amended on the record drawing markups if finished elevations are different.

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SECTION 01550

SITE ACCESS AND STORAGE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Access Roads

1. The CONTRACTOR shall construct and maintain such temporary access roads as required to perform the work of this Contract.

2. Access roads, where possible, shall be located over the areas of the future road system.

3. Access roads shall be located within the property lines of JEA unless the CONTRACTOR independently secures easements for his use and convenience. CONTRACTOR shall submit written documentation to JEA for any CONTRACTOR secured easements across privately held property. Easement agreement shall specify terms and conditions of use and provisions for site restoration. A written release from the property owner certifying that all terms of the easement agreement have been complied with the CONTRACTOR shall be furnished to JEA prior to final payment.

4. Existing access roads used by the CONTRACTOR shall be suitably maintained by the CONTRACTOR at his expense during construction. CONTRACTOR shall not be permitted to restrict JEA access to existing facilities. JEA may direct CONTRACTOR to perform maintenance of existing access roads when JEA determines that such work is required to insure all weather access by JEA.

B. Parking Areas: Each CONTRACTOR shall construct and maintain suitable parking areas for his construction personnel on the project site where approved by JEA.

C. Restoration: At the completion of the work, the surfaces of land used for access roads and parking areas shall be restored by each CONTRACTOR to its original condition and to the satisfaction of JEA. At a minimum, such as restoration shall include establishment of a permanent ground cover adequate to restrain erosion for all disturbed areas.

D. Traffic Regulations: CONTRACTOR shall obey all traffic laws and comply with all the requirements, rules and regulations of the Florida Department of Transportation and other local authorities having jurisdiction to maintain adequate warning signs, lights, barriers, etc., for the protection of traffic on public roadways.

E. Storage of Equipment and Materials

1. CONTRACTOR shall store his equipment and materials at the job site in accordance with the requirements of the General Conditions, the Supplemental Conditions, Section 01600 and as hereinafter specified. All equipment and materials shall be stored in accordance with manufacturer's recommendations and as directed by JEA,

and in conformity to applicable statutes, ordinances, regulations and rulings of the public authority having jurisdiction. Where space or strip heaters are provided within the enclosure for motors, valve operators, motor starters, panels, instruments, or other electrical equipment, the CONTRACTOR shall make connections to these heaters from an appropriate power source and operate the heaters with temperature control as necessary until the equipment is installed and being operated according to its intended use.

2. CONTRACTOR shall enforce the instructions of JEA regarding the posting of regulatory signs for loadings on structures, fire safety, and smoking areas.

3. CONTRACTOR shall not store materials or encroach upon private property without the written consent of the owners of such private property.

4. CONTRACTOR shall not store unnecessary materials or equipment on the job site, and shall take care to prevent any structure from being loaded with a weight which will endanger its security or the safety of persons.

5. Materials shall not be placed within ten (10) feet of fire hydrants. Gutters, drainage channels and inlets shall be kept unobstructed at all times.

6. CONTRACTOR shall provide adequate temporary storage buildings/facilities, if required, to protect materials or equipment on the job site.

7. JEA shall not be responsible for the unloading or receipt of materials delivered to the project site. CONTRACTOR shall retain full responsibility to coordinate and schedule the delivery, unloading and placement of equipment in storage during the normal time of work.

8. If the CONTRACTOR requires additional staging area than shown on the Drawings, the CONTRACTOR shall obtain such areas from off-site sources at no additional cost to JEA.

9. Upon completion of the Contract, the CONTRACTOR shall remove from the storage areas all of its equipment, temporary fencing, surplus materials, rubbish, etc., and restore the areas.

F. JEA's Facilities

1. The CONTRACTOR shall not enter any of JEA's existing facilities without the expressed written authorization from JEA or JEA's project representative.

2. Except for the CONTRACTOR's superintendent, no CONTRACTOR's personnel shall enter the Operations Building.

3. Where the CONTRACTOR is required to perform work in an existing JEA's facility, the CONTRACTOR's superintendent shall notify JEA and request a meeting to discuss the limits of work.

4. The CONTRACTOR, subcontractors, suppliers, and others shall park only in the CONTRACTOR's project staging area.

1.02 CONTRACTOR'S SITE ACCESS

A. The Work is located at the Arlington East WRF, which maintains a perimeter fence and security gates. Unless otherwise required by JEA, delivery and employee access will be via the east 118th Street entrance to the site.

1.03 SAFETY AND PROTECTION DEVICES

A. It shall be the sole responsibility of the CONTRACTOR to protect persons from injury and to avoid property damage. Adequate barricades, construction signs, torches, red lanterns, and guards as required shall be placed and maintained during the progress of the construction work for the protection of the public in compliance with the Contract and all Federal, OSHA and local ordinances.

B. The CONTRACTOR shall have unit responsibility for and be required to make good, at its own expense, all damage to property or adjacent properties caused in the execution of this Contract.

C. The CONTRACTOR shall take all necessary precautions for the safety of its employees on the job and shall comply with all applicable provisions of Federal, State, County, and municipal safety laws and regulations to prevent accidents or injury to persons on, about, or adjacent to the premises where the Work is being performed.

D. In the event the CONTRACTOR's tools or materials delivered to the premises are stolen or damaged, it shall be responsible for such theft.

1.04 SECURITY BADGE IDENTIFICATION SYSTEM

A. The CONTRACTOR shall have a security badge identification system only for its Superintendent(s).

B. The I.D. badges shall be made of plastic or laminated plastic material. A recent photo of the employee shall be visible on the badge. Badges shall be issued and retrieved daily by the CONTRACTOR. All text shall be typewritten or printed by computer. The badges shall include the following information:

| | |
|---|---|
| First Line: | The words CONTRACTOR (or VISITOR for vendors etc.) shall be printed in all caps across the top of the badge. |
| Second Line: | The name of the CONTRACTOR. |
| Third Line: | The name and phone number (preferably a cell phone number) of the CONTRACTOR’s on-site manager or superintendent for the project. |
| Fourth Line: | Employee Name. |
| Fifth Line: | A unique badge control number for each badge. |

C. CONTRACTOR shall obtain separate site access privileges and ID for Superintendent(s) from JEA.

1.05 CONTRACTOR DELIVERY LOGS

A. The CONTRACTOR shall provide a daily log of deliveries to the site for the project. The daily log shall include deliveries received each day with the driver's name and truck license number, in addition to expected deliveries for the following day. The log shall be submitted to JEA at the end of each week. This log will be used by JEA at its discretion for security purposes at the site. The CONTRACTOR shall receive deliveries only at designated locations, in accordance with the Contract.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01560

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide temporary environmental controls in accordance with the Contract and as specified herein.

1.02 EXPLOSIVES AND BLASTING

A. The use of explosives on the Work will not be permitted.

1.03 DUST ABATEMENT

A. The CONTRACTOR shall furnish all labor, equipment, and means required and shall carry out effective measures wherever and as often as necessary, as determined by the JEA REPRESENTATIVE, to prevent its operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity. The CONTRACTOR shall be responsible for any damage resulting from any dust originating from its operations. The dust abatement measures shall be continued until the CONTRACTOR is relieved of further responsibility by the JEA REPRESENTATIVE. No separate payment will be allowed for dust abatement measures and all costs thereof shall be included in the CONTRACTOR's bid price.

1.04 RUBBISH CONTROL

A. During the progress of the Work, the CONTRACTOR shall keep the site of the Work and other areas used by it in a neat and clean condition, and free from any accumulation of rubbish. The CONTRACTOR shall dispose of all rubbish and waste materials of any nature occurring at the Work site, and shall establish regular intervals of collection and disposal of such materials and waste. The CONTRACTOR shall also keep its haul roads free from dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the particular requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.

1.05 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, paint, fuel, solvent or reactant of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. The handling, storage, use and disposal of all such chemicals and disposal of residues shall be in strict accordance with the contract, all applicable rules and regulations of Federal, State and local jurisdictional agencies and the printed instructions of the manufacturer and all regulatory requirements.

Copies of antidote literature shall be kept at the storage site and at the CONTRACTOR's job site office. A supply of antidotes shall be kept at the CONTRACTOR's office.

1.06 NOISE CONTROL

A. Noise resulting from the CONTRACTOR's work shall not exceed the noise levels and other requirements stated in local ordinances. The CONTRACTOR shall be responsible for curtailing noise resulting from its operation. It shall, upon written notification from the JEA REPRESENTATIVE or noise control officers, make any repairs, replacements, adjustments, additions and furnish mufflers when necessary to fulfill requirements.

1.07 EROSION ABATEMENT AND WATER POLLUTION

A. It is imperative that any CONTRACTOR dewatering operation not contaminate or disturb the environment of the properties adjacent to the Work. The CONTRACTOR shall, therefore, schedule and control its operations to confine all runoff water from disturbed surfaces, water from dewatering operations that becomes contaminated with silt, muck and other deleterious matter, fuels, oils, bitumens, calcium chloride, chemicals and other polluting materials.

B. The CONTRACTOR shall construct temporary stilling basin(s) of adequate size and provide all necessary temporary materials, operations and controls including, but not limited to, filters, coagulants, screens, and other means necessary to attain the required discharge water quality.

C. The CONTRACTOR shall be responsible for providing, operating and maintaining materials and equipment used for conveying the clear water to the point of discharge. All pollution prevention procedures, materials, equipment and related items shall be operated and maintained until such time as the dewatering operation is discontinued. Upon the removal of the materials, equipment and related items, the CONTRACTOR shall restore the area to the condition prior to its commencing work.

D. The CONTRACTOR shall be responsible for acquiring all applicable permits for discharge of waters as necessary, except as may have otherwise been provided in other sections of these specifications.

1.08 PRECAUTIONS DURING ADVERSE WEATHER

A. During adverse weather, and against the possibility thereof, the CONTRACTOR shall take all necessary precautions so that the Work may be properly done and satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building paper shelters, or other acceptable means. The CONTRACTOR shall be responsible for all changes caused by adverse weather.

B. The JEA REPRESENTATIVE may suspend construction operations at any time when, in its judgment, the conditions are unsuitable or the proper precautions are not being taken, whatever the weather conditions may be, in any season.

1.09 HURRICANE AND STORM WARNINGS

A. The CONTRACTOR shall take all precautions necessary to protect the job site during hurricane and storm watches and warnings.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

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# SECTION 01600

# MATERIALS AND EQUIPMENT

## PART 1 -- GENERAL

### 1.01 THE REQUIREMENT

A. The word “Products," as used herein, is defined to include purchased items for incorporation into the Work, regardless of whether specifically purchased for project or taken from CONTRACTOR's stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of Work. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

B. The CONTRACTOR shall supply materials and equipment in accordance with the Contract, the JEA Water and Sewer Standards and as specified herein.

### 1.02 QUALITY ASSURANCE

A. Source Limitations: To the greatest extent possible for each unit of Work, the CONTRACTOR shall provide products, materials, or equipment of a singular generic kind from a single source.

B. Compatibility of Options: Where more than one choice is available as options for CONTRACTOR's selection of a product, material, or equipment, the CONTRACTOR shall select an option which is compatible with other products, materials, or equipment already selected. Compatibility is a basic general requirement of product/material selections.

C. JEA Standards: Products shall conform and meet the criteria as specified in the latest edition and revision of the JEA publications, including but not limited to the following:

- Water and Sewer Standards Manual - JEA’s most recent publications can be found at their website:

  *https://www.jea.com/Working_With_JEA/Engineering_and_Construction/Reference_Materials/Water_and_Sewer_Standards.aspx*

### 1.03 DESIGN

A. Equipment and appurtenances shall be designed in conformity with the ASME, AIEE, NEMA and other generally accepted applicable standards and shall be rugged construction and of sufficient strength to withstand all stresses which may occur during fabrication, testing, transportation, installation and all conditions of operation. All bearings and moving parts shall be adequately protected by bushings or other acceptable means against wear, and provision shall be made for adequate lubrication by readily accessible devices. Details shall

be designed for appearance as well as utility. Protruding members, joints, corners, gear covers, etc., shall be finished in appearance.

B. All exposed welds on machinery shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.

1.04 PRODUCT DELIVERY-STORAGE-HANDLING

A. The CONTRACTOR shall deliver, handle, and store products in accordance with supplier's written recommendations and by means and methods that will prevent damage, deterioration, and loss including theft. Delivery schedules shall be coordinated with JEA to minimize long-term storage of products at site and overcrowding of construction spaces. In particular, the CONTRACTOR shall notify JEA in advance of deliveries and provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other sources of loss.

B. The CONTRACTOR shall provide a daily log of deliveries to the Arlington East Water Reclamation Facility site for the project per Section 01550.

1.05 TRANSPORTATION AND HANDLING

A. Products shall be transported by methods to avoid product damage and shall be delivered in undamaged condition in supplier's unopened containers or packaging, dry.

B. The CONTRACTOR shall provide equipment and personnel to handle products, materials, and equipment including those provided by JEA, by methods to prevent soiling and damage.

C. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

1.06 STORAGE AND PROTECTION

A. Products shall be stored in accordance with supplier's written instructions, with seals and labels intact and legible. Sensitive products shall be stored in weather-tight enclosures and temperature and humidity ranges shall be maintained within tolerances required by supplier's written instructions.

B. For exterior storage of fabricated products, they shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering; ventilation shall be provided to avoid condensation.

C. Loose granular materials shall be stored on solid surfaces in a well-drained area and shall be prevented from mixing with foreign matter.

D. Storage shall be arranged to provide access for inspection. The CONTRACTOR shall periodically inspect to assure products are undamaged and are maintained under required conditions.

E. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

1.07 MAINTENANCE OF STORAGE

A. Stored products shall be periodically inspected on a scheduled basis. The CONTRACTOR shall maintain a log of inspections and shall make said log available to JEA on request.

B. The CONTRACTOR shall verify that storage facilities comply with supplier's product storage requirements.

C. The CONTRACTOR shall verify that supplier-required environmental conditions are maintained continually.

D. The CONTRACTOR shall verify that surfaces of products exposed to the elements are not adversely affected and that any weathering of finishes is acceptable under requirements of Contract Documents.

1.08 MAINTENANCE OF EQUIPMENT STORAGE

A. For mechanical and electrical equipment in long-term storage, the CONTRACTOR shall provide a copy of the supplier's service instructions to accompany each item, with notice on enclosed instruction shown on exterior of package.

B. Equipment shall be serviced on a regularly scheduled basis, and a log of services shall be maintained and submitted as a record document to JEA. JEA representative shall witness services provided by CONTRACTOR.

1.09 LUBRICANTS

A. During testing and prior to acceptance, the CONTRACTOR shall furnish all lubricants necessary for the proper lubrication of all equipment furnished under this Contract. CONTRACTOR shall conform to JEA standards and JEA approved sources for lubricants.

1.10 SPECIAL TOOLS

A. For each type of equipment furnished by it, the CONTRACTOR shall provide a complete set of all special tools (including calibration and test equipment) which may be necessary for the adjustment, operation, maintenance and disassembly of such equipment.

B. Special tools shall be delivered at the same time as the equipment to which they pertain. The CONTRACTOR shall properly store and safeguard such special tools until completion of the Work, at which time they shall be delivered to JEA.

1.11 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

1.12 FASTENERS

A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the CONTRACTOR in accordance herewith. Bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.

B. All bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be Type 316 Stainless Steel unless otherwise specified on the Drawings. If no material is indicated on the Drawings, such items shall be furnished Type 304 Stainless Steel.

C. Unless otherwise specified, stud, tap, and machine bolts shall be of the best quality refined bar iron. Hexagonal nuts of the same quality of metal as the bolts shall be used.

1.13 SALVAGED AND EXCAVATED MATERIALS

A. In the absence of special provisions in other Sections of the Specifications, salvage materials, equipment or supplies that occur are the property of JEA and shall be cleaned and stored as directed by JEA.

B. All excavated materials needed for backfilling operation shall be stored on site. Where additional area is needed for stockpiling, it shall be obtained by the CONTRACTOR.

1.14 EQUIPMENT AND MATERIALS

A. All equipment, materials, instruments or devices incorporated in this project shall be new and unused, unless indicated otherwise in the Contract Documents. Equipment and materials to be incorporated into the work shall be delivered sufficiently in advance of their installation and use to prevent delay in the execution of the work, and they shall be delivered as nearly as feasible in the order required for executing the work.

B. The Contractor shall protect all equipment and materials from deterioration and damage, including provisions for temporary storage buildings as needed and as specified in Section 01550 entitled "Site Access and Storage". Storage of equipment and materials shall be in locations completely protected from flooding, standing water, excessive dust, falling rock, brush fire, etc. Storage areas shall be located sufficiently distant from all construction activities and the movement of construction vehicles to minimize the potential for accidental damage. Any equipment or materials of whatever kind which may have become damaged or deteriorated from any cause shall be removed and replaced by good and satisfactory items at the Contractor's expense for both labor and materials.

1.15 INSTALLATION OF EQUIPMENT

A. Equipment and materials shall be installed in accordance with the requirements of the General Conditions, Supplemental Conditions and the respective Specification Sections.

B. Concrete foundations for equipment shall be of approved design and shall be adequate in size, suitable for the equipment erected thereon, properly reinforced, and tied into floor slabs by means of reinforcing bars or dowels. Foundation bolts of ample size and strength shall be provided and properly positioned by means of suitable templates and secured during placement of concrete. Foundations shall be built and bolts installed in accordance with the manufacturer's certified drawings.

C. Before mounting equipment on a foundation, the Contractor shall clean the top surface; if necessary, rough it with a star chisel and clean again; and clean out all foundation bolt sleeves. The Contractor shall provide a sufficient number of stainless steel plate shims about 2-inches wide and 4-inches long, and of a varying thickness from 1/8 to 1/2 inch. A combination of these shims shall be placed next to each foundation bolt to bring the bottom of the bedplate or frame about 1/8 inch above the final setting. The equipment shall be lowered by changing the combination of shims. Using stainless steel shim stock of various thicknesses, continue to level the equipment a little at a time and in rotation until it is at the correct elevation in both directions. When the equipment is level, tighten down on the foundation bolts a little at a time in rotation to make certain the equipment remains level and does not shift on the shims. A preliminary alignment check shall be made before grout is placed.

D. Equipment shall be set, aligned and assembled in conformance with manufacturer's drawings or instructions. Run out tolerances by dial indicator method of alignment shall be plus or minus .002 inches, unless otherwise directed by JEA.

E. All blocking and wedging required for the proper support and leveling of equipment during installation shall be furnished by the Contractor. All temporary supports shall be removed, except stainless steel wedges and shims, which may be left in place with the approval of JEA.

F. Each piece of equipment or supporting base, bearing on concrete foundations, shall be bedded in grout. The Contractor shall provide a minimum of 1-1/2-inch thick grouting under the entire baseplate supporting each pump, motor drive unit and other equipment. Grout shall be non-shrink grout, as specified under Section 03315 entitled "Grout".

G. When motors are shipped separately from driven equipment, the motors shall be received, stored, meggered once a month, and the reports submitted to JEA. After driven equipment is set, the motors shall be set, mounted, shimmed, millrighted, coupled and connected complete. Motors shall then be turned once per month and documented by the Contractor to JEA.

1.16 CONNECTIONS TO EQUIPMENT

A. Connections to equipment shall follow manufacturer's recommendations as to size and arrangement of connections and/or as shown in detail on the Drawings or approved Shop Drawings. Piping connections shall be made to permit ready disconnection of equipment with minimum disturbance of adjoining piping and equipment.

B. The Electrical Contractor or Contractor if no electrical contract exists shall be responsible for bringing proper electrical service to each item of equipment requiring electrical service as shown on the Drawings or approved Shop Drawings. Electrical connections to equipment requiring electrical service shall be made by the Electrical Contractor, unless otherwise indicated on the Drawings or in the Technical Specifications.

C. The HVAC Contractor or Contractor if no HVAC Contract exists shall bring and connect HVAC service to all equipment items requiring same as shown on the Drawings. Electrical connections to equipment requiring electrical service shall be made by the Electrical Contractor, unless otherwise indicated on the Drawings or in the Technical Specifications.

D. The Plumbing Contractor or Contractor if no plumbing contract exists shall bring and connect plumbing service to all equipment items requiring same as shown on the Drawings.

1.17 IDENTIFICATION TAGS FOR EQUIPMENT AND INSTRUMENTS

A. All process equipment, pumps, blowers, valves, gates and process instruments that are identified by a tag number on the Process and Instrumentation Diagrams (P&IDs on Instrumentation contract drawings) shall have an identification tag at the device.

B. The identification tag shall show a unique tag number for the device (e.g., MOG-101), and the common name of the device (e.g., Screenings Channel Isolation Gate No. 1).

C. The identification tag shall be either lamacoid tag with white background and black core letters, or non-corrosive metal tags, ASTM A240 Grade 430 stainless steel with a bright annealed finish.

D. Characters on identification tags shall be 3/16” high and surface cut deep unless otherwise noted. Characters shall be cut into the lamacoid tags with a hardened steel router bit and into stainless steel tags with a diamond tip cutter.

E. Identification tags shall be buffed around the perimeter to remove any sharp edges or corners.

F. Identification tags shall be attached to the equipment item, valve, or instrument with 0.9 mm diameter wire or stainless steel screws.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

# SECTION 01660

# EQUIPMENT TESTING AND PLANT STARTUP

## PART 1 -- GENERAL

### 1.01 THE REQUIREMENT

A. Equipment testing and startup are requisite to satisfactory completion of the contract and, therefore, shall be completed within the time specified for substantial completion.

B. The CONTRACTOR shall allow sufficient time in his construction schedule to complete equipment testing, troubleshooting, corrections, and startup based upon the general sequence set forth in Section 01520 entitled "Maintenance of Utility Operations During Construction".

C. As construction of the project proceeds through the final stages of completion associated with each construction phase, the CONTRACTOR shall, in accordance with the requirements set forth in the Contract Documents, attend to the following items for the equipment and facilities scheduled to be placed into service:

1. Schedule equipment manufacturer's visits to site.

2. Calibrate instruments, controls and controlled equipment.

3. Perform required testing, adjusting, and balancing of project components.

4. Schedule start-up and initial operation.

5. Furnish skilled personnel during initiation operation.

6. Perform JEA operation and maintenance training.

D. Refer to other Divisions for further requirements regarding this Section.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01520 - Maintenance of Utility Operations During Construction

### 1.03 EQUIPMENT TESTING

A. The CONTRACTOR shall provide the services of an experienced and authorized representative of the supplier of each item of equipment (excluding minor items of equipment specifically exempted by JEA in writing), who shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation prior to startup. In each case, the CONTRACTOR shall arrange to have the supplier's representative revisit the job site as often as necessary until any and all trouble is corrected and the equipment installation and operation are satisfactory to JEA.

B. The CONTRACTOR shall require that each supplier's representative test performance of his equipment and furnish to JEA a written report addressed to JEA, certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, and has been tested, operated satisfactorily under full-load conditions, is ready for operation, and JEA's operating personnel have been instructed in the operation, maintenance and lubrication of the equipment.

C. The CONTRACTOR shall be responsible for scheduling all operations testing. The CONTRACTOR is advised that JEA and JEA's operating personnel will witness operations testing.

D. The CONTRACTOR shall furnish all personnel, chemicals, fuel, oil, grease, and all other necessary equipment, facilities, and services required for conducting tests.

1.04 EQUIPMENT START-UP SERVICES

A. Equipment start-up period, for the training of plant personnel, shall begin after satisfactory completion and acceptance of the field tests and coincidentally with the completion date for the part of the work for which the equipment is included in accordance with the construction schedule. If the equipment is not covered by a certificate of substantial completion for a part of the work, the period shall begin upon substantial completion of the project.

B. During the equipment start-up period and in accordance with the sequence of construction and schedule, the CONTRACTOR shall furnish, at no additional cost to JEA the services of factory trained representatives of the equipment manufacturers for the equipment designated in the Specifications to:

1. Assist in the start-up and operations of the equipment.

2. Assist in the training of plant personnel, designated by JEA in the proper operation and maintenance of the equipment.

C. JEA shall:

1. Provide the necessary plant personnel to be instructed in the operation and maintenance of the equipment. JEA's personnel shall operate all equipment.

2. Pay for all fuel, power and chemicals consumed beyond quantities specified in the Contract Documents. The CONTRACTOR shall pay for fuel, power, and chemicals consumed up to the date of "certified substantial completion" except as otherwise specified herein.

D. CONTRACTOR shall be available to promptly repair all work during the equipment startup so as to cause minimum disruption to the plant operation.

E. Upon completion of a minimum of ten (10) consecutive and continuous days of satisfactory operation, or the number of days called for in the Technical Specifications, JEA will assume operation and operating cost of the equipment associated with the completed phase of work. If the equipment malfunctions during this start-up period, the start-up period will be repeated until satisfactory operation is achieved.

F. In the event a system, equipment or component proves defective or is unable to meet specified performance criteria, the CONTRACTOR shall replace the defective item and the guarantee period called for in the Contract Documents for the item shall start after satisfactory replacement and testing of the item.

1.05 PLANT STARTUP

A. The startup of a treatment plant is a highly complex operation requiring the combined technical expertise of the CONTRACTOR, suppliers, subcontractors, and JEA. The CONTRACTOR shall provide the effective coordination of all parties necessary for the successful startup during each phase of the sequence of work.

B. It is not the intent of JEA to instruct the CONTRACTOR in the startup of equipment for the plant; however, JEA will be available prior to and during startup to provide technical support to the CONTRACTOR. Treatment process startup shall be provided by JEA personnel.

C. Not less than 3 months prior to startup of facilities associated with each phase of the work, the CONTRACTOR shall submit to JEA for review, a detailed schedule of operations which will be necessary to effect a successful initial operation and sustained period of operation for the duration of the required startup period.

D. Startup of completed work shall not commence until all required leakage tests, disinfection, and equipment tests have been completed to the satisfaction of JEA.

E. The control system startup shall be coordinated with process startup activities and shall be extended as required until all plant processes are fully operational and to satisfy JEA that all control system contract requirements have been fulfilled in accordance with the Contract Documents. Refer to Section 17070 entitled "Control and Information System Testing – General" for additional requirements.

F. All defects in materials or workmanship which appear during this test period shall be immediately corrected by the CONTRACTOR. Time lost for equipment repairs, wiring corrections, control point settings, or other reasons which actually interrupt the startup may, at the discretion of JEA, be justifiable cause for extending the startup test duration.

G. During the startup, the CONTRACTOR shall provide the services of authorized representatives of the suppliers, in addition to those services required under operations testing, as necessary, to correct faulty equipment operation.

1.06 DEMONSTRATION AND INSTRUCTION

A. The supplier's representative shall instruct JEA's operating personnel in correct operation and maintenance procedures. The instruction shall demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment. Such instruction shall be scheduled in accordance with the sequence of each phase of the work at times arranged with JEA at least 2 weeks in advance and shall be provided while the respective representative's equipment is fully operational. On-site instruction shall be given by qualified persons who have been made familiar in advance with the equipment and systems in the plant. Training shall not commence until O&M Manuals have been accepted by JEA as specified in Sections 01300 and 01730.

B. The CONTRACTOR shall notify and distribute training session agenda and training material to JEA at least 14 days in advance of each equipment test or JEA training session.

C. Training shall be provided to four (4) separate shifts of JEA's personnel between the hours of 6:00 A.M. and 6:00 P.M. as necessary.

D. Provide professional video recording of all training sessions. Completed, labeled DVDs shall be provided to JEA for each type of training session.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01700

PROJECT CLOSEOUT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Final Cleaning

1. At the completion of each phase of the work and prior to startup, as scheduled the CONTRACTOR shall remove all rubbish from and about the site of the completed work, and all temporary structures, construction signs, tools, scaffolding, materials, supplies and equipment which he or any of his Subcontractors may have used in the performance of the work. CONTRACTOR shall broom clean paved surfaces and rake clean other surfaces of grounds.

2. CONTRACTOR shall thoroughly clean all materials, equipment and structures; all marred surfaces shall be touched up to match adjacent surfaces; dirty filters and burned out lights replaced as required; all glass surfaces cleaned and floors cleaned and polished so as to leave work in a clean and new appearing condition.

3. CONTRACTOR shall maintain cleaning until project, or portion thereof, is occupied by JEA.

B. Spare Parts and Special Tools

1. As soon as practicable after approval of the list of equipment, the CONTRACTOR shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies, with current unit prices and source or sources of supply.

2. Prior to equipment startup, CONTRACTOR shall also furnish a list of parts, and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified to be furnished as part of the Contract and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 120 days for the particular installation.

3. All parts shall be securely boxed and tagged, and clearly marked on the box and individually for identification as to the name of manufacturer or supplier, applicable equipment, part number, description and location in the equipment. All parts shall be protected and packaged for a shelf life of at least ten (10) years.

4. CONTRACTOR shall furnish at no additional cost to JEA with each piece of equipment as a minimum, one (1) complete set, or the number of sets called for in the Technical Specifications, of suitably marked special tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment prior to equipment startup.

5. Any special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, and maintenance of any equipment shall be furnished with the respective equipment. CONTRACTOR shall submit, for approval by JEA, a complete list of the special tools and appliances to be furnished and instructions for their use. Such tools and appliances shall be furnished in approved painted steel cases properly labeled and equipped with good grade cylinder locks and duplicate keys prior to equipment startup.

6. Spare parts for startup of equipment shall be furnished and provided by the CONTRACTOR. The forms appended to this section shall be submitted to list spare parts to be supplied during startup.

7. It is the intent of JEA to purchase spare parts for normal operation of the equipment delivered under this contract via normal maintenance operations.

C. Final Cleanup; Site Rehabilitation

1. Before final acceptance, the CONTRACTOR shall wash and clean all exposed surfaces which have become soiled or marked, and shall remove from the site of work all accumulated debris and surplus materials of any kind which result from his operation, including construction equipment, tools, sheds, sanitary enclosures, etc. The CONTRACTOR shall leave all equipment, fixtures, and work, which he has installed, in a clean condition. The completed project shall be turned over to JEA in a neat and orderly condition.

2. The site of the work shall be rehabilitated or developed in accordance with other sections of the Specifications and the Drawings. In the absence of any portion of these requirements, the CONTRACTOR shall completely rehabilitate the site to a condition and appearance equal or superior to that which existed just prior to construction, except for those items whose permanent removal or relocation was required in the Contract Documents or ordered by JEA.

3. The CONTRACTOR shall:

   a. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

   b. Use each type of cleaning material on only those surfaces recommended by the cleaning material manufacturer.

   c. Use only materials which will not create hazards to health or property.

D. Final Inspection

1. Final cleaning and repairing shall be so arranged as to be finished upon completion of the construction work. The CONTRACTOR will make his final cleaning and repairing, and any portion of the work finally inspected and accepted by JEA shall be kept clean by the CONTRACTOR, until the final acceptance of the entire work.

2. When the CONTRACTOR has finally cleaned and repaired the whole or any portion of the work, he shall notify JEA that he is ready for final inspection of the whole or a portion of the work, and JEA will thereupon inspect the work. If the work is not found satisfactory, JEA will order further cleaning, repairs, or replacement.

3. When such further cleaning or repairing is completed, JEA, upon further notice, will again inspect the work. The "Final Payment" will not be processed until the CONTRACTOR has complied with the requirements set forth, and JEA has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents.

E. Project Close Out

1. As construction of the project enters the final stages of completion, the CONTRACTOR shall, in concert with accomplishing the requirements set forth in the Contract Documents, attend to or have already completed the following items as they apply to his contract:

   a. Scheduling equipment manufacturers' visits to site.

   b. Required testing of project components.

   c. Scheduling start-up and initial operation.

   d. Scheduling and furnishing skilled personnel during initial operation.

   e. Correcting or replacing defective work, including completion of items previously overlooked or work which remains incomplete, all as evidenced by JEA's "Punch" Lists.

   f. Attend to any other items listed herein or brought to the CONTRACTOR's attention by JEA.

2. Just before JEA's Certificate of Final Completion is issued, the CONTRACTOR shall accomplish the cleaning and final adjustment of the various building components as specified in the Specifications and as follows:

   a. Clean all glass and adjust all windows and doors for proper operation.

   b. Clean all finish hardware after adjustment for proper operation.

   c. Touch up marks or defects in painted surfaces and touch up any similar defects in factory finished surfaces.

   d. Wax all resilient flooring materials.

   e. Remove bitumen from gravel stops, fascias, and other exposed surfaces.

   f. Remove all stains, marks, fingerprints, soil, spots, and blemishes from all finished surfaces, tile, stone, brick, and similar surfaces.

3. Final Submittals: In addition, and before the Certificate of Final Completion is issued, the CONTRACTOR shall submit to JEA certain records, certifications, etc., which are specified elsewhere in the Contract Documents. A partial list of such items appears below, but it shall be the CONTRACTOR's responsibility to submit any other items which are required in the Contract Documents:

a. Test results of project components.

b. Performance Affidavits for equipment.

c. Certification of equipment or materials in compliance with Contract Documents.

d. Operation and maintenance instructions or manuals for equipment.

e. One set of neatly marked-up drawings showing as-built changes and additions to the work under his Contract.

f. Any special guarantees or bonds (Submit to JEA).

4. The CONTRACTOR's attention is directed to the fact that required certifications and information under Item 3 above, must actually be submitted earlier in accordance with the sequence of construction and other Sections of the Specifications.

F. Grease, Oil, Chemicals and Fuel

1. All grease, oil, chemicals and fuel required for testing of the equipment shall be furnished by the CONTRACTOR.

G. Maintenance and Guarantee

1. The CONTRACTOR shall comply with all maintenance and guarantee requirements of the Contract Documents.

2. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the CONTRACTOR which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the CONTRACTOR shall have obtained a statement in writing from the affected private or public agency releasing JEA from further responsibility in connection with such repair or resurfacing.

3. The CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from JEA. If the CONTRACTOR fails to make such repairs or replacements promptly, JEA reserves the right to do the Work and the CONTRACTOR and its surety shall be liable to JEA for the cost thereof.

H. Punch Lists

1. JEA will make its final inspection whenever the CONTRACTOR has notified JEA that the work is ready for the inspection. Any work not found acceptable and requiring cleaning, repair and/or replacement will be noted on the punch list. Work that has been inspected and accepted by JEA shall be maintained by the CONTRACTOR, until final acceptance of the entire project.

2. Whenever the CONTRACTOR has completed the items on the punch list, it shall again notify JEA that it is ready for final inspection. This procedure will continue until the entire project is accepted by JEA. The final Application for Payment will not be processed until the entire project has been accepted by JEA and all of the requirements in previous Article E.3 “Final Submittals” have been satisfied.

I. Closeout Timetable: The CONTRACTOR shall establish dates for equipment testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow JEA, and their authorized representatives sufficient time to schedule attendance at such activities.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01660 - Equipment Testing and Plant Startup

B. Section 01720 - Record Drawings

C. Section 01730 - Operations and Maintenance Manuals

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

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SECTION 01720

PROJECT RECORD DRAWINGS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall keep and maintain, at the job site, one record copy of all drawings, specifications, addenda, change orders, and other modifications to the Contract, approved shop drawings, and field test records.

B. The CONTRACTOR shall mark the drawings to indicate all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings. Said record drawing markups shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These master record drawing markups of the CONTRACTOR's representation of as-built conditions, including all revisions made necessary by addenda and change orders shall be maintained up-to-date during the progress of the Work.

C. Project record drawing markups shall be maintained and updated by the CONTRACTOR on a month-to-month basis.

D. Record drawing markups shall be accessible to JEA at all times during the construction period.

E. Periodic payments shall not be processed prior to JEA's review and acceptance of record drawing markups development for the pay period submitted.

F. Final payment will not be acted upon until the CONTRACTOR has prepared and delivered record drawing markups to JEA. Said up-to-date record drawing markups shall be in the form of a set of prints 22 x 34 inch in size with carefully plotted information overlaid in red ink.

G. Upon substantial completion of the Work and prior to final acceptance, the CONTRACTOR shall finalize and deliver a complete set of record drawing markups to JEA conforming to the construction records of the CONTRACTOR. This set of drawings shall consist of corrected drawings showing the reported location of the Work. The information submitted by the CONTRACTOR and incorporated by JEA into the Record Drawings will be assumed to be correct, and the CONTRACTOR shall be responsible for the accuracy of such information, and shall bear the costs resulting from the correction of incorrect data furnished to JEA.

1.02 RELATED REQUIREMENTS

A. Section 01300 - Submittals

B. Section 01700 - Project Closeout.

C. All record “as-built” documents shall be prepared in accordance with and shall include all information required by JEA and any additional requirements listed herein.

1.03 RECORDING

A. Label each document "PROJECT RECORD" in neat large printed letters.

B. Record information concurrently with the progress of construction.

C. Legibly mark drawings to record actual construction

1. Incorporate changes made by Field Order, Change Order, or Construction Change Directive.

2. Incorporate details generated during the construction phase not shown on the original Contract Drawings.

1.04 SUBMITTAL

A. Prior to Final Completion, submit Record Documents to JEA.

B. Accompany submittal with a transmittal letter in duplicate, containing:

1. Date.

2. Project title and number.

3. CONTRACTOR’s name and address.

4. Title and number of each record document.

5. Signature of CONTRACTOR or its authorized representative.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01730

OPERATION AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Description

B. Quality Assurance

C. Format and Contents

1.02 SUBMITTALS

A. Written operations and maintenance instructions are required for all equipment items supplied for this project. The amount of detail shall be commensurate with the complexity of the equipment item. Pictorial cuts of equipment are required for operator reference in servicing.

B. Information not applicable to the specific piece of equipment installed on this project shall be struck from the Manual by the CONTRACTOR. Information provided shall include a source of replacement parts and names of service representatives, including addresses and telephone numbers.

C. In accordance with the provisions of Section 01300 submit the following:

1. Preliminary Operation and Maintenance Manuals: The Contractor shall submit five (5) complete preliminary Operations and Maintenance (O&M) Manuals for each item of equipment at the same time the equipment is delivered to the project site.

2. Final Operation and Maintenance Manuals: Furnish to JEA five (5) printed copies and five (5) electronic searchable PDF copies of an Operation and Maintenance Manual for all substantially complete equipment and associated control systems furnished and installed. The final manuals shall incorporate all JEA's review comments associated with the preliminary operation and maintenance Manual.

D. Operating and Maintenance Data shall be prepared and submitted in accordance with the requirements as listed in *JEA Water & Sewer Standards Section 445 – Pump Station Operation and Maintenance Data Submission Requirements*. See Appendix E for worksheet to be used for data submission.

E. Periodic payments shall not be processed prior to JEA's review and acceptance of EAM Worksheet development for the pay period submitted.

1.03 FORMAT AND CONTENTS

A. Each operations and maintenance manual shall contain the following information:

1. Storage instructions and requirements (short term and long term)

2. Installation instructions

3. Assembly and erection drawings/details

4. Dimensional drawings

5. Wiring diagrams including all control and lightning systems

6. Equipment data summary table (see sample form at the end of this section)

7. Equipment preventative maintenance data summary (see sample form at the end of this section)

8. Manufacturer's operating manual/instructions including equipment start-up, normal operation, shutdown, and emergency operation

9. Manufacturer's maintenance instructions including equipment calibration and adjustment, preventive and repair maintenance, and lubrication instructions

10. Trouble shooting guide

11. Parts diagram/list

12. Spare parts list (these are parts that the manufacturer recommends having readily available for use during preventative maintenance or are normal wear items)

13. Recommended lubricant types (lubrication schedule shall be included with the preventative maintenance data summary)

14. Tools list (any tools that will be required for preventative maintenance, disassembly, or re-assembly of the equipment)

15. Single line schematic

16. List of electrical relay settings and control and alarm contact settings.

17. Applicable software (if required)

18. Software manuals (if required)

19. Warranty

20. Contact information for the contractor, manufacturer, manufacturer's representative and nearest service representative

B. Any equipment that contains multiple components (for example a pump and motor), the above information shall be provided for each component.

C. For valve operation and maintenance manuals, provide one valve schedule giving valve number, location, fluid, and fluid destination for each valve installed. Group all valves in same piping systems together in the schedule. Obtain a sample of the valve numbering system from JEA.

D. All operation and maintenance manual material shall be printed on 8-1/2”x11” or 11”x17” paper.

E. Each manual shall be bound together in appropriate three-ring binders. Each binder shall be provided with front cover with the following information, as a minimum:

1. JEA logo

2. Project name

3. Date (Month / Year)

4. Equipment name

5. Applicable specification section

6. Manufacturer’s name

7. Contractor’s name

F. Each manual shall also be provided with a binder edge cover that contains, at a minimum, the project name, date and equipment name.

G. Each manual shall be divided into sufficient sections to facilitate ease of use and reference of the manual. Sections shall be identified using heavy section dividers with reinforced holes and numbered plastic index tabs; tabs with section titles shall be acceptable. A detailed table of contents shall be provided. At a minimum, the following sections shall be provided:

1. Equipment technical data summary

2. Storage / installation instructions

3. Operation instructions

4. Maintenance instructions

5. Dimensional/assembly drawings, diagrams, and parts lists

6. Wiring drawings and diagrams

7. Contact information

8. Warranty

H. All operating and maintenance material that comes bound by the equipment manufacturer shall be left in its original bound state. Cross-reference the appropriate sections of the Contractor's operations and maintenance manual to the manufacturers' bound manuals.

I. Label binders Volume 1, 2, and so on, where more than one binder is required. Include the table of contents for the entire set, identified by volume number, in each binder.

J. When manufacturer’s manuals and diagrams contain information applicable to multiple models or configurations, the information not applicable to this specific installation shall be stricken.

K. The final operations and maintenance manual shall reflect the most current edition of the shop drawing accepted by the Engineer. Any field changes or modifications shall also be included.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 16000

BASIC ELECTRICAL REQUIREMENTS

## PART 1 -- GENERAL

### 1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, materials, tools, and equipment, and perform all work and services necessary for, or incidental, to the furnishing and installation of all electrical work as shown on the Drawings, and as specified in accordance with the provisions of the Contract Documents and completely coordinate with the work of other trades involved in the general construction. Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation shall be furnished and installed as part of this work. The Contractor shall obtain approved Shop Drawings showing wiring diagrams, connection diagrams, roughing-in and hook up details for all equipment and comply therewith. All electrical work shall be complete and left in operating condition in accordance with the intent of the Drawings and the Specifications for the electrical work.

B. The electrical scope of work for this project primarily includes, but is not limited to, the following:

1. Furnish and install temporary electrical equipment to facilitate all work as specified herein and as indicated on the Drawings. All temporary installations shall be in accordance with Article 590 of the NEC. Remove all temporary facilities provided at the end of construction.

2. Remove and dispose of existing low voltage switchgear assembly (after JEA is supplied with all equipment they prefer to keep out of the gear).

3. Furnish and install new low voltage switchgear assembly including utility isolation main section, and automatic transfer controls.

4. Furnish and install power panelboards and other low voltage electrical power distribution equipment.

5. Furnish and install all aboveground raceway systems including conduit, fittings, boxes, supports, and other pertinent components.

6. Furnish and install all low voltage wire and cable resulting in a complete and operable electrical system. This includes temporary and permanent installations.

7. Provide a minimum of one (1) skilled worker 24hours a day, 7 days a week, for the duration of the plant being on temporary power. Person shall be qualified to manually transfer to/from the portable generator in the event of a utility outage.

8. Other electrical work as specified herein and indicated on the Drawings.

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C. All material and equipment must be the product of an established, reputable, and approved manufacturer; must be new and of first class construction; must be designed and guaranteed to perform the service required; and must bear the label of approval of the Underwriters Laboratories, Inc., where such approval is available for the product of the listed manufacturer as approved by the Engineer.

D. When a specified or indicated item has been superseded or is no longer available, the manufacturer's latest equivalent type or model of material or equipment as approved by the Engineer shall be furnished and installed at no additional cost to the Owner.

E. Where the Contractor's selection of equipment of specified manufacturers or additionally approved manufacturers requires changes or additions to the system design, the Contractor shall be responsible in all respects for the modifications to all system designs, subject to approval of the Engineer. The Contractor's bid shall include all costs for all work of the Contract for all trades made necessary by such changes, additions or modifications or resulting from any approved substitution.

F. Furnish and install all stands, racks, brackets, supports, and similar equipment required to properly serve the equipment which is furnished under this Contract, or equipment otherwise specified or indicated on the Drawings.

1.02 EQUIPMENT LOCATION

A. The Drawings show the general location of feeders, transformers, outlets, conduits, and circuit arrangements. Because of the small scale of the Drawings, it is not possible to indicate all of the details involved. The Contractor shall carefully investigate the structural and finish conditions affecting all of his work and shall arrange such work accordingly; furnishing such fittings, junction boxes, and accessories as may be required to meet such conditions. The Contractor shall refer to the entire Drawing set to verify openings, special surfaces, and location of other equipment, or other special equipment prior to roughing-in for panels, switches, and other outlets. The Contractor shall verify all equipment dimensions to ensure that proposed equipment will fit properly in spaces indicated.

B. Where outlets are shown near identified equipment furnished by this or other Contractors, it is the intent of the Specifications and Drawings that the outlet be located at the equipment to be served. The Contractor shall coordinate the location of these outlets to be near the final location of the equipment served whether placed correctly or incorrectly on the Drawings.

1.03 LOCAL CONDITIONS

A. The Contractor shall examine the site and become familiar with conditions affecting the work. The Contractor shall investigate, determine, and verify locations of any overhead or buried utilities on or near the site, and shall determine such locations in conjunction with all public and/or private utility companies and with all authorities having jurisdiction. All costs, both temporary and permanent to connect all utilities, shall be included in the Bid. The Contractor shall be responsible for scheduling and coordinating with the local utility for temporary and permanent services.

B. In addition, the Contractor shall relocate all duct banks, lighting fixtures, receptacles, switches, boxes, and other electrical equipment as necessary to facilitate the Work included in this project. Costs for such work shall be included in the Bid.

C. The Contractor is responsible for coordinating all electric utility equipment installations with the serving electric utility. The Contractor shall furnish and install all electric utility equipment required by the electric utility to be installed by the Contractor whether specifically shown on the Drawings or not.

D. The Contractor is responsible for ensuring all electric utility equipment and construction installed by the Contractor is furnished and installed in accordance with the electric utility's design specifications and requirements. The Contractor is fully responsible for coordinating his scope of work with the electric utility. Any additional required electric utility construction or equipment not specified herein or shown on the Drawings shall be supplied by the Contractor at no additional cost to the Owner.

E. The contact person at the serving electrical utility is:

Costa Theodores
JEA Electrical Utility Department
TheoC@jea.com
904.665.6734

1.04 SUBMITTALS

A. The Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Operation and Maintenance Manuals

3. Spare Parts List

4. Proposed Testing Methods and Reports of Certified Shop Tests.

5. Reports of Certified Field Tests.

6. Manufacturer's Representative's Certification.

B. Submittals shall be sufficiently complete in detail to enable the Engineer to determine compliance with Contract requirements.

C. Submittals will be approved only to the extent of the information shown. Approval of an item of equipment shall not be construed to mean approval for components of that item for which the Contractor has provided no information.

D. Some individual Division 16 specification sections may require a Compliance, Deviations, and Exceptions (CD&E) letter to be submitted. If the CD&E letter is required and shop drawings are submitted without the letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy

of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

1.05 APPLICABLE CODES AND REQUIREMENTS

A. Conformance

1. All work, equipment and materials furnished shall conform with the existing rules, requirements and specifications of the following:

a. Insurance Rating Organization having jurisdiction

b. The serving electrical utility company

c. The currently adopted edition of the National Electrical Code (NEC)

d. The National Electric Manufacturers Association (NEMA)

e. The Institute of Electrical and Electronic Engineers (IEEE)

f. The Insulated Cable Engineers Association (ICEA)

g. The American Society of Testing Materials (ASTM)

h. The American National Standards Institute (ANSI)

i. The requirements of the Occupational Safety Hazards Act (OSHA)

j. The National Electrical Contractors Association (NECA) Standard of Installation

k. National Fire Protection Association (NFPA)

l. International Electrical Testing Association (NETA)

m. All other applicable Federal, State and local laws and/or ordinances.

2. All material and equipment shall bear the inspection labels of Underwriters Laboratories, Inc., if the material and equipment is of the class inspected by said laboratories.

B. Nonconformance

1. Any paragraph of requirements in these Specifications, or Drawings, deviating from the rules, requirements and Specifications of the above organizations shall be invalid and their (the above organizations) requirements shall hold precedent thereto. The Contractor shall be held responsible for adherence to all rules, requirements and specifications as set forth above. Any additional work or material necessary for adherence will not be allowed as an extra, but shall be included in the Bid. Ignorance of any rule, requirement, or Specification shall not be allowed as an excuse for nonconformity. Acceptance by the Engineer does not relieve the

Contractor from the expense involved for the correction of any errors which may exist in the drawings submitted or in the satisfactory operation of any equipment.

C. Certification

1. Upon completion of the work, the Contractor shall obtain certificate(s) of inspection and approval from the National Board of Fire Underwriters or similar inspection organization having jurisdiction and shall deliver same to the Engineer and the Owner.

1.06 PERMITS AND INSPECTIONS

A. The Contractor shall coordinate with JEA to obtain the appropriate permits and inspections as applicable to the scope of the project.

1.07 TEMPORARY LIGHTING AND POWER

A. The Contractor shall reference the Contract Drawings. At a minimum, the Contractor shall provide a portable 1100kW (minimum) standby generator to keep the required loads fully operational during the required outages outlined in the Contract Documents. Contractor is responsible for the complete installation of all connections for all temporary power sources to the loads to meet this requirement.

1.08 TESTS

A. Upon completion of the installation, the Contractor shall perform tests for operation, load (Phase) balance, overloads, and short circuits. Tests shall be made with and to the satisfaction of the Owner and Engineer.

B. The Contractor shall perform all field tests and shall provide all labor, equipment, and incidentals required for testing and shall pay for electric power required for the tests. All defective material and workmanship disclosed shall be corrected by the Contractor at no cost to the Owner. The Contractor shall show by demonstration in service that all circuits and devices are in good operating condition. Test shall be such that each item of control equipment will function not less than five (5) times.

C. Refer to each individual specification section for detailed test requirements.

D. The Contractor shall complete the installation and field testing of the electrical installation at least one (1) week prior to the start-up and testing of all other equipment. During the period between the completion of electrical installation and the start-up and testing of all other equipment, the Contractor shall make all components of the Work available as it is completed for their use in performing Preliminary and Final Field Tests.

E. Before each test commences, the Contractor shall submit a detailed test procedure, and also provide test engineer resume, manpower and scheduling information for the approval by the Engineer. In addition, the Contractor shall furnish detailed test procedures for any of his equipment required as part of the field tests of other systems.

1.09 INFRARED INSPECTION

A. Just prior to the final acceptance of a piece of equipment, the Contractor shall perform an infrared inspection to locate and correct all heating problems associated with electrical equipment terminations.

B. The infrared inspection shall apply to all new equipment and existing equipment that is in any way modified under this Contract. All heating problems detected with new equipment furnished and installed under the Scope of this Contract shall be corrected by the Contractor. All problems detected with portions of existing equipment modified under this Contract shall also be corrected by the Contractor.

C. Any issues detected with portions of existing equipment that were not modified under this Contract are not the responsibility of the Contractor. Despite the Contractor not being held responsible for these problems, the Contractor shall report them to the Owner and Engineer immediately for resolution.

D. The infrared inspection report shall include both digital and IR pictures positioned side by side. Both the digital and IR pictures shall be clear and high quality. Fuzzy, grainy, or poorly illuminated pictures are not acceptable. The IR picture shall be provided with a temperature scale beside it, and an indication of the hot spot temperature in each picture. Reports shall be furnished in a 3-ring binder, with all pages printed in full color, with equipment assemblies separated by tabs.

1.10 PROTECTIVE DEVICE SETTING AND TESTING

A. The Contractor shall provide the services of a field services organization to adjust, set, calibrate and test all protective devices in the electrical system. The organization shall be a subsidiary of or have a franchise service agreement with the electrical equipment manufacturer. The qualifications of the organization and resumes of the technicians as well as all data forms to be used for the field testing shall be submitted.

B. All protective devices in the electrical equipment shall be set, adjusted, calibrated and tested in accordance with the manufacturers' recommendations, the coordination study, and best industry practice.

C. Proper operation of all equipment associated with the device under test and its compartment shall be verified, as well as complete resistance, continuity and polarity tests of power, protective and metering circuits. Any minor adjustments, repairs and/or lubrication necessary to achieve proper operation shall be considered part of this Contract.

D. All solid state trip devices shall be checked and tested for setting and operation using manufacturers recommended test devices and procedures.

E. Circuit breakers and/or contactors associated with the above devices shall be tested for trip and close functions with their protective device.

F. When completed, the Contractor shall provide a comprehensive report for all equipment tested indicating condition, readings, faults and/or deficiencies in same. Inoperative or defective equipment shall be brought immediately to the attention of the Engineer.

G. Prior to placing any equipment in service, correct operation of all protective devices associated with this equipment shall be demonstrated by field testing under simulated load conditions.

1.11 POWER SYSTEM STUDIES

A. The Contractor will provide the Power System studies and properly set all protective devices in accordance with the results of the studies. Studies shall include a comprehensive coordination study and arc flash risk assessment. Studies shall be signed and sealed by a Professional Engineer registered in the State of Florida.

B. Power system studies shall be performed and provided to Engineer for review. After approval of power system study, labels shall be furnished and installed on all electrical equipment as applicable.

1.12 SCHEDULES AND FACILITY OPERATIONS

A. Since the equipment testing required herein shall require that certain pieces of equipment be taken out of service, all testing procedures and schedules must be submitted to the Engineer for review and approval two (2) weeks prior to any work beginning. When testing has been scheduled, the Engineer must be notified 48 hours prior to any work to allow time for load switching and/or alternation of equipment. In addition, all testing that requires temporary shutdown of facility equipment must be coordinated with the Owner/Engineer so as not to affect proper facility operations.

B. At the end of the workday, all equipment shall be back in place and ready for immediate use should a facility emergency arise. In addition, should an emergency condition occur during testing, at the request of the Owner, the equipment shall be placed back in service immediately and turned over to Owner personnel.

C. In the event of accidental shutdown of Owner equipment, the Contractor shall notify Owner personnel immediately to allow for an orderly restart of affected equipment.

D. Maintaining the operation of these facilities during the duration of the construction period is essential and required. The Contractor shall furnish and install temporary equipment as required to maintain facility operation. Reference the Construction Sequencing and Constraint notes on the Contract Drawings for further details.

1.13 MATERIALS HANDLING

A. Materials arriving on the job site shall be stored in such a manner as to keep material free of rust and dirt and so as to keep material properly aligned and true to shape. Rusty, dirty, or misaligned material will be rejected. Electrical conduit shall be stored to provide protection from the weather and accidental damage. Rigid non-metallic conduit shall be stored on even supports and in locations not subject to direct sun rays or excessive heat. Cables shall be sealed, stored, and handled carefully to avoid damage to the outer covering or insulation and damage from moisture and weather. Adequate protection shall be required at all times for electrical equipment and accessories until installed and accepted. Materials damaged during shipment, storage, installation, or testing shall be replaced or repaired in a manner meeting with the approval of the Engineer. If space heaters are provided in a piece of electrical equipment, they shall be temporarily

connected to a power source during storage. The Contractor shall store equipment and materials in accordance with Section 01550, Site Access and Storage.

1.14 WARRANTIES

A. Unless otherwise specified in an individual specification section, all equipment and electrical construction materials furnished and installed under Division 16 shall be provided with a three (3) year warranty by the Contractor. This warranty includes all parts and labor supplied by the Contractor, inclusive.

1.15 TRAINING

A. Unless otherwise specified in an individual specification section, all training for equipment furnished and installed under Division 16 shall be provided as indicated herein.

PART 2 -- PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Unless otherwise indicated, the materials to be provided under this Specification shall be the products of manufacturers regularly engaged in the production of all such items and shall be the manufacturer's latest design. The products shall conform to the applicable standards of UL and NEMA, unless specified otherwise. International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured, and labeled in compliance with IEC standards is not acceptable.

B. All items of the same type or ratings shall be identical. This shall be further understood to include products with the accessories indicated.

C. All equipment and materials shall be new, unless indicated or specified otherwise.

D. The Contractor shall submit proof if requested by the Engineer that the materials, appliances, equipment, or devices that are provided under this Contract meet the requirements of Underwriters Laboratories, Inc., in regard to fire and casualty hazards. The label of or listing by the Underwriters Laboratories, Inc., will be accepted as conforming to this requirement.

2.02 SUBSTITUTIONS

A. Unless specifically noted otherwise, any reference in the Specifications or on the Drawings to any article, service, product, material, fixture, or item of equipment by name, make, or catalog number shall be interpreted as establishing the type, function, and standard of quality and shall not be construed as limiting competition. The Contractor, in such cases may, at his option use any article, device, product, material, fixture, or item of equipment which in the judgment of the Engineer, expressed in writing, is equal to that specified.

2.03 CONCRETE

A. The Contractor shall furnish all concrete required for the installation of all electrical work, Concrete shall be Class A unless otherwise specified. Concrete and reinforcing steel shall meet the appropriate requirements of Division 3 of the Specifications.

B. The Contractor shall provide concrete equipment pads for all free standing electrical apparatus and equipment located on new or existing floors or slabs. The Contractor shall provide all necessary anchor bolts, channel iron sills, and other materials as required. The exact location and dimensions shall be coordinated for each piece of equipment well in advance of the scheduled placing of these pads. Equipment pads shall be 4 inches high unless otherwise indicated on the Drawings and shall conform to standard detail for equipment pads shown on the Contract Drawings. Equipment pads shall not have more than 3" excess concrete beyond the edges of the equipment.

C. The Contractor shall provide concrete foundations for all free standing electrical apparatus and equipment located outdoors or where floors or slabs do not exist and/or are not or provided by others under this Contract. The Contractor shall provide all necessary anchor bolts, channel iron sills, and other materials as required. The location and dimensions shall be coordinated for each piece of equipment well in advance of the scheduled placing of the foundations. Equipment foundations shall be constructed as detailed on the Drawings or if not detailed on the Drawings shall be 6 inches thick minimum reinforced with #4 bars at 12-inch centers each way placed mid-depth. Concrete shall extend 6 inches minimum beyond the extreme of the equipment base and be placed on a compacted stone bed (#57 stone or ABC) 6 inches thick minimum.

2.04 RUBBER INSULATING MATTING

A. Rubber insulating matting shall be furnished and installed on the floor and in front of each piece of electrical equipment that is located indoors and installed under this Contract. Rubber insulating matting shall not be installed outdoors. The mat shall be long enough to cover the full length of the equipment. The mat shall be 1/4 inch thick with beveled edges, canvas back, solid type with corrugations running the entire length of the mat. The matting shall meet OSHA requirements and the requirements of ASTM D-178 for Type 2, Class 2 insulating matting. Matting shall be 36 inches wide, minimum. However, matting width shall be no less than the NEC working clearance for the equipment with which it is associated.

B. Matting shall be provided for the following equipment:

- New switchgear, SWGR-E
- New Power Panelboard, PP-EPS

PART 3 -- EXECUTION

3.01 CUTTING AND PATCHING

A. Coordination

1. The Work shall be coordinated between all trades to avoid delays and unnecessary cutting, channeling and drilling. Sleeves shall be placed in concrete for passage of conduit wherever possible.

B. Damage

1. The Contractor shall perform all chasing, channeling, drilling and patching necessary to the proper execution of his Contract. Any damage to the building, structure, or any equipment shall be repaired by qualified mechanics of the trades involved at the Contractor's expense. If, in the Engineer's judgment, the repair of damaged equipment would not be satisfactory, then the Contractor shall replace damaged equipment at his own expense.

C. Existing Equipment

1. Provide a suitable cover or plug for openings created in existing equipment as the result of work under this Contract. For example, provide round plugs in equipment enclosures where the removal of a conduit creates a hole and the enclosure. Covers and plugs shall maintain the NEMA rating of the equipment enclosure. Covers and plugs shall be watertight when installed in equipment located outdoors.

3.02 EXCAVATION AND BACKFILLING

A. The Contractor shall perform all excavation and backfill required for the installation of all electrical work. All excavation and backfilling shall be in complete accordance with the applicable requirements of Division 2 and as indicated on the Drawings.

3.03 CORROSION PROTECTION

A. Wherever dissimilar metals, except conduit and conduit fittings, come into contact, the Contractor shall isolate these metals as required with neoprene washers, nine (9) mil polyethylene tape, or gaskets.

- END OF SECTION -

SECTION 16111

CONDUIT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install conduits and conduit fittings to complete the installation of all electrically operated equipment as specified herein, indicated on the Drawings, and as required.

B. Requirements for conduit clamps, support systems, and anchoring are not included in this Section. Reference Section 16190, Electrical Supporting Devices, for these requirements.

C. Reference Section 16000, Basic Electrical Requirements.

1.02 CODES AND STANDARDS

A. Conduits and conduit fittings shall be designed, manufactured, and/or listed to the following standards as applicable:

1. American National Standards Institute (ANSI)

a. ANSI B1.20.1 – Pipe Threads, General Purpose

b. ANSI C80.1 – Electrical Rigid Steel Conduit

c. ANSI C80.5 – Electrical Rigid Aluminum Conduit

d. ANSI FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

2. Underwriters Laboratories (UL)

a. UL 1 – Standard for Flexible Metal Conduit

b. UL 6 - Electrical Rigid Metal Conduit-Steel

c. UL 6A – Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel

d. UL 360 – Standard for Liquid-tight Flexible Metal Conduit

e. UL 467 – Grounding and Bonding Equipment

f. UL 514B – Conduit, Tubing, and Cable Fittings

g. UL 651 – Standard for Schedule 40 and 80 Conduit and Fittings

h. UL 1479 – Standard for Fire Tests of Penetration Fire Stops

i. UL 1660 – Liquid-tight Flexible Nonmetallic Conduit

3. National Electrical Manufacturer's Association (NEMA)

a. NEMA RN 1 – PVC Externally Coated Galvanized Rigid Steel Conduit

b. NEMA TC-2 – Electrical PVC Conduit

c. NEMA TC-3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing

B. Others

1. ACI-318 – Building Code Requirements for Structural Concrete

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300 – Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets for conduits and fittings.

2. Conduit identification methods and materials.

3. Evidence of training for all personnel that will install PVC coated rigid metal conduit.

1.05 DEFINITIONS

A. Conduits are categorized by the circuit type of the wiring to be installed inside. Conduits are defined as follows:

1. Power Conduits – Conduits that carry AC or DC power wiring from a source to a load. Conduits that carry lighting and receptacle wiring.

2. Control Conduits – Conduits that carry AC or DC discrete control wiring between devices and/or equipment. Conduits that carry fiber optic cables between devices and/or equipment.

3. Instrumentation Conduits – Conduits that carry AC or DC analog signal wiring between devices and/or equipment.

## PART 2 – PRODUCTS

### 2.01 GENERAL

A. Conduit and conduit fitting products are specified in the text that follows this article. Reference Part 3 herein for the application, uses and installation requirements of these conduits and conduit fittings.

B. All metallic conduit fittings shall be UL 514B and UL 467 Listed, and constructed in accordance with ANSI FB 1. All metallic conduit fittings for use in Class I Division I hazardous areas shall be UL 1203 Listed. All non-metallic fittings shall be UL 651 Listed and constructed in accordance with NEMA TC-3.

C. Flexible conduit couplings for use in Class I Division I hazardous areas shall have threaded stainless steel end fittings and a flexible braided core. Flexible braid shall be constructed of stainless steel where available in the conduit trade size required for the application. Where stainless steel braid is not available, the braid shall be provided with a PVC coating. No other braid types or materials are acceptable.

D. Where threading is specified herein for conduit fitting connections, the fittings shall be manufactured to accept conduit that is threaded to ANSI B1.20.1 requirements.

E. Conduit expansion fittings for all conduit materials of construction shall be capable of 4 inches of movement along the axis of the conduit for trade sizes 2 inches or less. Expansion fittings shall be capable of 8 inches of movement along the axis of the conduit for trade sizes greater than 2 inches.

F. Conduit deflection fittings for all conduit materials of construction shall be provided with a flexible neoprene outer jacket that permits up to ¾ inch of expansion/contraction along the axis of the conduit as well as up to ¾ inch of parallel misalignment between the conduit axes. Outer jacket shall be secured to the conduit hubs by stainless steel clamps.

G. Conduit seals shall either be Listed and labeled for 40% fill, or conduit reducing fittings and a trade size larger conduit seal shall be provided to achieve 25% or less fill within the seal. Percentage fill calculation shall be based on the conductors to be installed. Conduit seals shall be provided with breathers and/or drains where required by the NEC.

H. Conduit insulating bushings shall be constructed of plastic and shall have internal threading.

I. Additional conduit and conduit fitting requirements are specified in the articles that follow based on the specific conduit material of construction to be used.

2.02 RIGID NONMETALLIC CONDUIT AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be Schedule 40 or 80 (dependent on application) polyvinyl chloride (PVC) construction, manufactured in accordance with NEMA TC-2, UL 651 Listed, and suitable for conductors with 90 degree C insulation.

B. Conduit Bodies for use with Rigid Nonmetallic Conduit

1. Conduit bodies shall be constructed of PVC. Conduit hubs shall be integral to the conduit body and shall be smooth inside to accept a glued conduit connection.

2. Conduit body shall be provided with cover that is affixed in place by stainless steel screws which thread directly into the conduit body. Covers that utilize wedge nuts or any other method of attachment to the conduit body are not acceptable. Covers shall be provided with matching gasket.

C. Conduit Couplings and Unions for use with Rigid Nonmetallic Conduit

1. Conduit couplings and unions shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection.

D. Conduit Expansion and Deflection Fittings for use with Rigid Nonmetallic Conduit

1. Conduit expansion fittings and conduit deflection fittings shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection.

E. Conduit Termination Fittings for use with Rigid Nonmetallic Conduit

1. Conduit hubs shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection. Hubs shall have external threads and an accompanying PVC locknut, and shall be watertight when assembled to an enclosure.

2. Conduit locknuts shall be constructed of zinc plated steel. Locknuts shall have internal threading. Locknuts constructed of PVC and locknuts with integral gasket or seal are not acceptable.

3. Conduit end bells shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection. End bell shall have a smooth inner surface that curves outward towards the edge of the fitting.

2.03 RIGID ALUMINUM CONDUIT AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be made of heavy wall high strength 6063 alloy aluminum with temper designation T1. Conduit shall be manufactured in accordance with ANSI C80.5, and shall be UL 6A Listed.

2. Conduit shall be provided with factory-cut 3/4 inch per foot tapered threads at each end in accordance with ANSI B1.20.1. Threads shall be cut prior to galvanizing to ensure corrosion protection adequately protects the threads. Conduit shall be provided with a matching coupling on one end and a color-coded thread protector on the other.

B. Conduit Bodies for use with Rigid Aluminum Conduit

1. Conduit bodies shall be constructed of copper-free aluminum which is coated with an aluminum enamel finish. Conduit bodies shall have integral threaded conduit hubs.

2. Conduit bodies for Class I Division I hazardous areas shall be provided with integrally threaded covers constructed of copper-free aluminum which is coated with an aluminum enamel finish.

3. Conduit bodies for all other areas shall be provided with stamped copper-free aluminum covers that are affixed in place by stainless steel screws which thread directly into the conduit body. Covers that utilize wedge nuts or any other method of attachment to the conduit body are not acceptable. Covers shall be provided with matching gasket.

C. Conduit Couplings, Nipples, and Unions for use with Rigid Aluminum Conduit

1. Couplings and nipples shall be threaded and shall be constructed of heavy wall high strength 6063 alloy aluminum with temper designation T1. Split-type couplings that use compression to connect conduits are not acceptable.

2. Unions shall be threaded, rain-tight, and constructed of copper-free aluminum which is coated with an aluminum enamel finish.

D. Conduit Expansion and Deflection Fittings for use with Rigid Aluminum Conduit

1. Conduit expansion fittings and conduit deflection fittings shall be constructed of copper-free aluminum which is coated with an aluminum enamel finish. Expansion and deflection fittings shall have threaded conduit connections.

2. Expansion fittings shall have an integral bonding jumper and deflection fittings shall have an external bonding jumper.

E. Conduit Seals for use with Rigid Aluminum Conduit

1. Conduit seals shall be constructed of copper-free aluminum which is coated with an aluminum enamel finish. Conduit seals shall have threaded conduit connections.

F. Conduit Termination Fittings for use with Rigid Aluminum Conduit

1. Conduit hubs shall be constructed of copper-free aluminum and shall have threaded connections to the conduit and enclosure. Hubs shall have a plastic insulated throat and shall be watertight when assembled to an enclosure.

2. Conduit locknuts shall be constructed of copper-free aluminum. Locknuts shall have internal threading. Locknuts with integral gasket or seal are not acceptable. Locknuts shall have integral bonding screw where required for proper bonding.

3. Conduit bonding bushings shall be constructed of copper-free aluminum. Bonding bushings shall have a threaded conduit connection. Bonding bushing shall be provided with properly sized set screw for connecting bonding conductor and an integral plastic insulator rated for 150 degrees C located in the throat.

2.04 LIQUID TIGHT FLEXIBLE METAL CONDUIT (LFMC) AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be manufactured using a single strip of hot dip galvanized high strength steel alloy, helically formed into a continuously interlocked flexible metal conduit. Trade size 1-1/4 inch and smaller conduits shall be provided with an integrally woven copper bonding strip.

2. Conduit shall be covered with an outside PVC jacket that is UV resistant, moisture-proof, and oil-proof. Conduit shall be UL 360 Listed.

B. Conduit Termination Fittings for use with LFMC

1. Conduit termination fittings shall be constructed of either 304 stainless steel or an electro-galvanized malleable iron alloy which is coated on the exterior with a 40 mil (minimum) PVC jacket and coated on the interior with a 2 mil (minimum) layer of urethane. PVC coated fittings shall have a sealing sleeve constructed of PVC which covers the connection to conduit.

2. Termination fittings shall have a threaded end with matching locknut and sealing ring for termination to equipment, and shall have an integral external bonding lug where required for proper bonding. Termination fittings shall have a plastic insulated throat and shall be watertight when assembled to the conduit and equipment.

2.05 LIQUID TIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC) AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be constructed of rigid polyvinyl chloride (PVC), fabricated to provide flexibility. Conduit shall be covered with an outside PVC jacket that is UV resistant, moisture-proof, and oil-proof. Conduit shall be UL 1660 Listed.

B. Conduit Termination Fittings for use with LFNC

1. Conduit termination fittings shall be constructed PVC and shall have a threaded end with matching locknut and sealing ring for termination to equipment. Termination fittings shall be watertight when assembled to the conduit and equipment.

2.06 FLEXIBLE METAL CONDUIT (FMC) AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be manufactured using a single strip of hot dip galvanized high strength steel alloy, helically formed into a continuously interlocked flexible metal conduit. Conduit shall be UL 1 Listed.

B. Conduit Termination Fittings for use with FMC

1. Conduit termination fittings shall be constructed of an electro-galvanized malleable iron alloy. Fittings shall have a threaded end with matching locknut for termination to equipment, and a compression-style connection to the associated conduit.

2.07 CONDUIT BENDS

A. Rigid conduit bends, both factory fabricated and field fabricated, shall meet the same requirements listed in the articles above for the respective conduit type and material of construction.

B. Conduit bend radii for standard radius bends shall be no less than as follows:

| TRADE SIZE (inches) | 3/4 | 1 | 1-1/4 | 1-1/2 | 2 | 2-1/2 | 3 | 3-1/2 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MIN. RADIUS (inches) | 4-1/2 | 5-3/4 | 7-1/4 | 8-1/4 | 9-1/2 | 10-1/2 | 13 | 15 | 16 | 24 | 30 |

C. Conduit bend radii for long radius bends shall be no less than as follows:

| TRADE SIZE (inches) | 3/4 | 1 | 1-1/4 | 1-1/2 | 2 | 2-1/2 | 3 | 3-1/2 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MIN. RADIUS (inches) | N/A | 12 | 18 | 24 | 30 | 30 | 36 | 36 | 48 | 48 | 60 |

2.08 MISCELLANEOUS

A. Conduit Periphery Sealing

1. The sealing of the exterior surface of conduits to prevent water and/or air from passing around the conduit periphery from one space to another (where required) shall be through the use of one of the following:

a. A conduit sleeve and pressure bushing sealing system. Acceptable products are FSK by OZ-GEDNEY, Link-Seal by Crouse-Hinds, or Engineer approved equal.

b. A conduit sleeve that is two trade sizes larger than the conduit being sealed, with 2-hour fire rated UL 1479 Listed caulk filling the entire void between the conduit and sleeve. This method is only suitable for penetrations in non-fire rated walls and floors between spaces within buildings. This method shall not be used for the sealing of conduits leaving a building and/or structure.

2. Conduit penetrations through fire-rated walls and floors shall be made with an approved UL 1479 Listed product specifically intended for the trade size of the conduit.

B. Primer and Cement

1. Nonmetallic conduit shall be cleaned with primer and connected to fittings with the manufacturer's recommended cement that is labeled Low VOC.

C. Galvanizing Compounds

1. Galvanizing compounds for field application shall be the cold-applied type, containing no less than 93% pure zinc.

D. Conduit Interior Sealing

1. The sealing of the inside of conduits against water ingress shall be achieved through the use of one of the following:

a. Two-part expanding polyurethane foam sealing compound, dispensed from a single tube which mixes the two parts as it is injected into the conduit. Expanding foam shall be compatible with the conduit material of construction as well as the outer jacket of the cables in the conduit. Acceptable products are Q-Pak 2000 by Chemque, FST by American Polywater Corporation, or Hydra-seal S-60 by Duraline.

b. Inflatable bag that provides seal around cables and around inside diameter of conduit. Provide appropriate quantity of additional fittings for applications with three or more cables in the conduit to be sealed. Acceptable products are Rayflate by Raychem, or Engineer approved equal. This sealing method is only applicable to conduits trade size 2 inch and larger.

c. Neoprene sealing ring provided with the required quantity and diameter of holes to accommodate the cables in each conduit. Sealing ring shall be compressed by two stainless steel pressure plates. Acceptable products are type CSB by OZ-GEDNEY, or Engineer approved equal. This sealing method is only applicable to metallic conduits containing 4 or less cables.

2. The use of aerosol-based expanding foam sealants or any other method of sealing against water ingress not listed above is not acceptable.

E. Pull Rope

1. Pull ropes for empty and/or spare conduits shall be woven polyester, 1/2 inch wide, with a minimum tensile strength of 1250 lbs.

2. Pull ropes for the Contractors use in installing conductors shall be the size and strength required for the pull, and shall be made of a non-metallic material.

## PART 3 – EXECUTION

### 3.01 GENERAL

A. Minimum trade size for all rigid conduits shall be 3/4 inch in exposed applications and 1 inch in embedded applications. Conduits installed within ductbanks shall be allowed to be increased in size to trade size 2 inch, at the Contractor's option, to accommodate the saddle size of the ductbank spacers. However, no combining of circuits shall be allowed in the larger conduits.

B. Minimum trade size for flexible conduits (where specifically allowed herein) shall be 1/2 inch in all applications.

C. Conduit routing and/or homeruns within structures is not shown on the Drawings. Conduits shall be installed concealed wherever practical and within the limitations specified herein. All other conduits not capable of being installed concealed shall be installed exposed.

D. Empty and/or spare conduits shall be provided with pull ropes which have no less than 12 inches of slack at each end.

E. Nonmetallic conduits for installations requiring less than a factory length of conduit shall be field cut to the required length. The cut shall be made square, cleaned of debris, and primer shall be applied to ready each joint for fusing. Conduits shall then be fused together with the conduit manufacturer's approved cement compound.

F. Metallic conduits for installations requiring less than a factory length of conduit shall be field cut to the required length. The cut shall be made square, be cleaned of all debris and be de-burred, then threaded. Conduit threading performed in the field shall be ¾ inch per foot tapered threads in accordance with ANSI B1.20.1.

G. Conduits shall be protected from moisture, corrosion, and physical damage during construction. Install dust-tight and water-tight conduit fittings on the ends of all conduits immediately after installation and do not remove until conductors are installed.

H. Conduits shall be installed to provide no less than 12 inches clearance from pipes that have the potential to impart heat upon the conduit. Such pipes include, but are not limited to, hot water pipes, steam pipes, exhaust pipes, and blower air pipes. Clearance shall be maintained whether conduit is installed in parallel or in crossing of pipes.

I. Where non-metallic instrumentation conduits are installed exposed, the following clearances to other conduit types shall be maintained:

1. Instrumentation conduits installed parallel to conduits with conductors energized at 480V or above shall be 18 inches.

2. Instrumentation conduits installed parallel to conduits with conductors energized at 240V and below shall be 12 inches.

3. Instrumentation conduits installed at right angles to conductors energized at 480V and below shall be 6 inches.

4. Instrumentation conduits installed at right angles to conductors energized at voltages above 480V shall be 12 inches.

J. Where conduit fittings do not include an integral insulated bushing, an insulated bushing shall be installed at all conduit termination points.

K. Conduits which serve multi-section equipment shall be terminated in the section where wiring terminations will be made.

L. Conduits shall not penetrate the floors or walls inside liquid containment areas without specific written authorization from the Engineer. Liquid containment areas are indicated on the Drawings.

M. In no case shall conduit be supported or fastened to another pipe or be installed in a manner that would prevent the removal of other pipes for repairs. Spring steel fasteners are not permitted.

N. All field fabricated threads for rigid galvanized steel conduit shall be thoroughly coated with two coats of galvanizing compound, allowing at least two minutes to elapse between coats for proper drying.

O. The appropriate specialized tools shall be used for the installation of PVC coated conduit and conduit fittings. No damage to the PVC coating shall occur during installation. Conduit and conduit fittings with damaged PVC coating shall be replaced at the Contractor's cost. The use of PVC coating touch-up compounds is not permitted.

P. Aluminum conduits shall not be installed in direct contact with concrete surfaces. Where aluminum conduits are routed along concrete surfaces, they shall be installed with one-hole electro-galvanized malleable iron alloy straps with matching clamp-backs to space the conduit ¼ inch away from concrete surface. Where aluminum conduit passes through concrete, CMU or brick walls, the penetration shall be made such that the aluminum conduit does not come in contact with concrete, CMU, brick or mortar.

3.02 CONCEALED AND EMBEDDED CONDUITS

A. Conduits are permitted to be installed concealed and/or embedded with the following requirements:

1. Conduits shall not be installed horizontally when concealed within CMU walls, only vertical installation is acceptable.

2. Conduits installed embedded within concrete floors or walls shall be located so as not to affect the designed structural strength of the floor or wall. Embedded conduits shall be installed in accordance with Standard Detail 0331604 and ACI-318.

3. Where conduit bends emerge from concrete embedment, none of the curved portion of the bend shall be visible. Only the straight portion of the bend shall be visible.

4. Where multiple conduits emerge from concrete embedment or from concealment below a concrete floor, ample clear space shall be provided between conduits to allow for the appropriate and required conduit termination fittings to be installed.

5. Conduits installed embedded within concrete encasement of any kind shall be installed such that conduit couplings for parallel conduits are staggered so that they are not side by side.

B. Conduits are NOT permitted to be installed concealed and/or embedded for the following situations:

1. Conduits shall not be installed embedded within any water-bearing floors or walls. Conduits shall not be installed embedded within any liquid containment area floors or walls.

2. Conduits shall not be installed concealed within CMU walls or gypsum walls that are adjacent to Class I and II hazardous areas (Division I and Division II).

3. Conduits shall not be installed concealed within CMU walls or gypsum walls that are adjacent to indoor Type 1 or Type 2 chemical storage/transfer areas.

3.03 CONDUIT USES AND APPLICATIONS

A. Rigid Conduit

1. Rigid conduit for non-hazardous areas shall be furnished and installed in the materials of construction as follows:

| **RIGID CONDUIT FOR ALL AREAS** | | |
|---|---|---|
| **INSTALLATION AREA DESIGNATION/ SCENARIO** | **CONDUIT CATEGORY BY WIRING/CIRCUIT TYPE** | |
| | **Power and Control** | **Instrumentation** |
| Temporary Conduit | PVC Schedule 40 | Same as Power and Control |
| All Other Areas | Rigid aluminum conduit | Same as Power and Control |

2. The table for the materials of construction for rigid conduits are intended to exhaustively cover all possible scenarios and installation areas under this Contract. However, if a scenario or installation area is found that is not explicitly governed by this table, it shall be assumed for bid purposes that the conduit material of construction is to be rigid galvanized steel. This discrepancy shall be brought to the attention of the Engineer (in writing) immediately for resolution.

B. Conduit Bends

1. All conduit bends shall be the same material of construction as the rigid conduit listed in the tables above, with the following exceptions:

   a. All 90 degree bends or combinations of adjacent bends that form a 90 degree bend where concealed within concrete or below a concrete slab shall be pvc-coated rigid galvanized steel.

2. Field fabricated bends of metallic conduit shall be made with a bending machine and shall have no kinks. Field fabricated standard radius and long radius bends shall have minimum bending radii in accordance with the associated tables in Part 2 herein.

3. Field bending of non-metallic conduits is not acceptable, factory fabricated bends shall be used.

4. **Long radius bends** shall be furnished and installed for the following specific applications, all other bends shall be standard radius:

   a. Where specifically indicated on the Drawings.

C. Flexible Conduit

1. Flexible conduit shall only be installed for the limited applications specified herein. Flexible conduit shall not be installed in any other application without written authorization from the Engineer. Acceptable applications are as follows:

   a. Connections to motors and engine-generator sets (and similar vibrating equipment)

   b. Connections to solenoid valves and limit switches

   c. Connections to lighting fixtures installed in suspended ceilings

   d. Connections to lighting transformers

   e. Connections to pre-fabricated equipment skids

   f. Connections to HVAC equipment

   g. Connections to instrument transmitters and elements

   h. Where specifically indicated in the Standard Details

2. Flexible conduit length shall be limited to three (3) feet, maximum. Flexible conduit shall not be installed buried or embedded within any material.

3. Flexible conduit for non-hazardous areas shall be furnished and installed in the materials of construction as follows:

| FLEXIBLE CONDUIT FOR NON-HAZARDOUS AREAS | | |
|---|---|---|
| **INSTALLATION AREA DESIGNATION/SCENARIO** | **CONDUIT CATEGORY BY WIRING/CIRCUIT TYPE** | |
| | **Power and Control** | **Instrumentation** |
| Exposed in indoor dry non-process areas | Flexible metal conduit | Same as Power and Control |
| Exposed in outdoor areas | Liquid-tight flexible metal conduit | Same as Power and Control |

3.04 CONDUIT FITTING USES AND APPLICATIONS

A. General

1. Conduit fittings shall be furnished and installed in the materials of construction as indicated in Part 2, herein. Conduit fitting materials of construction are dependent on the material of construction used for the associated conduit.

2. Conduit fittings shall be provided in the trade size and configuration required to suit the application.

B. Conduit Bodies

1. Conduit bodies shall be installed where wire pulling points are desired or required, or where changes in conduit direction or breaking around beams is required.

2. Where conduit bodies larger than trade size 2 inches are intended to be used as a pull-through fitting during wire installation, oversized or elongated conduit bodies shall be used. Oversized or elongated conduit bodies shall not be required if the conduit body is intended to be used as a pull-out point during wire installation.

C. Conduit Nipples and Unions

1. Conduits with running threads shall not be used in place of 3-piece couplings (unions) or close nipples. After installation of a conduit fitting of any kind, there shall be no more than ¼ inch of exposed threads visible. Factory fabricated all-thread nipples may be used between adjacent enclosures, however, the same restriction applies regarding the length of exposed threads that are visible.

D. Conduit Expansion and Deflection Fittings

1. Conduit expansion fittings shall be installed where required by the NEC and where indicated on the Drawings. Expansion fittings shall also be installed for exposed straight metallic conduit runs of more than 75 feet, in both indoor and outdoor

locations. Expansion fittings for runs of non-metallic conduit shall be installed in accordance with the NEC.

2. Conduit deflection fittings shall be installed where required by the NEC and where conduits are installed (exposed and concealed) across structural expansion joints.

E. Conduit Seals

1. Conduit seals shall be installed for conduits installed within or associated with hazardous areas and other areas as required by the NEC. In addition, conduit seals shall also be furnished and installed as follows:

a. All conduits entering or leaving enclosed areas which store or distribute chlorine gas.

b. All conduits entering or leaving enclosed areas which store or distribute sulfur dioxide gas.

F. Conduit Termination Fittings

1. Where conduits terminate at enclosures with a NEMA 4, 4X, or 3R rating and the enclosure does not have integral conduit hubs, an appropriately sized watertight conduit hub shall be installed to maintain the integrity of the enclosure. The use of locknuts with integral gasket in lieu of watertight conduit hubs is not acceptable.

2. Where conduits terminate at enclosures that do not require conduit hubs, a two-locknut system shall be used to secure the conduit to the enclosure. One locknut shall be installed on the outside of the enclosure, and the other inside, drawn tight against the enclosure wall. The locknut on the interior of the enclosure shall be the type with integral bonding lug, or a conduit bonding bushing may be used in place of the locknut.

3. Conduits shall not be installed such that conduit fittings penetrate the top of any enclosure located outdoors, except in cases where specifically required by the serving electric utility. Conduits which serve outdoor equipment or an enclosure from above shall instead be routed into the side of the enclosure at the bottom. The conduit termination fitting shall be provided with a conduit drain to divert moisture from the raceway away from the enclosure.

3.05 MISCELLANEOUS

A. Conduit Periphery Sealing

1. All conduit penetrations through exterior walls shall be sealed around the periphery using the appropriate products specified in Part 2 herein to prevent air and/or water entry into the structure.

2. All conduit penetrations through interior walls and floors shall be sealed through the use of with conduit sleeves and caulk as specified in Part 2 herein. Alternatively, mortar may be used to seal around the conduit periphery.

3. Conduit penetrations through fire-rated walls as floors shall be made with the appropriate fire rated penetration product.

B. Conduit Interior Sealing

1. All conduits (including spares) entering a structure below grade shall be sealed on the interior of the conduit against water ingress. Sealing shall be at an accessible location in the conduit system located within the building structure and shall be via one of the methods specified in Part 2 herein. If conduit sealing cannot be achieved at an accessible location within the building structure, sealing shall be placed in the conduits in the nearest manhole or handhole outside the structure.

3.06 CONDUIT IDENTIFICATION

A. Exposed conduits shall be identified at the source, load, and all intermediate components of the raceway system. Examples of intermediate components include but are not limited to junction boxes, pull boxes, and disconnect switches. Identification shall be by means of an adhesive label with the following requirements:

1. Labels shall consist of an orange background with black text. Text for the label shall be the conduit number as indicated in the conduit and wire schedules.

2. In addition, at the source end of the conduit, a second line of text shall be included to indicate the load equipment name. This second line shall consist of the word "TO:" and the text for the destination of the conduit (e.g. TO: MCC-E). At the load end of the conduit, a second line of text shall be included to indicate the source equipment name. This second line shall consist of the word "FROM:" and the text for the source of the conduit (e.g. FROM: SWGR-E). This requirement applies only to the source and load ends of the conduit, and not anywhere in between.

3. For conduits trade sizes 3/4 inch through 1-1/2 inch, the text shall be a minimum 18 point font. For conduits trade size 2 inch and larger, the text shall be a minimum 24 point font.

4. Label height shall be 3/4 inch minimum, and length shall be as required to fit required text. The label shall be installed such that the text is parallel with the axis of the conduit. The label shall be oriented such that the text can be read without the use of any special tools or removal of equipment.

5. Labels shall be installed after each conduit is installed and, if applicable, after painting. Labels shall be printed in the field via the use of a portable label printing system. Handwritten labels are not acceptable.

6. Labels shall be made of permanent vinyl with adhesive backing. Labels made of any other material are not acceptable.

B. Conduits that are not exposed but installed beneath free standing equipment enclosures shall be identified by means of a plastic tag with the following requirements:

1. The tag shall be made of white Tyvek material, and have an orange label with black text, as described above, adhered to it. Text for the label shall be the conduit number as indicated in the conduit and wire schedules.

2. The tag shall be affixed to the conduit by means of a nylon cable tie. The tag shall be of suitable dimensions to achieve a minimum text size of 18 points.

C. Conduits for lighting and receptacle circuits shall not require identification.

D. Any problems or conflicts with meeting the requirements above shall immediately be brought to the attention of the Engineer for a decision.

3.07 TESTING

A. The following tests are required:

1. All conduit installed below grade or concrete encased shall be tested to ensure continuity and the absence of obstructions by pulling through each conduit a swab followed by a mandrel 85% of the conduit inside diameter. After testing, all conduits shall be capped after installation of a suitable pulling rope.

- END OF SECTION -

SECTION 16123

LOW VOLTAGE WIRE AND CABLE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, connect, test, and place in satisfactory operating condition, all low voltage wire and cable indicated on the Drawings and as specified herein and/or required for proper operation. The work of connecting cables to equipment and devices shall be considered a part of this Section. All appurtenances required for the installation of cable and wire systems shall be furnished and installed by the Contractor.

B. The scope of this Section does not include internal wiring factory installed by electrical equipment manufacturers.

C. Reference Section 16000, Basic Electrical Requirements; Section 16111, Conduit; and Section 16130, Boxes.

1.02 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the wire and cable manufacturer and submit the following:

1. Shop Drawings

2. Reports of Field Tests

3. Wiring Identification Methods

B. Each submittal shall be identified by the applicable specification section.

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1.03 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed material's compliance with the Contract Documents.

B. Partial, incomplete, or illegible Submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

2. Cable pulling calculations (if required).

3. Wiring identification methods and materials.

1.04 IDENTIFICATION

A. Each cable shall be identified as specified in Part 3, Execution, of this Specification.

1.05 CABLE PULLING CALCULATIONS

A. The Contractor shall submit cable pulling calculations. These calculations, to be performed by a currently registered professional engineer in the State of Florida, shall define pulling tension and sidewall loading (sidewall bearing pressure values) for all installations of 600VAC, #1/0 conductors and larger greater than 200 feet in length. Calculations for straight horizontal installations of 600VAC, #1/0 conductors and larger greater than 200 feet are not required.

## PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The wire and cable to be furnished and installed for this project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten (10) years. Wire and cable shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and indicated on the Drawings. Only one (1) manufacturer for each wire and cable type shall be permitted.

B. The wire and cable manufacturer shall be ISO 9000 registered.

2.02 POWER WIRE AND CABLE

A. Power wire and cable shall be stranded copper conductor with insulation type XHHW/XHHW-2, rated 90°C and 600V.

B. Conductors shall be stranded copper per ASTM-B8 and B-3, and Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be No. 12 AWG.

C. Multi-conductor power cable assemblies shall be UL 1277 Listed, provided with a bonding conductor, and furnished with an overall PVC jacket.

D. Power wire and cable shall be as manufactured by the Okonite Company, the Southwire Company, or General Cable.

E. For temporary connections, power wire and cable shall be stranded copper conductor with insulation type RHW-2, rated 90°C and 600V.

F. Temporary conductors shall be stranded copper per ASTM-B8 and B-3, and Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be No. 12 AWG.

2.03 CONTROL CABLE

A. 600 volt control cable shall consist of stranded, copper conductor with insulation type THHN, 90°C for dry locations and THWN, 75°C for wet locations, and 600V.

B. Conductors shall be stranded copper per ASTM B-8 and B-3, and Class B or C stranding contingent on the size unless otherwise specified. Minimum wire size shall be No. 14 AWG.

C. Multi-conductor control cable assemblies shall be UL 1277 Listed, provided with a bonding conductor, and furnished with an overall PVC jacket.

D. Control cable shall be as manufactured by the Okonite Company, the Southwire Company, or General Cable.

2.04 LIGHTING AND RECEPTACLE WIRE

A. The lighting and receptacle branch circuit wire shall consist of solid, copper conductors with insulation type THHN, 90°C for dry locations and THWN, 75°C for wet locations.

B. Conductors shall be solid copper per ASTM- B-3. Minimum size wire shall be No. 12 AWG.

C. Lighting and receptacle wire shall be as manufactured by the Okonite Company, the Southwire Company, or General Cable.

2.05 INSTRUMENTATION CABLE

A. The instrumentation cable for analog signals shall be single, shielded, twisted pairs or triads with 600 volt insulation and shall have a 75°C (minimum) insulation rating.

B. Conductors shall be tin or alloy coated (if available), soft, annealed copper, stranded per ASTM-B8, Class B stranding unless otherwise specified. Minimum size wire shall be No. 16 AWG.

C. The instrumentation cable shall be Okoseal-N Type P-OS for single pair or triad applications and Okoseal-N Type SP-OS for multiple pair or triad applications as manufactured by the Okonite Company, Belden equivalent, or Southwire Company equivalent.

2.06 CONDUCTOR IDENTIFICATION

A. Conductors shall be identified using a color coding method. Color coding for individual power, control, lighting, and receptacle conductors shall be as follows:

1. 480/277V AC Power

Phase A - BROWN
Phase B - ORANGE
Phase C - YELLOW
Neutral – GREY

2. 120/208V or 120/240V AC Power

   Phase A - BLACK
   Phase B - RED
   Phase C - BLUE
   Neutral - WHITE

3. DC Power

   Positive Lead - RED
   Negative Lead - BLACK

4. DC Control

   All wiring - BLUE

5. 120VAC Control

   120 VAC control wire shall be RED except for a wire entering a motor control center compartment or control panel which is an interlock. This interlock conductor shall be color coded YELLOW.

6. 24VAC Control

   All wiring - ORANGE

7. Equipment Grounding Conductor

   All wiring - GREEN

B. Individual conductors No. 2 AWG and smaller shall have factory color coded insulation. It is acceptable for individual conductors larger than No.2 AWG to be provided with factory color coded insulation as well, but it is not required. Individual conductors larger than No.2 AWG that are not provided with factory color coded insulation shall be identified by the use of colored tape in accordance with the requirements listed in Part 3 herein. Insulation colors and tape colors shall be in accordance with the color coding requirements listed above.

C. Conductors that are a part of multi-conductor control cable assemblies shall have black insulation. The conductor number shall be printed on each conductor's insulation in accordance with ICEA S-58-679, Method 4. Each conductor within the cable assembly shall also be identified with a heat shrink tag with color coded background in accordance with the requirements listed in Part 3 herein. Background color shall be in accordance with the color coding requirements listed above.

D. Conductors that are a part of multi-conductor power cable assemblies shall have black insulation. The conductor number shall be printed on each conductor's insulation in accordance with ICEA S-58-679, Method 4. Each conductor No.2 AWG and smaller within the cable assembly shall also be identified with a heat shrink tag with color coded background. Each conductor larger than No.2 AWG within the cable assembly shall also

be identified by the use of colored tape. Heat shrink tags and colored tape shall be in accordance with the requirements listed in Part 3 herein. Tape color and heat shrink tag background color shall be in accordance with the color coding requirements listed above.

2.08 CABLE PULLING LUBRICANTS

A. Cable pulling lubricants shall be non-hardening type and approved for use on the type of cable installed. Lubricant shall be Yellow #77 Plus by Ideal, Cable Gel by Greenlee, Poly-Gel by Gardner Bender, or equal.

PART 3 -- EXECUTION

3.01 POWER, CONTROL, AND LIGHTING/RECEPTACLE WIRE AND CABLE INSTALLATION

A. The wire and cable shall be installed as specified herein and indicated on the Drawings.

B. The cables shall be terminated in accordance with the cable and/or termination product manufacturer's instructions for the particular type of cable.

C. To minimize oxidation and corrosion, wire and cable shall be terminated using an oxide-inhibiting joint compound recommended for "copper-to-copper" connections. The compound shall be Penetrox E as manufactured by Burndy Electrical, or equal.

D. Splices shall not be allowed in the underground manhole and handhole systems. If splices are required, the Contractor shall obtain approval in writing from the Engineer prior to splicing. Splicing materials shall be barrel type butt splice connectors and heat shrink tubing as manufactured by 3M, Ideal, or equal. No splicing of instrumentation cable is allowed. The use of screw-on wire connectors (wire nuts) shall only be permitted for lighting and receptacle circuits.

E. Wire and Cable Sizes

1. The sizes of wire and cable shall be as indicated on the Drawings, or if not shown, as approved by the Engineer. If required due to field routing, the size of conductors and respective conduit shall be increased so that the voltage drop measured from source to load does not exceed 2-1/2%.

F. Additional Conductor Identification

1. In addition to the color coding identification requirements specified in Part 2 herein, individual conductors shall be provided with heat shrinkable identification tags. Identification tags for individual conductors shall have a white background where the conductor insulation is colored. Identification tags for individual conductors shall have a colored background where the conductor insulation is black. Background color shall match that of the taping provided on the individual black conductors.

2. Multi-conductor cables shall be provided with heat shrinkable identification tags in accordance with Part 2 herein.

3. All wiring shall be identified at each point of termination. This includes but is not limited to identification at the source, load, and in any intermediate junction boxes where a termination is made. The Contractor shall meet with the Owner and Engineer to come to an agreement regarding a wire identification system prior to installation of any wiring. Wire numbers shall not be duplicated.

4. Wire identification shall be by means of a heat shrinkable sleeve with appropriately colored background and black text. Wire sizes #14 AWG through #10 AWG shall have a minimum text size of 7 points. Wire sizes #8 AWG and larger shall have a minimum text size of 10 points. Sleeves shall be of appropriate length to fit the required text. The use of handwritten text for wire identification shall not be permitted.

5. Sleeves shall be suitable for the size of wire on which they are installed. Sleeves shall not be heat-shrunk onto control cables. Tags shall remain loose on cable to promote easier identification. For all other applications, sleeves shall be tightly affixed to the wire and shall not move. Sleeves shall be heat shrunk onto wiring with a heat gun approved for the application. Sleeves shall not be heated by any means which employs the use of an open flame. The Contractor shall take special care to ensure that the wiring insulation is not damaged during the heating process.

6. Sleeves shall be installed prior to the completion of the wiring terminations and shall be oriented so that they can be easily read.

7. Sleeves shall be polyolefin as manufactured by Brady, Seton, Panduit, or equal.

8. Wire identification in manholes, handholes, pull boxes, and other accessible components in the raceway system where the wiring is continuous (no terminations are made) shall be accomplished by means of a tag installed around the bundled group of individual conductors or around the outer conductor jacket of a multi-conductor cable. Identification shall utilize a FROM-TO system. Each group of conductors shall consist of all of the individual conductors in a single conduit or duct. The tag shall have text that identifies the bundle in accordance with the 'FROM' and 'TO' column for that particular conduit number in the conduit and wire schedule. Minimum text size shall be 10 point. The tag shall be affixed to the wire bundle by the use of nylon wire ties, and shall be made of polyethylene as manufactured by Brady, Seton, Panduit, or equal.

9. Where colored tape is used to identify cables, it shall be wrapped around the cable with a 25% overlap and shall cover at least 2 inches of the cable.

H. Wiring Supplies

1. Only electrical wiring supplies manufactured under high standards of production and meeting the approval of the Engineer shall be used.

2. Rubber insulating tape shall be in accordance with ASTM Des. D119. Friction tape shall be in accordance with ASTM Des. D69.

I. Training of Cable

1. The Contractor shall furnish all labor and material required to train cables around cable vaults within buildings and in manholes and handholes in the outdoor underground duct system. Sufficient length of cable shall be provided in each handhole, manhole, and vault so that the cable can be trained and racked in an approved manner. In training or racking, the radius of bend of any cable shall be not less than the manufacturer's recommendation. The training shall be done in such a manner as to minimize chaffing. Reference Section 16118.

2. Instrumentation cable shall be racked separate from other AC and DC wiring to maintain the required separation as follows:

   a. 18 inches for 480/277VAC wiring

   b. 12 inches for 208/120VAC wiring

   c. 6 inches for 24VDC wiring

J. Conductor Terminations

1. Where wires are terminated at equipment which requires lugs, connections shall be made by solderless mechanical lug, crimp type ferrule, or irreversible compression type lugs. Reference individual equipment specification sections as applicable for additional termination requirements.

2. Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches, pressure switches, temperature switches, and other devices make terminations impractical due to the size of the field wiring, the Contractor shall terminate field wiring in an adjacent junction per the requirements of Section 16130, Boxes, complete with terminal strips. Contractor shall install the smaller wiring from the device to the junction box in a conduit, using the terminal strip as the means for joining the two different wire sizes. Splicing of wires in lieu of using terminal strips is not acceptable.

3. All spare conductors shall be terminated on terminal blocks mounted within equipment or junction boxes. Unless otherwise noted, coiling up of spare conductors within enclosure is not acceptable.

K. Pulling Temperature

1. Cable shall not be flexed or pulled when the temperature of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature of 40°F or less within a three (3) day period prior to pulling, the cable reels shall be stored three (3) days prior to pulling in a protected storage area with an ambient temperature of 55°F or more. Cable pulling shall be completed during the work day for which the cable is removed from the protected storage. Any remaining cable reels shall be returned to storage at the completion of the workday.

3.02 INSTRUMENTATION CABLE INSTALLATION

A. The Contractor shall install all cable or conductors used for instrumentation wiring (4-20 mA DC, etc.) in conduit as specified in Section 16111 - Conduit. Only instrumentation cable as specified herein shall exclusively occupy these conduits. No other wiring for AC or discrete DC circuits shall be installed in these conduits.

B. All shielding shall be continuous and shall be **grounded at one point only**.

C. Where instrumentation cables are installed in panels, manholes, handholes, and other locations, the Contractor shall arrange wiring to provide maximum clearance between these cables and other conductors. Instrumentation cables shall not be installed in same bundle with conductors of other circuits.

D. Special instrument cable shall be as specified or recommended by the manufacturer of the equipment or instruments requiring such wiring. Installation, storage, and terminations, shall be per manufacturer's recommendations.

3.03 TESTING

A. All testing shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Shop Test

a. Cable and wiring shall be tested in accordance with the applicable ICEA Standards. Wire and cable shall be physically and electrically tested in accordance with the manufacturer’s standards.

2. Field Tests

a. After installation, all wires and cables shall be tested for continuity. Testing for continuity shall be “test light” or “buzzer” style.

b. After installation, some wires and cables shall be tested for insulation levels. Insulation resistance between conductors of the same circuit and between conductor and ground shall be tested. Testing for insulation levels shall be as follows:

(1) For #8 AWG and larger 600V power and control cable, apply 1,000 VDC from a Megaohmeter for one (1) minute for all 600V wires and cables installed in lighting, control, power, indication, alarm and motor feeder circuits. Resistance shall be no less than 100 Megaohms. Insulation testing is not required for power and control cables smaller than #8 AWG.

(2) 600V instrumentation signal cable shall be tested from conductor to conductor, conductor to shield, and conductor to ground using a Simpson No. 260 volt-ohmmeter, or approved equal. The resistance value shall be 200 Megaohms or greater.

B. Wires and cables shall be tested before being connected to motors, devices or terminal blocks.

C. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.

D. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment. Test reports shall be submitted to the Engineer.

- END OF SECTION -

(EXHIBIT A)
TEST DATA - MEGOHMS
TEST NO. ____

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date: | | | Company: | | | | |
| Time: | | | Location: | | | | |
| Circuit: | Circuit Length: | Aerial: | Duct: | Buried: | No. of Conduc-tors | Size: | AMG<br>MCM<br>Shld: |
| Insulation Material: | | | Insulation Thickness: | | Voltage Rating: | | Age: |
| Type: _____Pothead _____Terminal | | | | | Location: Indoors_____<br>Outdoors_____ | | |
| Number and Type of Joints: | | | | | | | |
| Recent Operating History: | | | | | | | |
| Manufacturer: | | | | | | | |
| State if Potheads or Terminals were grounded during test: | | | | | | | |
| List associated equipment included in test: | | | | | | | |
| Miscellaneous Information: | | | | | | | |

(EXHIBIT A)
TEST DATA - MEGOHMS
TEST NO. ____

Part Tested:Test Made:_____
Hours/Days:_____
After Shutdown:_____

Grounding Time:Dry Bulb Temperature:_____
Wet Bulb Temperature:_____

Test Voltage:

Equipment Temperature: _____
How Obtained: _____
Relative Humidity: _____
Absolute Humidity: _____
Dew Point: _____

Megohmmeter: Serial Number: _____ Range: _____
Voltage: _____ Calibration Date_____

| Test Connections | To Line To Earth To Ground | To Line To Earth To Ground | To Line To Earth To Ground | Test Connections | To Line To Earth To Ground | To Line To Earth To Ground | To Line To Earth To Ground |
|---|---|---|---|---|---|---|---|
| □ Minute | | | | 5 Minutes | | | |
| □ Minute | | | | 6 Minutes | | | |
| 3/4 Minute | | | | 7 Minutes | | | |
| 1 Minute | | | | 8 Minutes | | | |
| 2 Minutes | | | | 9 Minutes | | | |
| 3 Minutes | | | | 10 Minutes | | | |
| 4 Minutes | | | | 10/1 Minutes | | | |
| | | | | Ratio | | | |

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# SECTION 16130

# BOXES

## PART 1 -- GENERAL

### 1.01 THE REQUIREMENT

A. The scope of work under this Section includes furnishing and installing all pull boxes, junction boxes, and outlet boxes.

B. Requirements for other boxes and enclosures are not included in this Section. Reference each specific Division 16 equipment Section for requirements related to that equipment's respective enclosure.

C. Reference Section 16000, Basic Electrical Requirements, and Section 16111, Conduit.

### 1.02 CODES AND STANDARDS

A. Boxes shall be designed, manufactured, and/or listed to the following standards as applicable:

1. UL 514A - Metallic Outlet Boxes

2. UL 514C - Standard for Non-metallic Outlet Boxes, Flush Device Boxes, and Covers

3. UL 50 – Enclosures for Electrical Equipment, Non-environmental Considerations

4. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations

5. UL 1203 – Standard for Explosion-proof and Dust-ignition-proof Electrical Equipment for use in Hazardous (Classified) Locations.

6. NEMA 250 – Enclosures for Electrical Equipment

### 1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer(s) and submit the following:

B. Shop Drawings

C. Each submittal shall be identified by the applicable specification section.

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1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible Submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets for boxes, terminal strips, and all accessories

2. Overall bill of material for all boxes included under this Contract to summarize exactly what is being submitted for review. Bill of material shall at a minimum show each box type (i.e. pull, junction, or outlet), quantity, material of construction, dimensions, and proposed installation location.

1.05 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions and Division 1.

B. As-built drawings showing dimensions, internal box layout, terminal strip information, and terminal strip identification information shall be provided for all junction boxes. As-built drawings are not required for pull boxes or outlet boxes.

1.06 IDENTIFICATION

A. Each pull and junction box shall be identified with the box name as indicated on the Contract Drawings (e.g. PPB-2, CPB-1) or as directed by the Engineer. A nameplate shall be securely affixed in a conspicuous place on each box. Nameplates shall be as specified in Section 16195, Electrical – Identification.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 PULL AND JUNCTION BOXES

A. General

1. All pull and junction boxes shall be UL listed and labeled.

2. Pull and junction boxes shall not be provided with eccentric or concentric knockouts.

3. Pull and junction boxes mounted embedded in concrete shall be UL listed for embedment.

4. Where metallic boxes are used they shall be of all welded construction. Tack welded boxes are not acceptable.

B. Pull Boxes

1. All pull boxes shall be provided with a matching gasketed cover. For covers with dimensions of 24 inches by 24 inches or less, the cover shall be held in place by machine screws. Other screw types are not acceptable. For covers with dimensions greater than 24 inches by 24 inches, the cover shall be hinged and held in place by screw-operated clamp mechanisms. Hinge pins shall be removable. Clamp mechanism material of construction shall match that of the associated box.

2. Pull boxes shall not have any wire terminations inside, other than those for grounding/bonding. A ground bar shall be provided with the necessary number of screw type terminals. Twenty (20) percent of the total amount of terminals otherwise required for the pull box (minimum of two) shall be provided as spare terminations. Boxes requiring any other wire terminations shall be furnished and installed in accordance with the requirements for junction boxes herein.

3. Pull boxes shall be 6 inches wide by 6 inches tall by 4 inches deep, minimum. For applications requiring larger boxes, the box shall be sized in accordance with the fill requirements and dimensional requirements of the NEC.

4. Barriers shall be provided in pull boxes to isolate conductors of different voltages, types, and functions. Barrier material of construction shall match that of the box. Isolation shall be provided between the following groups:

   a. Power wiring

   b. AC control wiring

   c. DC control wiring

   d. Instrumentation wiring

C. Junction Boxes

1. Junction boxes used for lighting and receptacle circuits only shall be provided with a matching gasketed cover held in place by machine screws. Other screw types are not acceptable.

2. Junction boxes for all uses other than lighting and receptacle circuits shall be provided with a hinged, gasketed cover. Hinge pins shall be removable. Cover shall be held in place by screw-operated clamp mechanisms. Clamp mechanism material of construction shall match that of the associated box.

3. Barriers shall be provided in junction boxes to isolate conductors and terminal blocks of different voltages, types, and functions. Barrier material of construction shall match that of the box. Isolation shall be provided between the following groups:

   a. Power wiring

   b. AC control wiring

   c. DC control wiring

   d. Instrumentation wiring

4. Junction boxes used for lighting and receptacle circuits only shall be allowed to have screw-on (wire nut) type connectors for wire terminations/junctions.

5. Junction boxes for all uses other than lighting and receptacle circuits shall be provided with terminal strips, consisting the necessary number of screw type terminals. Current carrying parts of the terminal blocks shall be of ample capacity to carry the full load current of the circuits connected, with a 10A minimum capacity. Terminal strips shall be rated for the voltage of the circuits connected. A separate ground bar shall be provided with the necessary number of screw type terminals. Twenty (20) percent of the total amount of terminals otherwise required for the junction box (minimum of two) shall be provided as spare terminations. When barriers are provided within the box, separate terminal strips shall be provided in each barrier area. Terminals shall be lettered and/or numbered to conform to the wiring labeling scheme in place on the project.

6. Junction boxes shall be 6 inches wide by 6 inches tall by 4 inches deep, minimum. For applications requiring larger boxes, the box shall be sized in accordance with the fill requirements and dimensional requirements of the NEC. Terminal blocks (including spare terminals) shall be considered when sizing the junction box.

D. Enclosure Types and Materials

1. In non-hazardous locations, pull and junction boxes shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

| **AREA DESIGNATION** | **ENCLOSURE TYPE AND MATERIAL** |
|---|---|
| Indoor Wet Process Area | NEMA 4X, Type 316 Stainless Steel |
| Indoor Dry Process Area | NEMA 12, Painted Steel |
| Indoor Dry Non-process Area | NEMA 1, Painted Steel |
| All Outdoor Areas | NEMA 4X, Type 316 Stainless Steel |

2.03 OUTLET BOXES

A. General

1. Outlet boxes shall be provided with a trim appropriate for the wiring device installed inside. Reference Section 16141, Wiring Devices, for outlet box trim requirements. An appropriate outlet box trim is required to achieve the NEMA rating of the outlet boxes as specified herein.

B. Surface Mount Outlet Boxes

1. Outlet boxes shall be the deep type, no less than 2.5 inches deep.

2. Outlet boxes shall be provided in single or multi-gang configuration as required, sized in accordance with the requirements of the NEC.

3. In non-hazardous locations, outlet boxes shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

| **AREA DESIGNATION** | **ENCLOSURE TYPE AND MATERIAL** |
|---|---|
| Indoor Wet Process Area | NEMA 4X, Cast Aluminum |
| Indoor Dry Process Area | NEMA 1, Cast Aluminum |
| Indoor Dry Non-process Area | NEMA 1, Cast Aluminum |
| All Outdoor Areas | NEMA 4X, Cast Aluminum |

C. Flush Mount Outlet Boxes

1. Outlet boxes shall be no less than 2-1/8 inches deep, and 4-11/16 inches square. Boxes shall be UL listed and labeled. Pre-punched single diameter conduit knockouts are acceptable, however, concentric and eccentric knockouts are not acceptable.

2. Outlet boxes mounted flush in CMU walls shall be made of galvanized, tack welded steel, and suitable for installation in masonry walls. Sectional type boxes are not acceptable for this application.

3. Outlet boxes mounted flush in gypsum walls shall be made of galvanized pressed steel. Tack welded boxes are not acceptable for this application. Sectional type boxes are not acceptable for this application.

4. Outlet boxes mounted cast into concrete shall be concrete tight, and shall be made of galvanized steel or PVC.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Pull and Junction Boxes

1. Pull boxes and junction boxes shall be solidly attached to structural members prior to installation of conduit and set true and plumb. Boxes shall not be supported by their associated conduits.

2. Wooden plugs are not permitted for securing boxes to concrete. Appropriately rated anchors specifically suited for use in concrete shall be used.

3. Box penetrations for conduits shall be made with a punch tool, and penetrations shall be of the size required for the conduit entry and/or hub. Oversized penetrations in boxes are not acceptable.

4. Watertight conduit hubs shall be provided for boxes where a NEMA 4X enclosure rating is specified. Reference Section 16111, Conduit, for conduit hub requirements.

5. Pull and junction boxes may be installed flush mounted in gypsum, concrete or CMU walls where appropriate provided that covers are easily removed or opened.

6. Pull and junction boxes shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

B. Outlet Boxes

1. Outlet boxes shall be solidly attached to structural members prior to installation of conduit and set true and plumb. Boxes shall not be supported by their associated conduits.

2. Wooden plugs are not permitted for securing boxes to concrete. Appropriately rated anchors specifically suited for use in concrete shall be used.

3. Flush mounted outlet boxes shall be arranged and located so that tile and grout lines fit closely around the boxes, and so placed that the cover or device plate shall fit flush to the finished wall surface.

4. Outlet boxes shall be flush mounted in finished areas and other areas where practical. Flush mounted outlet boxes shall not be installed in hazardous areas and type 1 or 2 chemical storage/transfer areas.

5. For the below-named items, mounting heights from finished floor, or finished grade to top is applicable, depending on the type of wiring device to be installed in the outlet box. Mounting heights for outlet boxes shall be as follows, unless otherwise specified herein, indicated on the Drawings, or required by the Americans with Disability Act (ADA):

a. Light switches and wall mounted occupancy sensors, 48 inches

b. Receptacles in indoor dry process/non-process areas, 16 inches

c. Receptacles in indoor wet process areas and all indoor chemical storage/transfer areas, 48 inches

d. Receptacles in outdoor locations, 24 inches

6. Outlet boxes shall be provided in the material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

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SECTION 16141

WIRING DEVICES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install all switches, occupancy sensors, and receptacles of the type and at the locations as shown on the Drawings.

B. All switches and receptacles shall be furnished and installed in outlet boxes. Reference Section 16130, Boxes, for outlet box requirements.

C. Reference Section 16000, Basic Electrical Requirements, and Section 16123, Low Voltage Wire and Cable.

1.02 CODES AND STANDARDS

A. Wiring devices shall be designed, manufactured, and/or listed to the following standards as applicable:

1. UL 20 – General Use Snap Switches

2. UL 498 – Standard for Attachment Plugs and Receptacles

3. UL 943 – Ground Fault Circuit Interrupters

4. UL 1203 – Standard for Explosion-proof and Dust-ignition-proof Electrical Equipment for use in Hazardous (Classified) Locations.

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

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C. Shop drawings shall include, but not be limited to:

1. Product data sheets.

1.05 SPARE PARTS

A. The Contractor shall furnish 10% (minimum of 1) spare of each receptacle, switch, and plug furnished and installed for this project.

B. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

C. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size shall have the same parts number.

1.06 IDENTIFICATION

A. Each switch and receptacle shall be identified with the equipment item number, manufacturer's name or trademark, and such other information as the manufacturer may consider necessary, or as specified, for complete identification.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by these Specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. The Contractor shall use the products of a single manufacturer for each type of wiring device.

C. The Contractor shall use the products of a single manufacturer for all device plates. Plate variations are allowed for the following devices:

1. Where the selected plate manufacturer does not manufacture a suitable finish plate.

2. For heavy-duty receptacles rated at more than 30A.

3. Where non-standard plates are required, specified, or shown.

D. The Contractor shall furnish and install all wiring devices and device plates.

E. In non-hazardous areas, provide specification grade devices manufactured by Appleton, Crouse-Hinds, Leviton, Hubbell, Pass & Seymour, or Engineer approved equal.

F. In hazardous areas, provide devices manufactured by Appleton, Cooper Crouse-Hinds, Hubbell-Killark, or Engineer approved equal.

2.02 WIRING DEVICES

A. Wall switches for non-hazardous areas shall be rated for the current required to suit the application, but not less than 20A. Double pole, three-way, and four-way switches shall be provided where indicated on the Drawings, and as required. Switches shall be rated for 120-277VAC, and shall be UL 20 Listed.

B. Convenience receptacles for non-hazardous areas shall be rated for 20A at 125VAC. Convenience receptacles shall be UL 498 Listed. Tamper resistant receptacles are not acceptable.

C. Special purpose receptacles (welders, lab equipment, etc.) shall be provided with the proper NEMA configuration and ampacity as indicated on the Drawings. The coordinating plug for each special purpose receptacle shall be provided with the equipment which it is serving.

D. Ground fault circuit interrupter receptacles shall be rated for 20A at 125VAC. Ground fault circuit interrupter receptacles shall be UL 943 Listed. Tamper resistant receptacles are not acceptable.

E. Wall switches for hazardous areas shall be the factory sealed type, UL 1203 Listed for use in the hazardous area. Wall switches shall be rated for 120-277VAC, and shall be rated for the current required to suit the application, but not less than 20A

F. Receptacles for hazardous areas shall be rated 20A at 120-240VAC. Receptacles shall be UL 1203 listed for use in the hazardous area, utilizing delayed-action construction.

G. All wiring devices shall be approved for use with stranded conductors, if stranded conductors are to be used with the device. Reference Section 16123, Low Voltage Wire and Cable for conductor requirements

2.03 DEVICE PLATES

A. Device plates for indoor flush-mounted receptacles and switches shall be made of Type 304 stainless steel, not less than 0.032 of an inch thick, with beveled edges and milled on the rear so as to lie flat against the wall. Devices plates shall be provided with a gasket.

B. Device plates for outdoor installations, indoor wet process areas, and chemical storage/transfer areas shall be Appleton Type FSK, Crouse-Hinds #DS185, or equal for wall switches. Device plates for receptacles shall be “in-use” style. “In-use” weatherproof covers shall be rugged, minimum 3 ¼” depth, die-cast aluminum as manufactured by Thomas & Betts "Red Dot," Intermatic International, Inc., or equal.

C. Device plates for indoor dry process and non-process areas with surface mounted boxes shall be Crouse-Hinds DS32, or equal for switches, and Crouse-Hinds DS23 or equal for receptacles.

2.04 PLUGS

A. The Contractor shall furnish suitable plugs with equipment furnished under the respective specification Section. Plugs shall be black rubber or plastic. For waterproof receptacles, the plugs shall be similar in construction to the receptacles and shall be encased in corrosion resistant yellow housing provided with clamping nuts and stuffing gland cable outlets.

2.05 PROCESS INSTRUMENTS

A. The Contractor shall furnish and install a local disconnect switch at each process instrument (e.g., level transmitter, flow transmitter, analytical instrument etc.,) to disconnect the 120VAC power supply to the instrument. The device shall be a NSSC series manual motor starting switch without overload protection as manufactured by Crouse-Hinds, Appleton equivalent, or equal. For hazardous locations, the device shall be UL 1203 Listed.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Where more than one (1) switch occurs at one (1) location, gang plates shall be used.

B. All device plates shall be set true and plumb, and shall fit tightly against the finished wall surfaces and outlet boxes.

C. Wiring device box (outlet box) mounting heights shall be as specified in Section 16130, Boxes.

D. When indicated height would place any of the equipment at an unsuitable location such as at a molding or break in wall finish, the Contractor shall bring it to the attention of the Engineer for a decision.

E. Receptacles installed in toilet, locker, and bathrooms, and within 6 feet of a sink, shall be of ground fault interrupter type. Ground fault circuit interrupter receptacles shall also be furnished and installed in additional locations where indicated on the Drawings, and as required by the NEC.

F. All receptacles shall have a self-adhesive label installed on the top at the respective device plate that indicates which panel and which circuit number the receptacle is supplied from. Labels shall have a white background and black lettering in 14 point font.

3.02 CIRCUITING

A. Convenience receptacles shall be grouped on circuits separate from the lighting circuits. A maximum of eight (8) convenience receptacles are permitted per 20A, 120V circuit, unless otherwise indicated on the Drawings.

- END OF SECTION -

SECTION 16170

GROUNDING AND BONDING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install grounding systems complete in accordance with the minimum requirements established by Article 250 of the NEC. Article 250 of the NEC shall be considered a minimum requirement for compliance with this Specification.

B. Grounding of all instrumentation and control systems shall be furnished and installed in accordance with the manufacturer/system requirements and IEEE 1100-92, Powering and Grounding of Sensitive Electronic Equipment. Conflicts shall be promptly brought to the attention of the Engineer.

C. In addition to the NEC requirements, building structural steel columns shall be permanently and effectively grounded:

D. Reference Section 16000, Basic Electrical Requirements

1.02 CODES AND STANDARDS

A. Equipment and materials covered under this Section shall be designed, manufactured, and/or listed to the following standards as applicable:

1. UL 467 – Grounding and Bonding Equipment

2. IEEE 81 – Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Reports of certified field tests.

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

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B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

2. Drawings and written description of how the Contractor intends to furnish and install the grounding system.

## PART 2 -- PRODUCTS

### 2.01 MANUFACTURERS

A. The equipment covered by these specifications shall be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

### 2.02 GROUND RODS AND GRID

A. Ground rods shall be rolled to a commercially round shape from a welded copper-clad steel manufactured by the molten-welding process or by the electro-formed process (molecularly bonded). They shall have an ultimate tensile strength of 75,000 pounds per square inch (psi) and an elastic limit of 49,000 psi. The rods shall be not less than 3/4 inch in diameter by 10 feet in length; and the proportion of copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of 0.010 inch at any point on the rod. Ground rods shall be UL 467 listed. The ground rods shall be manufactured by Erico Products, Blackburn, or equal.

B. Except where specifically indicated otherwise, all exposed non current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductors in nonmetallic raceways and neutral conductors of wiring systems shall be grounded.

C. The ground connection shall be made at the main service equipment and shall be extended to the ground grid surrounding the structure. The ground grid shall also be connected to the point of entrance of the metallic water service. Connection to the water pipe shall be made by a suitable ground clamp or lug connection to a plugged tee. If flanged pipes are encountered, connection shall be made with the lug bolted to the street side of the flanged connection.

D. Where ground fault protection is employed, care shall be taken so that the connection of the ground and neutral does not interfere with the correct operation of the ground fault protection system.

2.03 FITTINGS

A. Grounding connections to equipment shall be bolted. Cable end connections shall be made by hydraulic crimp or exothermically welded. Split bolt type connectors are not acceptable. Fittings shall be UL 467 listed.

2.04 EQUIPMENT GROUNDING CONDUCTORS

A. An insulated equipment grounding conductor, which shall be separate from the electrical system neutral conductor, shall be furnished and installed for all circuits. Insulation shall be of the same type as the underground conductors in the raceway and shall be green in color. Equipment grounding conductors shall be furnished and installed in all conduits. Use of conduits as the NEC required equipment grounding conductor is not acceptable.

2.05 EQUIPMENT GROUNDS

A. Equipment grounds shall be solid and continuous from a connection at earth to all distribution panelboards. Ground connections at panelboards, outlets, equipment, and apparatus shall be made in an approved and permanent manner.

2.06 EXOTHERMIC WELDS

A. All exothermic welding shall be completed per welding kit manufacturer's instructions. Exothermic welds shall be CadWeld by Erico or ThermoWeld.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Metal surfaces where grounding connections are to be made shall be clean and dry. Steel surfaces shall be ground or filed to remove all scale, rust, grease, and dirt. Copper and galvanized steel shall be cleaned with emery cloth to remove oxide before making connections.

B. Ground Grid

1. A main ground grid shall be provided for each structure and interconnecting structure grids consisting of driven ground rods as shown on the Drawings. The ground rods shall be interconnected by the use of copper cable exothermically welded to the rods. The grounding cables shall be installed after the excavations for the building have been completed and prior to the pouring of concrete for the footings, mats, etc. Copper "pigtails" shall be connected to the ground grid and shall enter the buildings and structure from the outside and shall be connected to steel structures, and equipment as described in this Section and as required to provide a complete grounding system. The copper pigtails shall be exothermically welded to the ground grid, and connected to building reinforcement steel by hydraulic crimp.

2. Grounding conductors shall be continuous between points of connection; splices shall not be permitted.

3. Where conductors are exposed and subject to damage from personnel, traffic, etc., conductors shall be installed in metal raceway. The raceway shall be bonded to the grounding system.

4. Where subsurface conditions do not permit use of driven ground rods to obtain proper ground resistance, rods shall be installed in a trench or plate electrodes shall be provided, as applicable and necessary to obtain proper values of resistance.

5. Buried exothermic welds and ground ring shall not be backfilled until inspected by Engineer.

C. Raceways

1. Conduit which enters equipment such as switchgear, motor control centers, transformers, panelboards, variable frequency drives, instrument and control panels, and similar equipment shall be bonded to the ground bus or ground lug, where provided, and as otherwise required by the NEC.

3.02 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests

a. None required.

2. Field Tests

a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition.

b. Fall of potential tests shall be performed on the ground grid per IEEE81 recommendations by a third party, independent testing firm. A fall of potential plot shall be submitted at the conclusion of testing for Engineer review. Documentation indicating the location of the rod and grounding system as well as the resistance and soil conditions at the time the measurements were made shall be submitted. Testing shall show that the ground grid has 5 ohms resistance or less. Due to soil conditions and/or unforeseen field conditions, ground resistances greater than 5 ohms may be acceptable if specifically approved in writing by the Engineer. Ground resistance measurements shall be made in normally dry weather not less than 48 hours after rainfall and with the ground grid under test isolated from other grounds.

c. Continuity tests for the grounding electrode conductor shall also be performed. Test will be accepted when a resistance of less than 1 ohm is shown for this conductor.

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SECTION 16190

SUPPORTING DEVICES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install structural supports for mounting and installing all conduit, electrical equipment, lighting, alarm systems, instrumentation, and communications equipment furnished under this Contract.

B. Equipment shall be installed strictly in accordance with recommendations of the manufacturer and best practices of the trade resulting in a complete, operable, and safe installation. The Contractor shall obtain written installation manuals from the equipment manufacturer prior to installation.

C. Reference Section 16000, Basic Electrical Requirements.

1.02 CODES AND STANDARDS

A. Equipment and materials covered under this Section shall be designed, manufactured, and/or listed to the following standards as applicable:

1. ASTM A123 – Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

2. ASTM A153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

3. ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

4. ASTM A276 – Standard Specification for Steel Bars and Shapes

5. ASTM B783 – Standard Specification for Materials for Ferrous Powder Metallurgy Structural Parts

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop drawings

2. Structural support calculations (if required)

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B. Each submittal shall be identified by the applicable Specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

2. Complete assembly, layout, installation, and foundation drawings with clearly marked dimensions.

## PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 MATERIALS

A. Support channel shall be 1-5/8” by 1-5/8” minimum, with 12 gage material thickness.

B. Support channel, support channel fittings, and threaded rod shall be furnished with the following material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

| **AREA DESIGNATION** | **MATERIAL OF CONSTRUCTION** |
|---|---|
| Indoor Wet Process Area | Type 316 Stainless Steel |
| Indoor Dry Process Area | Hot Dipped Galvanized Steel |
| Indoor Dry Non-process Area | Hot Dipped Galvanized Steel |
| All Outdoor Areas | Type 316 Stainless Steel |
| All Hazardous Areas | Type 316 Stainless Steel |

C. Fastening hardware (bolts, nuts, washers, and screws) shall be furnished with the following material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

| AREA DESIGNATION | MATERIAL OF CONSTRUCTION |
|---|---|
| Indoor Wet Process Area | Type 316 Stainless Steel |
| Indoor Dry Process Area | Type 316 Stainless Steel |
| Indoor Dry Non-process Area | Type 316 Stainless Steel |
| All Outdoor Areas | Type 316 Stainless Steel |

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Concrete or Masonry Inserts

1. The Contractor shall be responsible for the furnishing and installation of all anchor bolts, masonry inserts, and similar devices required for installation of equipment furnished under this Contract.

2. If a time delay for the arrival of any special inserts or equipment drawings, etc. occurs, the Contractor may, if permitted by the Engineer, make arrangements for providing approved recesses and openings in the concrete or masonry and, upon subsequent installation, the Contractor shall be responsible for filling in such recesses and openings. Any additional costs that may be incurred by this procedure shall be borne by the Contractor.

3. The Contractor shall furnish leveling channels for all switchgear, switchboards, motor control centers, and similar floor mounted equipment. The leveling channels shall be provided for embedment in the equipment housekeeping pads. Coordination of the installation of these channels with the concrete pad is essential and required. Pad height shall be as required to maintain concrete coverage of the reinforcement bars while not causing associated equipment to exceed the maximum mounting height requirements of the NEC.

B. Support Fastening and Locations

1. All equipment fastenings to columns, steel beams, and trusses shall be by beam clamps or welded. No holes shall be drilled in the steel.

2. All holes made in reflected ceilings for support rods, conduits, and other equipment shall be made adjacent to ceiling grid bars where possible, to facilitate removal of ceiling panels.

3. Support channel shall be provided wherever required for the support of starters, switches, panels, and miscellaneous equipment.

4. All equipment, devices, and raceways that are installed on the dry side of a water bearing wall shall not be installed directly onto the wall. Support channel shall be used to allow ventilation air to pass behind the equipment, devices, or raceway.

5. All supports shall be rigidly bolted together and braced to make a substantial supporting framework. Where possible, control equipment shall be grouped together and mounted on a single framework.

6. Aluminum support members shall not be installed in direct contact with concrete. Stainless steel or non-metallic "spacers" shall be used to prevent contact of aluminum with concrete.

7. Actual designs for supporting framework should take the nature of a picture frame of support channels and bracket with a plate for mounting the components. The Contractor is responsible for the design of supporting structure; he shall submit design details to the Engineer for acceptance before proceeding with the fabrication.

8. Wherever dissimilar metals come into contact, the Contractor shall isolate these metals as required with neoprene washers, nine (9) mil polyethylene tape, or gaskets.

9. For all installations where fiberglass supporting materials are required, the Contractor shall submit structural calculations and the details of the proposed system of support. Structural calculations shall be signed and sealed by a registered professional engineer in the State of Florida.

10. For the following installations where conduits are provided with a support system suspended from the above or attached to a vertical structure, the Contractor shall submit structural calculations and details of the proposed system of support. Structural calculations shall be signed and sealed by a registered professional engineer in the State of Florida.

    a. A quantity of twelve (12) or more conduits trade size 1” and smaller are proposed for a conduit support rack.

    b. A quantity of eight (8) or more conduits trade sizes 1 ½” to 2 1/2” are proposed for a conduit support rack.

    c. A quantity of four (4) or more conduits trade sizes 3” and larger are proposed for a conduit support rack.

11. Single conduits installed exposed along walls and ceilings shall be secured to the wall or ceiling with a one-hole conduit clamp and clamp-back. Where multiple conduits are installed exposed together, support channel and conduit clamps shall be used.

- END OF SECTION -

SECTION 16195

ELECTRICAL - IDENTIFICATION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. All electrical equipment shall be properly identified in accordance with these Specifications and the Contract Drawings. All switchgear, switchboards, motor control centers, variable frequency drives, lighting and distribution panelboards, combination starters, control panels, pull and junction boxes, enclosures, disconnect switches, control stations, and similar equipment shall be identified in the manner described, or in an equally approved manner.

B. The types of electrical identification specified in this section include, but are not limited to, the following:

1. Operational instructions and warnings.

2. Danger signs.

3. Equipment/system identification signs.

4. Nameplates.

1.02 SIGNS

A. "DANGER-HIGH-VOLTAGE" signs shall be securely mounted on the entry doors of all electrical rooms.

1.03 LETTERING AND GRAPHICS

A. The Contractor shall coordinate names, abbreviations, and other designations used in the electrical identification work with the corresponding designations shown, specified or scheduled. Provide numbers, lettering, and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the electrical systems and equipment.

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable specification section.

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1.05 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The material covered by these Specifications is intended to be standard material of proven performance as manufactured by reputable concerns. Material shall be fabricated, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and shown on the Drawings.

2.02 NAMEPLATES

A. Nameplates shall be engraved, high pressure plastic laminate, white with black lettering.

B. Nameplates shall be attached to NEMA 4X enclosures utilizing UL-recognized mounting kits designed to maintain the overall UL Type rating of the enclosure. Mounting kit fasteners shall be stainless steel Type AHK10324X as manufactured by Hoffman, or equal.

2.03 HIGH VOLTAGE SIGNS

A. Standard "DANGER" signs shall be of baked enamel finish on 20 gage steel; of standard red, black and white graphics; 14 inches by 10 inches size except where 10 inches by 7 inches is the largest size which can be applied where needed, and except where a larger size is needed for adequate identification.

2.04 CONDUIT IDENTIFICATION

A. Conduit identification shall be as specified in Section 16111, Conduit.

2.05 WIRE AND CABLE IDENTIFICATION

A. Field installed wire and cable identification shall be as specified in Section 16123, Low Voltage Wire and Cable.

B. A plastic laminate nameplate shall be provided at each panelboard, motor control center, switchgear assembly, and switchboard assembly. This nameplate shall be used to clearly convey the conductor identification means used at that piece of equipment (i.e. Phase A=Brown, Phase B=Orange, C = Yellow).

C. Wiring identification for factory installed wiring in equipment enclosures shall be as specified in the respective section.

2.06 BOX IDENTIFICATION

A. Pull, junction and device box identification shall be as specified in Section 16130 – Boxes.

PART 3 -- EXECUTION

3.01 NAMEPLATES

A. Nameplates shall be attached to the equipment enclosures with (2) two stainless steel sheet metal screws for nameplates up to 2-inches wide. For nameplates over 2-inches wide, four (4) stainless steel sheet metal screws shall be used, one (1) in each corner of the nameplate. The utilization of adhesives is not permitted.

3.02 OPERATIONAL IDENTIFICATION AND WARNINGS

A. Wherever reasonably required to ensure safe and efficient operation and maintenance of the electrical systems and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install plastic signs or similar equivalent identification, instruction, or warnings on switches, outlets, and other controls, devices, and covers or electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for the intended purposes. Signs shall be attached as specified above for nameplates.

3.03 POWER SOURCE IDENTIFICATION

A. After installation of all field equipment (i.e. valves, motors, fans, unit heaters, instruments, etc) install nameplates at each power termination for the field equipment. Nameplate data shall include equipment designation (tag number), power source (MCC number, panelboard, etc), circuit number, conduit number from schedule and voltage/phase.

B. Contractor to coordinate with the Engineer and the Owner regarding exact nameplate placement during construction.

C. Nameplates shall be as specified herein.

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SECTION 16426

LOW VOLTAGE SWITCHBOARDS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, test, and place in satisfactory operation, the low voltage switchboards as specified herein and indicated on the Drawings.

B. The main circuit breaker assembly shall serve as the service entrance equipment and connection to the service shall be coordinated with the serving electric utility. See Section 16000 for serving electric utility contact information.

C. The line-up shall contain main breaker, generator breaker, manual transfer between main and generator breaker, feeder breakers, metering equipment, control devices, and all accessories as specified herein, indicated on the Drawings, and as required to result in a complete and operable power distribution equipment assembly.

D. The Contractor shall obtain the switchboard from one manufacturer who shall also manufacture the structure and major equipment components, which includes, but is not limited to, circuit breakers, instrument transformers, meters, relays, and controls. Sub-contracting of wiring is not acceptable.

E. The switchboard shall be assembled using NEMA rated components. Components designed and built to International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured and labeled in compliance with IEC standards is not acceptable.

F. Circuit breaker control and relaying/metering circuits shall be wired in accordance with the requirements specified herein or indicated on the Drawings.

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1.02 CODES AND STANDARDS

A. All equipment shall be listed by and shall bear the label of Underwriter's Laboratories, Incorporated (U.L.).

B. The equipment shall comply with the following codes and standards:

1. National Electrical Code (NEC)

2. Institute of Electrical and Electronic Engineers (IEEE)

3. American National Standards Institute (ANSI):

a. C12.1 - Code for Electricity Metering

b. C57.13 - Instrument Transformers

4. National Electrical Manufacturer's Association (NEMA):

   a. AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

   b. PB 2 - Deadfront Distribution Switchboards.

5. Underwriters Laboratories, Inc. (U.L.):

   a. U.L. 98 - Enclosed and Dead Front Switches.

   b. U.L. 489 - Molded Case Circuit Breakers.

   c. U.L. 891 - Dead-Front Switchboards.

1.03 SUBMITTALS

A. The Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Operation and Maintenance Manuals

3. Spare Parts List

4. Reports of Certified Shop and Field Tests

5. Manufacturer’s Representatives Installation Certification

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submissions will be returned to the Contractor without review for resubmittal.

C. Shop drawings for <u>each switchboard assembly</u> shall include but not be limited to:

1. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten

explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

2. Product data sheets identifying all electrical ratings.

3. Complete assembly, layout, anchoring, and installation drawings with clearly marked dimensions.

4. Approximate total shipping weight of each equipment assembly.

5. Example equipment nameplate data sheet.

6. Plan, front and side view drawings, including overall dimensions of each switchboard assembly. Identify shipping splits and show conduit stub-up area locations on the Drawings.

7. Internal wiring diagram of each low voltage switchboard assembly. Each wiring diagram shall include wire identification and terminal numbers.

8. Internal interconnection wiring diagrams including wiring identification and terminal numbers.

9. Complete single line diagram for each switchboard line-up. The drawing shall indicate devices comprising the switchboard assembly including, but not limited to, circuit breakers, control power and instrument transformers, meters, relays, and control devices. Clearly indicate electrical ratings of all devices.

10. Bill of material list for each switchboard assembly.

11. Nameplate schedule.

12. Manufacturer's installation instructions.

13. Manufacturer's warranty statement.

14. Key interlock scheme drawing and sequence of operations.

The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items the Contractor intends to provide are acceptable and shall be submitted.

1.05 OPERATIONS AND MAINTENANCE MANUALS

A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions and Division 1. The manuals shall include:

1. Instruction books and/or leaflets.

2. Recommended spare parts list.

3. Final as-built construction drawings included in the shop drawings incorporating all changes made in the manufacturing process and field installation.

1.06 SPARE PARTS

A. The switchboard shall be furnished with all spare parts as recommended by the equipment manufacturer. All spaces in switchboards shall be furnished with a spare circuit breaker where indicated on the Drawings.

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the Work, at which time they shall be delivered to the Owner.

D. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.07 IDENTIFICATION

A. Each switchboard assembly shall be identified with the identification name and/or number indicated on the Drawings (e.g., SWBD-TEMP, PP-EPS). A nameplate shall be securely affixed in a conspicuous place on each switchboard assembly. Nameplates shall be as specified in Section 16195, Electrical - Identification.

## PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. It is the intent of these specifications that the switchboard be produced by a single manufacturer who shall be responsible for matching all components and providing equipment which functions together as a system.

C. The equipment shall be Pow-R-Line C as manufactured by Eaton or Square D Company equivalent. **No substitutions shall be permitted.**

2.02 CIRCUIT BREAKER SWITCHBOARD

A. General

1. Furnish and install dead-front type, completely metal enclosed, self-supporting electrical equipment including main circuit breaker(s) and molded case branch circuit breaker assemblies of the number, rating and type noted on the Drawings. The equipment shall meet Underwriters' Laboratories requirements and shall be a furnished with a U.L. service entrance label where indicated on the Drawings.

2. The main breaker section and distribution section shall be NEMA Type 3R industrial use enclosures. The main circuit breaker section shall be totally accessible from the front and the sides. The distribution switchboard shall be totally accessible from the front and the sides. Equipment assemblies requiring rear access are not acceptable. The framework shall be of U.L. gauge steel. Ventilation shall be provided as required.

3. All wire troughs shall have hinged doors.

4. The equipment assemblies shall be suitable for operation at the available fault current, 65 kA (minimum). The equipment assemblies shall be labeled to indicate the maximum available fault current rating, taking into account the structure, bussing, main circuit breaker and switchboard branch circuit devices. The short circuit current rating shall not be less than that specified herein or indicated on the Drawings. The distribution switchboard branch circuit devices short circuit current rating shall be fully rated.

5. All bus shall be tin-plated copper. The bussing shall be of sufficient cross sectional area to meet U.L. standard 891 for temperature rise. The fully rated main bus shall have a maximum ampacity as indicated on the Drawings and extend the full length of the equipment. The main bus shall be 100 percent rated. The ground bus shall be sized per U.L. standard 891, installed in the entire length of the equipment assemblies. The distribution switchboard bus shall be rated as required by the rating of the mounted branch devices, including spares or spaces. Full height vertical bus shall be provided to accommodate future circuit breakers. Less than full height vertical bus which will only accommodate the circuit breakers included for this project is unacceptable.

6. Provide engraved plastic nameplates to identify the main circuit breaker and each branch circuit breaker. The circuit number and circuit name shall appear on the nameplate in accordance with the single line diagram(s) indicated on the Drawings. Nameplates shall be as specified in Section 16195, Electrical - Identification.

B. Utility Pull and Metering Section

1. The Contractor shall furnish and install a pull and metering section, as required, in accordance with all applicable utility requirements. This section shall be suitable for outdoor use.

2. During the design period, some information was gained from the utility regarding service requirements and is specified herein or shown on the Drawings.

3. The Contractor shall be responsible for all final coordination with the electric utility to furnish and install the necessary equipment to meet the latest utility requirements. This includes pull and metering section dimensions, materials of construction, location, bus/cable restrictions, and requirements for concrete pad, utility vault, bumper posts, and similar equipment.

C. Main Circuit Breaker Section

1. The main circuit breaker section shall be furnished and installed for front and side accessibility and manufactured to accept a bus duct connection.

2. The main circuit breaker shall be a fixed type, insulated case manually operated, on-off breaker, 100 percent rated with full-function trip system, sensors, and rating plug.

3. The main circuit breaker shall be Square-D Company Powerpact R or Cutler Hammer/Westinghouse SPB type. The breaker shall be rated for 65,000 A RMS symmetrical at 480V. The full function trip system shall be MICROLOGIC 6.0A Ammeter Trip with Modified Differential Ground Fault (MDGF) by Square D Company or Cutler Hammer/Westinghouse Digitrip RMS 810 with adjustable instantaneous, long-time pick-up and delay, short-time pick-up and delay, ground fault pick-up and delay, and trip indicator, minimum. The main breaker shall be capable of being tripped from a remote control circuit (e.g. command from computer control system or hard-wired trip circuit).

4. Provide control power and current transformers as required. Provide a minimum of two (2) auxiliary contacts for remote indication of breaker position. Provide other accessories as specified herein or indicated on the Drawings.

D. Distribution Switchboard

1. The distribution switchboard shall be furnished complete with auxiliary section to accept an incoming bus duct connection. This auxiliary section shall be completely front accessible.

2. The auxiliary section shall also contain a PM 5563 with dual Ethernet Ports as manufactured by Square D Company or an IQ Analyzer as manufactured by Eaton. All voltage and current transformers, fuses, wiring, and other devices shall be furnished and installed to produce a complete monitoring system.

3. The distribution switchboard shall include individually mounted branch circuit breakers which are to be totally front accessible and front connectable. The circuit breaker connections to the distribution panel bussing shall be of bolt-on design such that the connections grip the bus bars firmly under high-fault conditions.

4. The switchboard manufacturer shall provide all the proper lugs for all cable connections as required to avoid field modifications.

5. Branch circuit breakers shall be molded case type with ratings as indicated on the Drawings. For the temporary switchboard, all breakers shall have digital, adjustable trip units so that the switchboard can be used at both Southwest and Arlington East. **The Contractor is responsible for providing breakers within the switchboard to accommodate both projects.** Some branch circuit breakers shall have shunt trips as indicated on the Drawings. Branch circuit breakers shall be rated for 65,000 A RMS symmetrical at 480V.

2.03 SURGE PROTECTIVE DEVICES

A. The switchboard shall be furnished with integrated Type II surge protective devices (SPD). SPDs shall be provided in the location and quantity as shown on the Drawings.

B. The SPD shall be rated, designed, tested, listed, and labeled in accordance with UL-1449, latest edition.

C. The SPD shall be factory installed by the switchboard manufacturer using a direct bus connection. There shall be no cable connection between the bus bar and the SPD device.

D. The SPD shall have a fault current rating equal to or greater than that of the fault current rating of the switchboard. The SPD shall employ metal-oxide varistor (MOV) technology. If integral fusing is used, the fuses shall allow the maximum rated surge current to pass without fuse operation.

E. The SPD shall have a maximum continuous operating voltage (MCOV) of at least 115% of the nominal voltage of the switchboard. The Voltage Protection Rating (VPR) of each SPD shall not exceed the following:

| SYSTEM VOLTAGE | L-N | L-G | L-L | N-G |
|---|---|---|---|---|
| 208Y/120 | 700V | 700V | 1200V | 700V |
| 480Y/277 | 1200V | 1200V | 1800V | 1200V |
| 480 DELTA | N/A | 1200V | 2000V | N/A |
| 240 DELTA | N/A | 1200V | 1200V | N/A |
| 120/240 | 700V | 700V | 1200V | 700V |

F. The Nominal Discharge Current ($I_n$) of the SPD shall be 20kA. Peak surge current ratings shall not be used as a basis for applying the SPD to the system.

The surge current rating for each SPD shall be as indicated on the Drawings. Surge current ratings are indicated on single line diagrams. Surge current rating indicated is on a per phase basis.

G. Each SPD system shall provide surge protection in all possible modes. Surge protection shall be as follows:

| SYSTEM CONFIGURATION | MODES OF PROTECTION | NUMBER OF MODES |
|---|---|---|
| 3-Phase Wye | L-N, L-G, N-G | 7 |
| 3-Phase Delta | L-L, L-G | 6 |
| 3-Phase Impedence | L-L, L-G | 6 |

| SYSTEM CONFIGURATION | MODES OF PROTECTION | NUMBER OF MODES |
|---|---|---|
| Grounded | | |
| Single-Phase | L-N, L-G, N-G | 3 |

H. The SPD shall be furnished with an audible alarm and silence pushbutton, integral SPD status LEDs (one per phase), and a Form C dry contact for remote indication of alarm. A surge counter shall also be provided.

I. The SPD equipment shall be SPD Series by Eaton or SurgeLogic by the Square D Company.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. The switchboard shall be furnished and installed as shown on the Drawings and in accordance with the manufacturer's installation instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment. The equipment shall be suitably protected until accepted by the Owner.

B. The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to:

1. Checking to ensure that the pad location is level to within .125 inches.

2. Checking to ensure that all bus bars are torqued to the manufacturer's recommendations.

3. Assemble all shipping sections, remove all shipping braces and connect all shipping split mechanical and electrical connections.

4. Secure assemblies to foundation or floor channels.

5. Inspect and install all circuit breakers in their proper places.

3.02 PAINTING

A. Prior to final completion of the work, all metal surfaces of the equipment shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same lacquer as used for shop finishing coats.

3.03 TESTING

A. The following tests are required:

1. Witness Shop Tests

a. Not required.

2. Certified Shop Tests and Reports

a. Submit description of proposed testing methods, procedures, and apparatus. Submit notarized and certified copies of all test reports.

b. As a minimum, the entire switchboard assembly shall go through a quality inspection before shipment. This inspection shall include, but is not limited to, the following:

i. Physical inspection of the structure and the electrical conductors including bussing, general wiring, and units.

ii. General electrical tests including power circuit phasing, control circuit wiring, instrument transformers, meters, ground fault system, and device electrical operation.

iii. AC dielectric tests of the power circuits and control circuits.

iv. Markings/labels, including instructional type, Underwriters Laboratory (U.L.), and inspector's stamps.

The manufacturer shall use integral quality control checks throughout the manufacturing process to maintain the correctness of the switchboard.

3. Field Tests

a. Field tests shall be performed in accordance with requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition

3.04 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide the services of a qualified, factory-trained manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment furnished under this Contract. The manufacturer's representative shall certify in writing that the equipment has been installed in accordance with the manufacturer's recommendations. No further testing or equipment startup may take place until this certification is accepted by the Owner.

B. The manufacturer’s technical representative shall perform startup and functional testing of the switchboard and controls as specified herein.

C. The Contractor shall provide training for Owner personnel. Training shall be conducted by the manufacturer's factory-trained representative who shall instruct Owner personnel in operation and maintenance of all equipment provided under this Section. Training shall be provided for two (2) sessions of four (4) hours each. Training shall not take place until after all switchboard units have been installed and energized. Training shall be at times coordinated with the Owner.

D. The services of the manufacturer's representative shall be provided for a period of not less than as follows:

1. One (1) trip of two (2) working days during the installation of the switchboard.

2. One (1) trip of two (2) working days for the testing and startup of the switchboard.

3. One (1) trip of one (1) working day to perform training as specified herein.

4. One (1) trip of one (1) working day two (2) months before the warranty expiration to identify any issues to be corrected under warranty.

E. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor.

3.05 FIELD ADJUSTMENTS

A. The circuit breaker trip units shall be set in the field by a qualified representative of the manufacturer, or an outside testing company retained by the Contractor, in accordance with the settings designated in the coordination study. See Section 16000 – Basic Electrical Requirements.

- END OF SECTION -

SECTION 16428

LOW VOLTAGE SWITCHGEAR

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, test, and place in satisfactory operation, dead-front type, low voltage, draw-out, metal enclosed power circuit breaker switchgear as specified herein and indicated on the Drawings.

B. The switchgear shall be the air break power circuit breaker type with drawout circuit breaker elements.

C. The line-up shall contain utility isolation main breaker, main breaker, a generator main breaker, feeder breakers, metering equipment, transfer control devices, and all accessories as specified herein, indicated on the Drawings, and as required to result in a complete and operable power distribution equipment assembly.

D. The Contractor shall obtain the switchgear from one manufacturer who shall also manufacture the structure and major equipment components, which includes, but is not limited to, assemblies of circuit breakers and auxiliary housings, drawout type air circuit breakers, instrument transformers, meters, relays, and controls. Sub-contracting of wiring is not acceptable.

E. The switchgear shall be assembled using NEMA rated components. Components designed and built to International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured and labeled in compliance with IEC standards is not acceptable.

F. Circuit breaker control and relaying/metering circuits shall be wired in accordance with the requirements specified herein or indicated on the Drawings.

1.02 CODES AND STANDARDS

A. The switchgear assemblies and power circuit breakers shall comply with the following codes and standards:

1. American National Standards Institute (ANSI):

a. C37.13 - Low Voltage AC Power Circuit Breakers Used in Enclosures.

b. C37.16 - Preferred Ratings, Related Requirements and Application Recommendations for Low Voltage Power Circuit Breakers and AC Power Circuit Protectors.

c. C37.20.1 - Standard for Metal - Enclosed Low Voltage Power Circuit Breaker Switchgear.

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d. C37.51 - Standard Conformance Test Procedures for Metal-Enclosed Low Voltage AC Power Circuit Breaker Switchgear Assemblies.

2. Institute of Electrical and Electronic Engineers (IEEE).

3. National Electrical Manufacturers' Association (NEMA):

a. SG3 - Low-Voltage Power Circuit Breakers.

b. SG5 - Power Switchgear Assemblies.

4. Underwriters Laboratories, Inc. (UL):

a. UL 1558 - Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear.

b. UL 1066 –Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Operation and Maintenance Manuals

3. Spare Parts List

4. Proposed Testing Methods and Reports of Certified Shop Tests

5. Manufacturer’s Field Start-up Report

6. Manufacturer’s Representative’s Installation Certification

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submissions will be returned to the Contractor without review for resubmittal.

C. Shop drawings for each switchgear assembly shall include but not be limited to:

1. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

2. Equipment specifications and product data sheets identifying all electrical ratings.

3. Complete assembly, layout, installation, and foundation drawings with clearly marked dimensions.

4. Assembled weight of units and approximate total shipping weight.

5. Example equipment nameplate data sheet.

6. Plan, front and side view drawings, including overall dimensions of each switchgear assembly. Identify shipping splits and show conduit stub-up area locations on the drawings. Provide details for busway connections.

7. Internal wiring diagram of each low voltage switchgear compartment. Each wiring diagram shall include wire identification and terminal numbers.

8. Internal compartment-to-compartment interconnection wiring diagrams including wiring identification and terminal numbers.

9. Complete one-line diagram of each switchgear line-up and complete three-line diagram for each switchgear line-up. These drawings shall indicate devices comprising the switchgear assembly including, but not limited to, circuit breakers, control power and instrument transformers, meters, relays, and control devices. Clearly indicate electrical ratings of all devices.

10. Bill of material list for each switchgear assembly including each switchgear compartment.

11. Nameplate schedule for each compartment.

12. Manufacturer's installation instructions.

13. Manufacturer's written warranty statement.

14. Written sequence of operation for automatic transfer controls.

15. UPS system sizing characteristics.

The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items the Contractor intends to provide are acceptable and shall be submitted.

1.05 OPERATIONS AND MAINTENANCE MANUALS

A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions and Division 1. The manuals shall include:

1. Instruction books and/or leaflets.

2. Recommended spare parts list.

3. Final as-built construction drawings included in the shop drawings incorporating all changes made in the manufacturing process.

1.06 SPARE PARTS

A. The switchgear shall be furnished with all spare parts as recommended by the equipment manufacturer.

In addition to the spare parts recommended by the manufacturer, the Contractor shall furnish the following minimum spare parts for each switchgear assembly:

| No. Required | Description |
|---|---|
| 1 set | Fuses of each size provided. |
| 1 | Control power transformer of each size used. |
| 1 | Lamps and lenses for indicating lights, each color. |
| 1 | Indicating lamp sockets for each type used. |
| 2 | Pilot devices (e.g. pushbutton, selector switch, etc.) complete with contact blocks and legend plates for each type, color, size and rating used. |

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the Work, at which time they shall be delivered to the Owner.

D. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.07 IDENTIFICATION

A. Each switchgear assembly shall be identified with the identification number indicated on the Drawings (e.g., Switchgear SWGR-E). A nameplate shall be securely affixed in a conspicuous place on each switchgear assembly. Nameplates shall be as specified in Section 16195, Electrical - Identification.

1.08 WARRANTY TERMS

A. The manufacturer's and Contractor's warranty shall in no event be for a period of less than two (2) years from date of delivery of equipment to the project site and shall include repair labor, travel expense necessary for repairs at the jobsite, and expendables used during the course of repair. Submittals received without written warranties as specified shall be rejected in their entirety.

B. The Contractor shall provide a complete warranty covering all equipment included in the scope of supply. This warranty shall include, but is not limited to, the following:

- All transfer controls
- Complete switchgear lineup, including all components and accessories
- UPS system

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. It is the intent of these specifications that the switchgear be produced by a single manufacturer who shall be responsible for matching all components and providing equipment which functions together as a system. Manufacturers that provide complete switchgear assemblies using power circuit breakers produced by another major manufacturer shall only be allowed if specifically accepted by the Engineer

C. The switchgear basis of design is the Power Zone 4 as manufactured by the Square D Company. A Magnum DS as manufactured by Eaton switchgear lineup may be submitted as an alternative, but all specific layouts and requirements indicated on the Drawings and Specifications shall be adhered to with no exceptions. Alternative equipment to the basis of design must be approved in writing by the Engineer prior to bid. **No substitutions are permitted.**

## 2.02 LOW VOLTAGE METAL ENCLOSED SWITCHGEAR

A. General

1. Switchgear shall be suitable for use as service entrance equipment in accordance with Underwriters Laboratories requirements. Each complete assembly shall bear a U.L. label.

B. Ratings

1. Voltage rating shall be as indicated on the Drawings. The entire assembly shall be suitable for 600 volts maximum AC service.

2. Rate complete switchgear assembly to withstand mechanical forces exerted during short circuit conditions when connected directly to a power source having available fault current of 65,000 amperes symmetrical at rated voltage. Test switchgear for conformance according to ANSI C37.51.

3. The bus system shall have a minimum ANSI 30-cycle short circuit withstand rating of 100,000 amperes symmetrical without upstream current limiting fuses.

4. All ratings shall be tested to the requirements of ANSI C37.20.1, C37.50 and C37.51 and U.L. witnessed and approved.

5. The switchgear assembly enclosure rating shall be NEMA 1 suitable for indoor use. Enclosure shall be painted ANSI-61 light grey, using the manufacturer's standard painting process.

C. Stationary Structure

1. The switchgear structure shall be constructed of formed sections of specially smooth and leveled steel, welded together and reinforced where necessary with formed steel members. The sides shall be covered with removable bolt on covers. The resulting structure shall be rigid and self-supporting.

2. The rear of structure shall be covered with concealed hinged, padlockable steel doors for access to buses, connections, and other equipment mounted within. The ends of the structure shall be closed with removable steel panels held in place with slotted head bolts or concealed screws. The hinged access doors shall be provided with 2-point latches, door stops, structural reinforcing to prevent sagging and provisions for padlocking. Knurled screwhead type fasteners are not acceptable.

3. Secondary control devices and associated wiring shall be isolated from all high voltage primary devices by grounded metal barriers. Primary circuits such as circuit breakers, transformers, and buses shall also be isolated from each other and from personnel by grounded metal barriers.

4. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position. Provisions shall be made for jacking of shipping groups for removal of skids or insertion of equipment rollers. Base of assembly shall be suitable for rolling directly on pipes without skids.

5. Each vertical steel unit forming part of the switchgear line-up shall be a self-contained housing having one or more individual breaker or instrument compartments, a centralized main bus compartment, and a rear cabling compartment. Each individual circuit breaker compartment shall be segregated from adjacent compartments and sections, including the bus compartment, by means of grounded steel barriers. It shall be equipped with drawout rails and primary and secondary disconnecting contacts. Current transformers for feeder instrumentation, where indicated on the Drawings, shall be located within the appropriate breaker cells.

6. The stationary part of the primary disconnecting devices for each power circuit breaker shall consist of a set of contacts extending to the rear through a glass polyester insulating support barrier; corresponding moving finger contacts suitably spaced shall be furnished on the power circuit breaker studs which engage in only the CONNECTED position. The assembly shall provide multiple silver-to-silver full floating high pressure point contacts with uniform pressure on each finger maintained by springs. Each circuit shall include the necessary three-phase bus connections between the section bus and the breaker line side studs. Load studs shall be equipped with insulated copper load extension busses. Bus extensions shall be tin-plated where outgoing terminals are attached.

7. The secondary disconnecting devices shall consist of floating fingers mounted on the removable unit and engaging flat contact segments at the rear of the compartment. The secondary disconnecting devices shall be silver-plated and sliding contact engagement shall be maintained in the CONNECTED and TEST positions.

8. The removable power circuit breaker element shall be equipped with disconnecting contacts, and interlocks for drawout application. It shall have four positions, CONNECTED, TEST, DISCONNECTED and REMOVE all of which permit closing the compartment door. Breakers shall be dead-front, through door construction, allowing racking with the door closed. The breaker drawout element shall contain a worm gear levering "in" and "out" mechanism with removable lever crank. Mechanical interlocking shall be provided so that the breaker is in the tripped position before levering "in" and "out" of the cell. The breaker shall include a provision for padlocking open to prevent manual or electric closing. The padlocking shall also secure the breaker in the CONNECTED, TEST, or DISCONNECTED position by preventing levering.

9. An insulating flash shield shall be mounted above each circuit breaker to prevent flashover from the arc chutes to ground.

10. Hinged doors shall be provided for the fronts of the drawout circuit breaker compartments.

11. Hinged panels shall be provided for mounting of meters, protective relays, and other devices. Doors and panels shall be equipped with concealed hinges and suitable latches. Doors and panels shall have one-inch (1") deep formed edges with double returns where necessary to assure stiffness.

12. A glass polyester safety shutter shall be furnished to automatically cover the bus stabs in the circuit breaker compartment when the circuit breaker unit is moved to the TEST, DISCONNECTED, or REMOVE position.

13. Provide a rear compartment steel barrier between the cable compartment and main bus to protect against inadvertent contact with the main or vertical bus bars. Provide full height and depth metal barriers between adjacent vertical structures in the cable compartment. Provide a full height and depth glass polyester barrier with appropriate slots for the main bus between adjacent vertical structures in the bus compartment.

14. Equip each cable compartment with cable lug adapters complete with hydraulic compression lugs which can be mounted up or down at a 45 degree angle to facilitate cable termination with a minimum bending radius. Provide lugs including grounding lugs, suitable for copper cable, of quantity and size required for the cables indicated on the Drawings. Mechanical type lugs utilizing a set screw are not acceptable.

15. Except as otherwise described herein, all "space" compartments specified herein or indicated on the Drawings shall be furnished as "prepared spaces" or "futures" complete with buses, supports, insulators, primary and secondary disconnects, lugs for future outgoing cables, and rails ready to receive a future circuit breaker of appropriate size. Insulating barriers shall be installed in the cubicles to cover all live terminals to prevent accidental contact.

16. The withdrawal type units and the stationary sections for these units shall be assembled in jigs which accurately locate the contacts, holding devices, and interlocks. One removable unit of each type and rating shall be tried in each stationary compartment of same type and rating. Each stationary compartment shall be checked with its own removable unit to insure interchangeability.

17. Switchgear shall be furnished complete with fused, thermostatically controlled spare heaters. One space heater shall be installed in each vertical structure. Utilize tubular type operated at half voltage for long life; 250 volt rated heaters at 120 volt. Provide power supplies to the space heaters as specified herein and indicated on the Drawings. The Contractor shall wire heaters to provide temporary heating during storage.

D. Bus

1. Buses and main connections shall consist of tin plated flat copper bars or copper channels of suitable size carried on supports fabricated from an approved insulating material. The buses shall be mounted in a compartment at the rear or above the circuit breakers. Bus sizes shall be based upon a maximum current density of 1000 amperes per square inch. All bus connections, including shipping breaks and for future bus extensions, shall be tin-plated and tightly clamped with

through bolts. Provide all bus joints with Bellville type spring washers. Buses shall have a continuous current-carrying capacity of not less than that specified herein or indicated on the Drawings.

2. Insulate/isolate buses to protect against spread of arcing faults and accidental contact by people or foreign objects.

3. Provide the 3 phase bus of each unit with insulation to completely encase each bar, including where provisions have been made by splicing adjacent units together, or making connections to disconnecting devices.

4. Fabricate bus bar molded insulation, molded insulation covers for bus joints, and bus insulated supports from insulation possessing flame-retardant and self-extinguishing, dielectric and anti-hydroscopic properties.

5. Provide a neutral landing lug in the incoming cable area to allow landing of all neutral conductors as indicated on the Drawings. Provide a bonding jumper from the neutral lugs to the ground bus for service entrance rated assemblies.

6. A tin plated ground bus of adequate capacity (1/4-inch by 2-inch minimum) shall be furnished and installed throughout the switchgear structure. Each stationary unit shall be effectively connected to this ground bus. A substantial ground contact shall be provided between each breaker and removable element and the ground bus, which shall automatically be made before the primary contacts touch. Contact engagement to the ground bus shall be maintained in the CONNECTED and TEST positions. Ground relay panels with a No. 6 AWG insulated copper wire to the ground bus.

7. Main and ground buses shall be extended through all units, including spares and prepared spaces.

8. A full neutral bus shall be provided as specified herein and where indicated on the Drawings.

E. Removable Element

1. Removable element of each circuit breaker unit shall consist of a 3-pole power circuit breaker with trip-free stored-energy mechanism, positive mechanical interlock, primary and secondary disconnecting devices, auxiliary switches, position indicator, and control wiring. The removable element shall have four positions: CONNECTED, TEST, DISCONNECTED, and REMOVE, all of which permit closing of the compartment door.

2. Provide for mechanical locking of the removable element in the TEST and DISCONNECTED position. Lock shall not interfere with operation of the breaker and its mechanism.

3. Provide an interlock on each circuit breaker unit to prevent the circuit breaker from being removed while breaker is closed and to prevent breaker from being placed in CONNECTED position unless the breaker is open. If the circuit breaker is closed, the interlock shall trip the breaker before it can be placed in CONNECTED position.

F. Circuit Breakers

1. Each circuit breaker shall be drawout type and enclosed in a separate metal compartment.

2. Circuit breakers shall be rated in accordance with Underwriters Laboratories Standards, with the following minimum ratings:

   a. Nominal voltage: 480 volts.

   b. Maximum design voltage: 600 volts

   c. Low frequency withstand: 2.2 kV

   d. Frame continuous current rating: as indicated on the Drawings.

   e. Sensor rating: Same as frame rating.

   f. Rated interrupting time: 5 cycles.

   g. Interrupting capability at rated voltage: 65,000 amperes (symmetrical). To assure a fully selective system, all circuit breakers shall have 30 cycle short time withstand ratings equal to their symmetrical interrupting ratings, regardless of whether equipped with instantaneous trip protection or not.

   h. Where circuit breakers are equipped with current limiters, the combination shall have short time ratings in accordance with the characteristics of the limiter selected.

3. Circuit breakers shall be UL listed for application in their enclosures for 100 percent of their continuous current rating.

4. Circuit breakers of equal rating shall be completely interchangeable.

5. Equip each circuit breaker with secondary disconnecting contacts to automatically engage in the CONNECTED and TEST position to complete circuits as required.

6. Provide a means for racking in and out of the compartment and between positions. Provide a means for holding the circuit breaker in the compartment in all positions. Include a provision for padlocking open to prevent manual or electric closure of the circuit breaker. A remote racking device with control station shall be provided to allow for remote removal of breaker with 120VAC motor driven device.

7. Provide interlocking to prevent a closed circuit breaker from racking to or from any position. Provide an additional interlock to assure automatic discharging of the closing springs upon insertion or removal of the breaker into or out of the compartment.

8. Circuit breakers shall be equipped with arc suppressors and individual poles shall be separated by insulating barriers. Main contacts shall be silver faced. Arcing contacts shall have non-welding and high conductivity features.

9. Each low voltage power circuit breaker shall be equipped with current sensors and a self-powered microprocessor-based trip device to sense overload and short circuit conditions. Trip devices shall be interchangeable so that any trip device can be used with any frame size circuit breaker. The device shall measure true RMS currents. Peak sensing devices will not be accepted. All adjustment setting switches shall be digitally encoded type with gold contacts. Trip units shall be removable.

   Equip each circuit breaker with a Micrologic by Square D Company microprocessor based trip unit complete with rating plug size as indicated on the Drawings. The trip units shall be furnished complete with all additional modules required to facilitate all trip unit functions. Trip units shall have adjustable long, short, instantaneous and ground fault functions. The main circuit breaker trip units shall be provided with a reduced energy let-thru mode to reduce arc-flash energy. The trip unit manufacturer shall match the manufacturer of the circuit breakers and other components of the switchgear assembly.

11. A programmable alarm relay output shall be provided to activate based on threshold and time delay values associated with any of the measured parameters. Alarm output operation shall be recorded in an event log.

12. The trip unit shall include an integral test pushbutton. A keypad shall be provided to enable the user to select the values of test currents within a range of available settings. The protection functions shall not be affected during test operations. The breaker may be tested in the TRIP or NO TRIP test mode.

13. Circuit breakers shall be equipped with a self-coupling primary and secondary disconnect contacts and arranged with a disconnect mechanism for moving it physically between the CONNECTED and DISCONNECTED positions.

14. A TEST position for each circuit breaker shall be provided and so interlocked to insure proper sequence and safe operation.

15. Each circuit breaker faceplate shall include a drawout position indicator, spring charge indictor, push-to-trip button, push-to-close mechanism release button, and open-close indicator.

16. Each circuit breaker shall be provided with "a" and "b" auxiliary contacts which will open or close when the breaker is open or closed. Each breaker shall also be provided with an alarm switch or contact to indicate that the breaker has tripped. All of these contacts shall be wired to terminals in each compartment for use in

indicating breaker status. Each circuit breaker shall be furnished with enough auxiliary contacts to indicate breaker position.

G. Operation and Interlocks for the 480V Switchgear

1. Normally, the utility isolation main breaker will operate independently from the downstream switchgear main breaker and generator breaker.

2. The switchgear main breaker and generator breaker shall be electrically and mechanically interlocked with each other, and also operate together as part of the automatic transfer system. The mechanical interlocks shall function as follows:

a. Permit closing the switchgear main breaker when the generator breaker is OPEN.

b. Permit closing the generator breaker when the switchgear main breaker is OPEN.

c. Prevent closing the generator breaker when the switchgear main breaker is CLOSED.

c. Prevent closing the switchgear main breaker when the generator breaker is CLOSED.

These mechanical interlocks shall be in addition to electrical interlocks specified herein or indicated on the Drawings.

H. Current Transformers

1. Ring type current transformers shall be dry type, for indoor service, insulated for 600 volts, 10 kV BIL. Design shall have a mechanical and thermal rating to withstand short-circuit current, stresses, and heating effects equal to the rating of the circuit breaker of the application.

2. Current ratio shall be as indicated on the Drawings.

3. Transformers shall be rated in accordance with ANSI Standard C37.20.1, with accuracy of the current transformers suitable for BO.5 metering accuracy at rated burden. The transformers shall be sized for the necessary burden for the required devices, minimum.

4. Identify the current transformers for polarity with standard marking or symbols. The transformers shall be capable of carrying rated primary current continuously without damage.

5. Run secondary wiring from current transformers in suitable wiring trough, or conduit, to proper short-circuiting type terminal blocks for connection to relays, instruments, and other devices.

6. Door mounted test blocks for all current transformers in the switchgear shall be provided.

I. Potential Transformers

1. Potential transformers shall be indoor dry type, single-phase, 60 hertz.

2. Potential transformers shall have an accuracy classification determined according to ANSI Standards. The potential transformers shall be suitable for metering accuracy, the burden to be served for the required devices plus 20 percent, and shall meet the following minimum requirements:

   a. BIL: 10kV

   b. Primary Voltage: 480 volts

   c. Secondary Voltage: 120 volts

   d. Winding Ratio: 4:1

   e. Metering Accuracy Class: 0.3 at rated burden

3. Identify polarity with standard markings or symbols. Connect secondaries to potential buses as required. Protect potential transformers with primary and secondary fuses. Protect primary side with current-limiting fuses.

4. Door mounted test switches located at the switchgear. Test switch wiring shall be plainly marked to indicate the respective circuits to each pole of the switch. Test switches shall be ABB Flexitest Type FT-1 with clear cover, GE/Multilin equivalent, or equal.

J. Control Power Transformers

1. Provide 480 to 120 VAC control power transformers as required. Verify that control power transformers have adequate capacity for the load to be served.

2. Protect control power transformers with both primary and secondary fuses. Protect primary side with current limiting fuses. Provide a manual disconnect ahead of the primary fuses.

3. Control power transformers for space heaters, lighting, receptacles and other ancillary loads shall be separate from those used for control circuits.

K. Control Wiring and Control Terminal Blocks

1. Wire and factory test switchgear to satisfy the requirements of the operation described or necessary.

2. Switchgear secondary wiring shall be NEC Type SIS, single-conductor, stranded copper, rated 600 volts, 90°C bundled and secured with nylon ties. Provide flexible stranding for swinging doors and panels. Minimum wire size shall be No. 14 AWG for voltage transformer wiring, interlock wiring, and control circuit wiring. For

current transformer circuits, minimum wire size shall be No. 12 AWG. Number 10 AWG or larger wire shall be used to decrease resistance as required.

3. Route outgoing control wires for outgoing or "cell-to-cell" interconnecting wiring to the master terminal blocks with suitable numbering strips numbered in agreement with the manufacturer's detailed wiring diagrams. Provide a minimum of 10 percent (10%) spare terminal blocks for each circuit breaker and auxiliary compartment.

4. Terminal blocks for control wiring shall be provided in accordance with Section 16902, Electric Controls and Relays.

5. Number wiring with shrink-type tag devices at both ends consistent with the manufacturer's detailed wiring diagrams. Duplication of wire numbers and terminal block numbers is not acceptable.

6. One control power circuit cut-out device shall be furnished in each circuit breaker housing. If cut-out device has exposed conductors (i.e., knife switch), the exposed conductors shall be suitably protected against inadvertent contact.

L. Analog Indicating Instruments

1. Provide analog indicating instruments where shown on the Drawings. Instruments shall be door-mounted, and shall be in accordance with ANSI C39.1, 1 percent accuracy class, 4-1/2 inch nominal square, with 250 degrees scale unless otherwise noted.

2. Analog indicating instrument switches shall be door-mounted, rotary operated type with means for maintaining contact position. Contacts shall be silver-to-silver, enclosed in easily removable protective covers.

M. Control Devices

1. Furnish and install control devices as required and/or shown on the Drawings. The following control devices shall be provided as specified in Section 16902, Electric Controls and Relays:

   a. Pilot devices (switches, indicating lights, etc)

   b. Relays and timers

2. For each electrically operated circuit breaker, provide door-mounted circuit breaker pistol grip control switch with red (closed) and green (open) indicating lights to indicate breaker contact position. Provide amber indicating lights to indicate breaker lockout status and tripped status, and blue indicating lights for trip coil status monitor.

N. Nameplates

1. Provide engraved plastic nameplates to identify switchgear units, door mounted devices, and internal components.

2. Nameplates shall be as specified in Section 16195, Electrical - Identification engraved with the circuit number and circuit name as indicated on the Drawings.

3. Label the switchgear per the requirements of NEC, Articles 110-21 and 110-22.

O. Power Metering

1. Provide a SENTRON PAC4200 as manufactured by Siemens to match existing power monitoring throughout JEA facilities. No substitutes shall be permitted. Provide the quantity indicated on the Drawings.

2. Power meter shall be provided with 1GB of memory, minimum, and network communications port. A hardware gateway shall be provided (if required) to convert the network communications from the respective meter to the Profinet Ethernet protocol for communication of metering parameters to the plant control system. The following parameters shall be communicated as a minimum:

- Current (all phases)
- Voltage (all phases)
- KW, KVAR, KVA
- Power Factor

P. Warning Signs

1. Provide a minimum of 2 warning signs on the front of the switchgear lineup and 2 on the back.

a. Red laminated plastic engraved with white letters approximately 1/2 inch high.

b. Signs shall read "DANGER HIGH VOLTAGE"

Q. Source Quality Control

1. Completely assemble, wire, and test switchgear at the factory. Detailed inspections before and after assembly shall assure correctness of design and workmanship. Provide groups of wires leaving the shipping-assembled equipment with terminal blocks with suitable numbering strips.

2. After assembly, provide the switchgear with lifting channels having eyebolts for attachment of crane slings to facilitate lifting and handling each shipping-assembly unit. These lifting channels shall be removable after equipment is placed on permanent foundations.

R. Accessories

1. Switchgear accessories shall be provided as follows:

a. Manual handles for operating circuit breakers.

b. One complete integral lifting device consisting of rails, hoist and dolly shall be furnished for each switchgear assembly for installing or removing breakers. The elevating table type lifting device is not acceptable.

c. Secondary couplers for operating a power circuit breaker in the DISCONNECTED position.

d. Auxiliary power module to provide power for testing the trip unit when the breaker is in the DISCONNECTED or REMOVED position.

e. Test plugs for draw-out relays and meters.

f. Auxiliary switches with at least two (2) unused normally open and two (2) unused normally closed contacts on each circuit breaker.

S. Uninterruptable Power Supply System for Switchgear Control

1. Furnish and install an independent UPS system as indicated on the Drawings and specified herein, to operate breaker mechanisms and protective relays. One UPS system shall be provided for the entire switchgear assembly.

2. The system shall be capable of operating 100% of the circuit breakers simultaneously. One-minute discharge rate down to final 1.75 volt/cell shall be equal to trip current drawn by 100% of breakers tripping simultaneously.

3. Minimum UPS system ratings shall be as required by the switchgear manufacturer plus 25% spare capacity. Submit UPS system sizing calculations in the Shop Drawings for Engineer review/approval.

T. Control Sequence

1. It is the intent of this specification that the switchgear control system will control the main breaker, the generator breaker, and the generator. Alternatives to this proposed approach will only be acceptable if approved by the Engineer and the Owner.

a. <u>Initial Conditions</u>

i. Utility present. Main breaker closed.

ii. Generator breaker open.

iii. Generator off.

iv. Feeder breakers closed.

b. <u>Utility Power Failure</u>

i. Initiate sequence when utility power source fails and the system control switch is in the auto mode.

ii. Open main breaker.

iii. Start generator.

iv. When generator voltage $\geq$ 460V and frequency is $59.5 \leq f \leq 60.5$, close generator breaker.

v. Supply plant load as required.

c. Return to Utility from Generator (open transition)

i. Initiate sequence automatically when utility bus voltage and frequency are 460V-510V, $59.5 \leq f \leq 60.5$ for an adjustable time delay, and the system control switch is in the Auto mode.

ii. Open the generator breaker. The generator shall then run in an unloaded cooldown mode for an adjustable time delay.

iii. Close the main breaker to supply plant load.

2.03 SURGE PROTECTIVE DEVICES

A. The switchgear shall be furnished with integrated Type II surge protective devices (SPD). SPDs shall be provided in the location and quantity as shown on the Drawings.

B. The SPD shall be rated, designed, tested, listed, and labeled in accordance with UL-1449, edition.

C. The SPD shall be factory installed by the switchgear manufacturer using a direct bus connection. There shall be no cable connection between the bus bar and the SPD device.

D. The SPD shall have a fault current rating equal to or greater than that of the fault current rating of the switchgear. The SPD shall employ metal-oxide varistor (MOV) technology. If integral fusing is used, the fuses shall allow the maximum rated surge current to pass without fuse operation.

E. The SPD shall have a maximum continuous operating voltage (MCOV) of at least 115% of the nominal voltage of the switchgear. The Voltage Protection Rating (VPR) of each SPD shall not exceed the following:

| SYSTEM VOLTAGE | L-N | L-G | L-L | N-G |
|---|---|---|---|---|
| 208Y/120 | 700V | 700V | 1200V | 700V |
| 480Y/277 | 1200V | 1200V | 1800V | 1200V |
| 480 DELTA | N/A | 1200V | 2000V | N/A |
| 240 DELTA | N/A | 1200V | 1200V | N/A |
| 120/240 | 700V | 700V | 1200V | 700V |

F. The Nominal Discharge Current ($I_n$) of the SPD shall be 20kA. Peak surge current ratings shall not be used as a basis for applying the SPD to the system.

The surge current rating for each SPD shall be as indicated on the Drawings. Surge current ratings are indicated on single line diagrams. Surge current rating indicated is on a per phase basis.

G. Each SPD system shall provide surge protection in all possible modes. Surge protection shall be as follows:

| SYSTEM CONFIGURATION | MODES OF PROTECTION | NUMBER OF MODES |
|---|---|---|
| 3-Phase Wye | L-N, L-G, N-G | 7 |
| 3-Phase Delta | L-L, L-G | 6 |
| 3-Phase Impedence Grounded | L-L, L-G | 6 |
| Single-Phase | L-N, L-G, N-G | 3 |

H. The SPD shall be furnished with an audible alarm and silence pushbutton, integral SPD status LEDs (one per phase), and a Form C dry contact for remote indication of alarm. A surge counter shall also be provided.

I. The SPD equipment shall be SPD Series by Eaton or SurgeLogic by the Square D Company.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. The switchgear shall be furnished and installed as shown on the Drawings and in accordance with the manufacturer's installation instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment. The equipment shall be suitably protected and space heaters connected until accepted by the Owner.

B. The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to:

1. Checking to ensure that the pad location is level to within .125 inches.

2. Checking to ensure that all bus bars are torque to the manufacturer's recommendations.

3. Assemble all shipping sections, remove all shipping braces and connect all shipping split mechanical and electrical connections.

4. Secure assemblies to foundation or floor channels.

5. Inspect and install all circuit breakers in their proper compartments.

C. Install the switchgear to allow complete unit door swing required for unit removal. This is specifically required where a vertical section of switchgear is set next to a wall to the left of a switchgear section.

3.02 PAINTING

A. Prior to final completion of the work, all metal surfaces of the equipment shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same coating as used for factory finishing coats.

3.03 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests

a. None required.

2. Certified Shop Tests and Reports

a. Submit description of proposed testing methods, procedures, and apparatus.

b. Submit notarized and certified copies of all test reports.

c. As a minimum, the entire switchgear assembly shall go through a quality inspection before shipment. This inspection shall include, but is not limited to, the following:

i. Physical inspection of the structure and the electrical conductors including bussing, general wiring, and units.

ii. General electrical tests including power circuit phasing, control circuit wiring, instrument transformers, meters, ground fault system, and device electrical operation.

iii. AC dielectric tests of the power circuits and control circuits.

iv. Markings/labels, including instructional type, Underwriters Laboratory (U.L.), and inspector's stamps.

d. The manufacturer shall use integral quality control checks throughout the manufacturing process to maintain the correctness of the switchgear.

3. Field Tests

a. Field tests shall be performed in accordance with requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition.

b. The manufacturer’s technical representative shall perform startup and functional testing of the switchgear controls. Functional testing shall include field verification of each and every part of the sequence of

operations listed herein. Representatives from the Owner and the Engineer shall be present to witness the functional testing.

c. Prior to commencement of the functional testing, a test plan shall be submitted for Owner and Engineer approval. Test plan shall demonstrate how each part of the sequence of operations will be tested, and shall detail any required outages, switchovers, or the like that must be performed during the testing.

3.04 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide the services of a qualified, factory-trained manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment furnished under this Contract. The manufacturer's representative shall certify in writing that the equipment has been installed in accordance with the manufacturer's recommendations. No further testing or equipment startup may take place until this certification is accepted by the Owner.

B. The manufacturer’s technical representative shall perform startup and functional testing of the switchgear and controls as specified herein.

C. The Contractor shall provide training for Owner personnel. Training shall be conducted by the manufacturer's factory-trained representative who shall instruct Owner personnel in operation and maintenance of all equipment provided under this Section. Training shall be provided for two (2) sessions of eight (8) hours each. Training shall not take place until after all switchgear units have been installed and energized. Training shall be at times coordinated with the Owner.

D. The services of the manufacturer's representative shall be provided for a period of not less than as follows:

1. One (1) trip of two (2) working days during the installation of the switchgear.

2. One (1) trip of two (2) working days for the testing and startup of the switchgear.

3. One (1) trip of five (5) working days to perform the functional testing of the entire switchgear assembly and controls.

4. One (1) trip of two (2) working days to perform training as specified herein.

5. One (1) trip of one (1) working day two (2) months before the warranty expiration to identify issues to be corrected under warranty.

E. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor.

3.05 FIELD ADJUSTMENTS

A. The protective relays and/or trip units shall be set in the field by a qualified representative of the manufacturer, or an outside testing company retained by the Contractor, in accordance with the settings designated in the coordination study. See Section 16000 – Basic Electrical Requirements.

- END OF SECTION -

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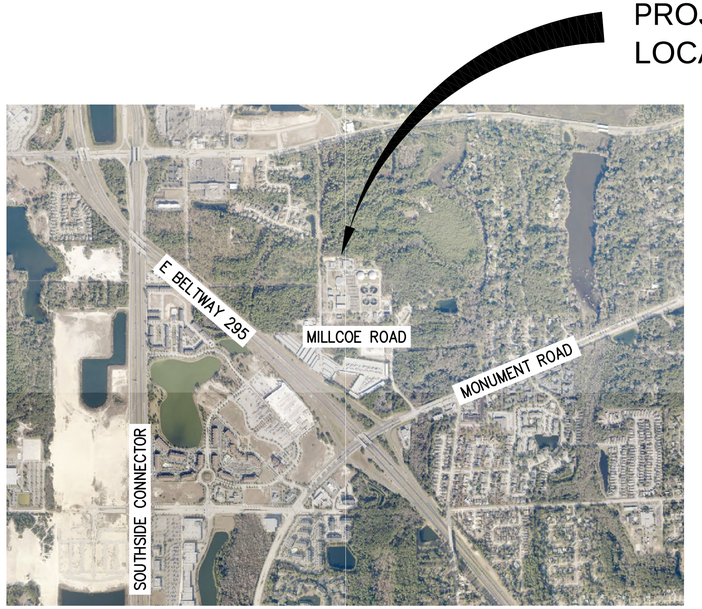
JEA

JACKSONVILLE, FLORIDA

# ARLINGTON EAST WATER RECLAMATION FACILITY SWITCHGEAR REPLACEMENT

HAZEN CONTRACT No. 42000-006

AUGUST 2017




LOCATION MAP

NOT TO SCALE

## INDEX OF DRAWINGS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COVER

ELECTRICAL

E01 - LEGEND & GENERAL NOTES

E02 - GENERATOR BUILDING PLAN - TEMPORARY & DEMOLITION

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E04 - GENERATOR BUILDING PLAN - MODIFIED

E05 - SWB-E SINGLE LINE DIAGRAM - TEMPORARY & DEMOLITION

E06 - SWGR-E SINGLE LINE DIAGRAM - MODIFIED AND STANDARD DETAILS



Hazen

HAZEN AND SAWYER

6675 CORPORATE CENTER PARKWAY, SUITE 330

JACKSONVILLE, FLORIDA 32216


BID SET

## SINGLE-LINE DIAGRAMS

XFMR
kVA
480-120/208V
3P/4W
DRY TRANS
TRANSFORMER

#
PROTECTIVE RELAY:
NUMBER DENOTES IEEE DEVICE FUNCTION

TSH MSH CF HP RPM TE ME
MOTOR AND TYPICAL ADDITIONAL DEVICES:
TSH: TEMPERATURE SWITCH
MSH: MOTOR SPACE HEATER
CF: COOLING FAN
TE: TEMPERATURE ELEMENT
ME: MOISTURE DETECTOR

XXXYYYYY
INSTRUMENT TAG:
X DENOTES INSTRUMENT TYPE
Y DENOTES INSTRUMENT NUMBER
SEE DRAWING I1 FOR INSTRUMENT ABBREVIATIONS

100A
FUSE

100A 3P
100A
FUSED DISCONNECT SWITCH

30A 3P
DISCONNECT SWITCH

30A 3P
FUSED DISCONNECT SWITCH

N.C. 800AF 800AP 800AT LSIGZ CTR
LOW-VOLTAGE POWER CIRCUIT BREAKER:
LEFT: FIXED-MOUNT
RIGHT: DRAWOUT
E.O. DENOTES ELECTRICALLY OPERATED
LSIG DENOTES INSTALLED TRIP FUNCTIONS:
L DENOTES LONG-TIME
S DENOTES SHORT-TIME
I DENOTES INSTANTANEOUS
G DENOTES GROUND FAULT
Z DENOTES ZONE-SELECTIVE INTERLOCKING
CTR DENOTES BREAKER-SPECIFIC CT AND RATIOS

52 1200A N.C. E.O. BATT.
MEDIUM-VOLTAGE DRAWOUT POWER CIRCUIT BREAKER:
E.O. DENOTES ELECTRICALLY OPERATED
BATT. DENOTES BATTERY BACKUP POWER

100AF 100AT ETU 800AF 800AP 800AT LSIG
LOW-VOLTAGE MOLDED CASE CIRCUIT BREAKER
LEFT: THERMAL-MAGNETIC TRIP UNIT
RIGHT: ELECTRONIC TRIP UNIT

30A MCP
MOTOR CIRCUIT PROTECTOR

GROUND

600:5 (3)
CT:
NUMBERS DENOTE CT WINDING RATIO AND CT QUANTITY

50:5 (1)
GFCT:
NUMBERS DENOTE GFCT WINDING RATIO AND GFCT QUANTITY

480:120 (3)
PT:
NUMBERS DENOTE PT WINDING VOLTAGES AND PT QUANTITY

DRAW-OUT ELEMENT

X X
LEFT: PANELBOARD
RIGHT: COMBINATION POWER UNIT
X DENOTES PANEL ID

LIGHTNING ARRESTOR

## SINGLE-LINE DIAGRAMS, CONT'D.

#%
LEFT: RESISTOR
RIGHT: LINE REACTOR:
#% DENOTES IMPEDANCE

CAPACITOR

ST
SHUNT TRIP

SPD XXXkA
SURGE PROTECTIVE DEVICE

K
KIRK-KEY INTERLOCK

30A MCP X
30A MCP M F R X
LEFT: FVNR STARTER:
X DENOTES NEMA SIZE
DP DENOTES DEFINITE PURPOSE CONTACTOR
RIGHT: FVR STARTER

100A MCP 5% 6 PULSE VFD
100A MCP ACTIVE FILTER 6 PULSE VFD
100A MCP IC 5% 6 PULSE VFD X OC
LEFT: VFD WITH LINE REACTOR
MIDDLE: VFD WITH HARMONIC FILTER
RIGHT: VFD WITH LINE REACTOR AND FVNR BYPASS
X DENOTES NEMA SIZE

100A MCP IC RVSS OC
100A MCP IC RVSS X OC
LEFT: RVSS STARTER
RIGHT: RVSS STARTER WITH FVNR BYPASS
X DENOTES NEMA SIZE

100A MCP IC PST 18 PULSE VFD OC IC RVSS OC
VFD WITH RVSS BYPASS

100A MCP X X #% X
RVAT STARTER:
X DENOTES NEMA SIZE
#% DENOTES TAP SETTING

### SWITCHES

X # Y
WALL SWITCH:
X DENOTES TYPE:
NO SUBSCRIPT DENOTES SINGLE-POLE SWITCH
3 DENOTES 3-WAY SWITCH
4 DENOTES 4-WAY SWITCH
M DENOTES MANUAL MOTOR STARTER
# DENOTES CIRCUIT NUMBER
WPCR DENOTES WEATHERPROOF CORROSION RESISTANT

COMBINATION MOTOR STARTER

DISCONNECT SWITCH

LOCAL CONTROL STATION

## SINGLE-LINE DIAGRAMS, CONT'D.

500kW 480V,3Ø,4W
GENERATOR

S1 S2 L
ATS 480V, 800A 3Ø 4W 4P 65kA OPEN TRANSITION
CONTACTOR-STYLE ATS OR MTS

S1 S2 L
ATS 480V, 800A 3Ø 4W 4P 65kA OPEN TRANSITION
CONTACTOR-STYLE ATS OR MTS WITH OFF POSITION

100AF 100AT S1 S2 L
ATS 480V, 800A 3Ø 4W 4P 65kA OPEN TRANSITION
CONTACTOR-STYLE ATS OR MTS, SERVICE-ENTRANCE RATED

S1 S2 L
ATS 480V, 800AF/800AT 3Ø 4W 4P 65kA OPEN TRANSITION
MCCB-STYLE ATS OR MTS

S1 S2 L
ATS 480V, 800AF/800AT 3Ø 4W 4P 65kA OPEN TRANSITION
DRAWOUT CB-STYLE ATS OR MTS

### MISC PLAN VIEW SYMBOLS

E
EQUIPMENT CONNECTION

GROUND RODS:
LEFT: BURIED
RIGHT: IN TESTWELL

DBXX EXX
DUCTBANK SECTION CUT IDENTIFIER:
DBXX DENOTES DUCTBANK ID
EXX DENOTES DRAWING NUMBER WHERE SECTION CUT IS LOCATED

DB X X
DUCTBANK TAG:
X DENOTES DUCTBANK ID

TRAY X Y X Y
CABLE TRAY TAG:
X DENOTES CABLE TRAY ID
Y DENOTES SCHEDULE REFERENCE

X #
INSTRUMENT TAG:
X DENOTES INSTRUMENT TYPE
# DENOTES INSTRUMENT NUMBER
SEE DRAWING I1 FOR INSTRUMENT ABBREVIATIONS

P-XXXX P-XXX-XXX
CONDUIT TAGS:
P DENOTES POWER
C DENOTES CONTROL
I DENOTES INSTRUMENTATION
XXXX DENOTES CONDUIT ID
XXX-XXX DENOTES CONDUIT ID

### EQUIPMENT/DEVICE LOCATION SYMBOLS

*
LOCATED IN MCC

□
LOCATED IN STAND-ALONE MOTOR STARTER/CONTROLLER

△
LOCATED IN FIELD

X
LOCATED AT PANEL:
X DENOTES PANEL ID:
L DENOTES LOCAL CONTROL STATION

### WIRING

CONDUIT HOME RUN
CONDUIT EXPOSED
CONCRETE ENCASED CONDUIT
CONDUIT CONCEALED
FLEXIBLE CONDUIT
CONCRETE ENCASED DUCTBANK
LEFT: CONDUIT RISE (TURN UP)
RIGHT: CONDUIT DROP (TURN DOWN)

## ABBREVIATIONS

| | |
|---|---|
| AE | ANALYSIS ELEMENT |
| AHU | AIR HANDLING UNIT |
| AIC | AMPERE INTERRUPTING CAPACITY |
| AIT | ANALYSIS INDICATING TRANSMITTER |
| ANSI | AMERICAN NATIONAL STANDARDS INSTITUTE |
| ASCE | AMERICAN SOCIETY OF CIVIL ENGINEERS |
| ASME | AMERICAN SOCIETY OF MECHANICAL ENGINEERS |
| AF | AMPERE FRAME |
| AT | AMPERE TRIP |
| ATS | AUTOMATIC TRANSFER SWITCH |
| BC | BYPASS CONTACTOR |
| BKR | BREAKER |
| (L/V)CP | (LOCAL/VENDOR) CONTROL PANEL |
| CPT | CONTROL POWER TRANSFORMER |
| CT | CURRENT TRANSFORMER |
| DB | DUCTBANK |
| DSW | DISCONNECT SWITCH |
| EHH | ELECTRIC HAND HOLE |
| EMH | ELECTRIC MANHOLE |
| EO | ELECTRICALLY OPERATED |
| ETM | ELAPSED TIME METER |
| ETU | ELECTRONIC TRIP UNIT |
| FAAP | FIRE ALARM ANNUNCIATOR PANEL |
| FACP | FIRE ALARM CONTROL PANEL |
| FS | FLOW SWITCH |
| FSL | FLOW SWITCH LOW |
| FVNR | FULL VOLTAGE NON-REVERSING |
| FVR | FULL VOLTAGE REVERSING |
| GFCI | GROUND FAULT CIRCUIT INTERRUPTER |
| GFCT | GROUND FAULT CURRENT TRANSFORMER |
| GNG | GO-NO GO |
| GND | GROUND |
| HOA | HAND-OFF-AUTO |
| HPU | HYDRAULIC POWER UNIT |
| IC | INPUT CONTACTOR |
| IEEE | INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS |
| ISO | INTERNATIONAL ORGANIZATION FOR STANDARDIZATION |
| JB | JUNCTION BOX |
| LCS | LOCAL CONTROL STATION |
| LP | LIGHTING PANEL |
| LS | LEVEL SWITCH |
| LSL | LEVEL SWITCH LOW |
| LSLL | LEVEL SWITCH LOW-LOW |
| LSH | LEVEL SWITCH HIGH |
| LSHH | LEVEL SWITCH HIGH-HIGH |
| LT | LEVEL TRANSMITTER |
| MFR | MULTI-FUNCTION RELAY |
| MH | MANHOLE |
| MOD | MOTOR OPERATED DAMPER |
| MOG | MOTOR OPERATED GATE |
| MOL | MOTOR OPERATED LOUVER |
| MOV | MOTOR OPERATED VALVE |
| MPR | MOTOR PROTECTION RELAY |
| MTD | MOUNTED |
| MTS | MANUAL TRANSFER SWITCH |
| MWTS | MOTOR WINDING TEMPERATURE SWITCH |
| NC | NORMALLY CLOSED |
| NEC | NATIONAL ELECTRICAL CODE |
| NEMA | NATIONAL ELECTRICAL MANUFACTURERS ASSN |
| NFPA | NATIONAL FIRE PROTECTION ASSOCIATION |
| NO | NORMALLY OPEN |
| NTS | NOT TO SCALE |
| OC | OUTPUT CONTACTOR |
| OL | OVERLOAD |
| PB | PULLBOX |
| PC | PHOTOCELL |
| PCC | POINT OF COMMON COUPLING |
| PE | PRESSURE ELEMENT |
| PIT | PRESSURE INDICATING TRANSMITTER |
| PLC | PROGRAMMABLE LOGIC CONTROLLER |

## ABBREVIATIONS, CONT.

| | |
|---|---|
| PP | POWER PANEL |
| PST | PHASE SHIFTING TRANSFORMER |
| PT | POTENTIAL TRANSFORMER |
| PTT | PUSH TO TEST |
| RCS | REMOTE CONTROL STATION |
| RECP | RECEPTACLE |
| RIO | REMOTE I/O |
| RM | ROOM |
| RTD | RESISTANCE THERMAL DEVICE |
| RTU | REMOTE TELEMETRY UNIT |
| RVAT | REDUCED VOLTAGE AUTO TRANSFORMER |
| RVSS | REDUCED VOLTAGE SOLID STATE |
| SA | SUPPLY AIR |
| S.E. | SERVICE ENTRANCE |
| SP. C. | SPARE CONDUIT |
| SPD | SURGE PROTECTIVE DEVICE |
| SST | STAINLESS STEEL |
| TB | TEST BLOCK |
| TC | TIMED CLOSE |
| TO | TIMED OPEN |
| TSH | TWISTED SHIELDED |
| TX | TRANSFORMER |
| TYP | TYPICAL |
| UPS | UNINTERRUPTIBLE POWER SUPPLY |
| VFD | VARIABLE FREQUENCY DRIVE |
| WPCR | WEATHER PROOF CORROSION RESISTANT |
| WT | WALK THROUGH |
| XFMR | TRANSFORMER |

## NOTES:

1. UNLESS SPECIFICALLY NOTED OTHERWISE, ALL UNDERGROUND CONCRETE ENCASED ELECTRICAL CONDUITS SHALL BE PER STANDARD DETAIL 1611801.
2. THE INSTALLATION OF ALL CONCRETE ENCASED ELECTRICAL CONDUITS SHALL COMPLY WITH ACI 318, SECTION 6.3. CONTRACTOR SHALL SUPPLY EXPANSION JOINT FITTINGS AS REQUIRED FOR THERMAL EXPANSION AND DEFLECTION.
3. BOND ALL NEW CONCRETE ENCASED GROUND CONDUCTORS TO EXISTING GROUND CONDUCTORS IN ALL MANHOLES, PULL BOXES, CABLE TRAYS, AND SIMILAR LOCATIONS WHERE APPLICABLE.
4. UNLESS OTHERWISE SPECIFIED OR NOTED, ALL WALL MOUNTED ELECTRICAL PANELS, ENCLOSURES, AND SIMILAR EQUIPMENT SHALL BE MOUNTED 6'-6" (MAX) FROM THE TOP OF THE PANEL TO FINISHED FLOOR OR GRADE.
5. UNLESS OTHERWISE NOTED, ALL LIGHTING SWITCHES, CONTROL SWITCHES, AND SIMILAR EQUIPMENT SHALL BE MOUNTED WITH THEIR CENTERLINE APPROXIMATELY 4'-0" ABOVE FINISHED FLOOR, SLAB, OR GRADE. THERMOSTATS SHALL BE MOUNTED 4'-4" ABOVE FINISHED FLOOR.
6. A SEPARATE EQUIPMENT GROUNDING CONDUCTOR SHALL BE PROVIDED FOR EACH CIRCUIT (SEPARATE CONDUCTOR IN THE CONDUIT). THE CONDUCTOR SHALL BE TERMINATED AT THE PROPER DEVICE, TERMINAL, OR LUG AT THE POWER SOURCE (MCC GROUND BUS, PANELBOARD GROUND BUS, ETC.). GROUND CONDUCTOR SIZE SHALL BE PER THE LATEST EDITION OF THE NEC.
7. UNLESS SPECIFICALLY NOTED OTHERWISE, EXISTING PAVEMENT SHALL BE SAW CUT AND REMOVED TO ALLOW FOR THE INSTALLATION OF NEW ELECTRICAL DUCTBANKS. AFTER INSTALLATION, REPLACE PAVEMENT WITH NEW TO MATCH ORIGINAL CONDITIONS.

## CONSTRUCTION SEQUENCING AND CONSTRAINTS:

**1. THE FOLLOWING EFFLUENT PUMP STATION LOADS SHALL BE OPERATIONAL AT ALL TIMES:**

**a. TWO (2) OF THE THREE (3) EFFLUENT PUMPS.**

**b. THREE (3) OF THE THREE (3) REUSE PUMPS.**

**c. MCC-CH IN ITS ENTIRETY.**

**d. MCC-E IN ITS ENTIRETY.**

**2. A TEMPORARY PORTABLE GENERATOR (1100kW MINIMUM) SHALL BE PROVIDED BY THE CONTRACTOR DURING CONSTRUCTION.**

**3. A NEW, TEMPORARY SWITCHBOARD LINEUP SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR AS INDICATED HEREIN.**

**4. PREFERRED SEQUENCE OF CONSTRUCTION:**

**a. FURNISH AND INSTALL TEMPORARY GENERATOR AND TEMPORARY SWITCHBOARD.**

**b. FURNISH AND INSTALL NEW POWER PANEL PP-EPS.**

**c. CONNECT ALL EXISTING LOADS LISTED IN STEP 1 AND INDICATED HEREIN TO TEMPORARY SOURCE OF POWER (INCLUDING MCC-CH).**

**d. TRANSFER REUSE PUMP VFD LOADS TO PP-EPS.**

**e. REMOVE AND INSTALL NEW SWGR-E, INCLUDING NEW OVERHEAD FEEDERS TO MCC-E AND TO PP-EPS.**

**f. REMOVE ALL TEMPORARY CONNECTIONS AND RESTORE PERMANENT CONNECTIONS.**

**5. COORDINATE ALL DETAILS OF THE SEQUENCE OF CONSTRUCTION WITH JEA/ENGINEER PRIOR TO STARTING ANY WORK.**

**6. MAXIMUM SHUTDOWN LENGTH TO INSTALL AND REMOVE TEMPORARY FACILITIES SHALL BE 2 HOURS, DURING 6am TO 8am, AND COORDINATED WITH JEA.**

**7. CONTRACTOR SHALL PROVIDE PERSONNEL TO CONTINUOUSLY MONITOR OF THE TEMPORARY POWER SYSTEM WHILE THE TEMPORARY SYSTEM IS SUPPLYING THE FACILITY. THE PERSONNEL SHALL BE CAPABLE OF MANUALLY STARTING AND MANUALLY TRANSFERRING TO/FROM THE PORTABLE GENERATOR IN CASE OF A UTILITY OUTAGE. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING DIESEL FUEL FOR THE PORTABLE GENERATOR AS REQUIRED.**

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|---|---|---|---|
| 3 | BIDDING | 08/2017 | J.B.P. |
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| 1 | 90% DESIGN | 05/2017 | J.B.P. |

PROJECT ENGINEER: B. PICKETT
DESIGNED BY: B. PICKETT
DRAWN BY: N. SIEBACH
CHECKED BY: J. BURKE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

JOSEPH B. PICKETT, PE NO. 74106

Hazen
HAZEN AND SAWYER
6675 CORPORATE CENTER PKWY, STE 330
JACKSONVILLE, FLORIDA 32216
CERTIFICATE OF AUTHORIZATION NO. : 2771

JEA Building Community sm

ARLINGTON EAST WATER RECLAMATION FACILITY
SWITCHGEAR REPLACEMENT

ELECTRICAL
LEGEND & GENERAL NOTES

DATE: AUGUST 2017
HAZEN NO.: 42000-006
CONTRACT NO.:
DRAWING NUMBER: E01

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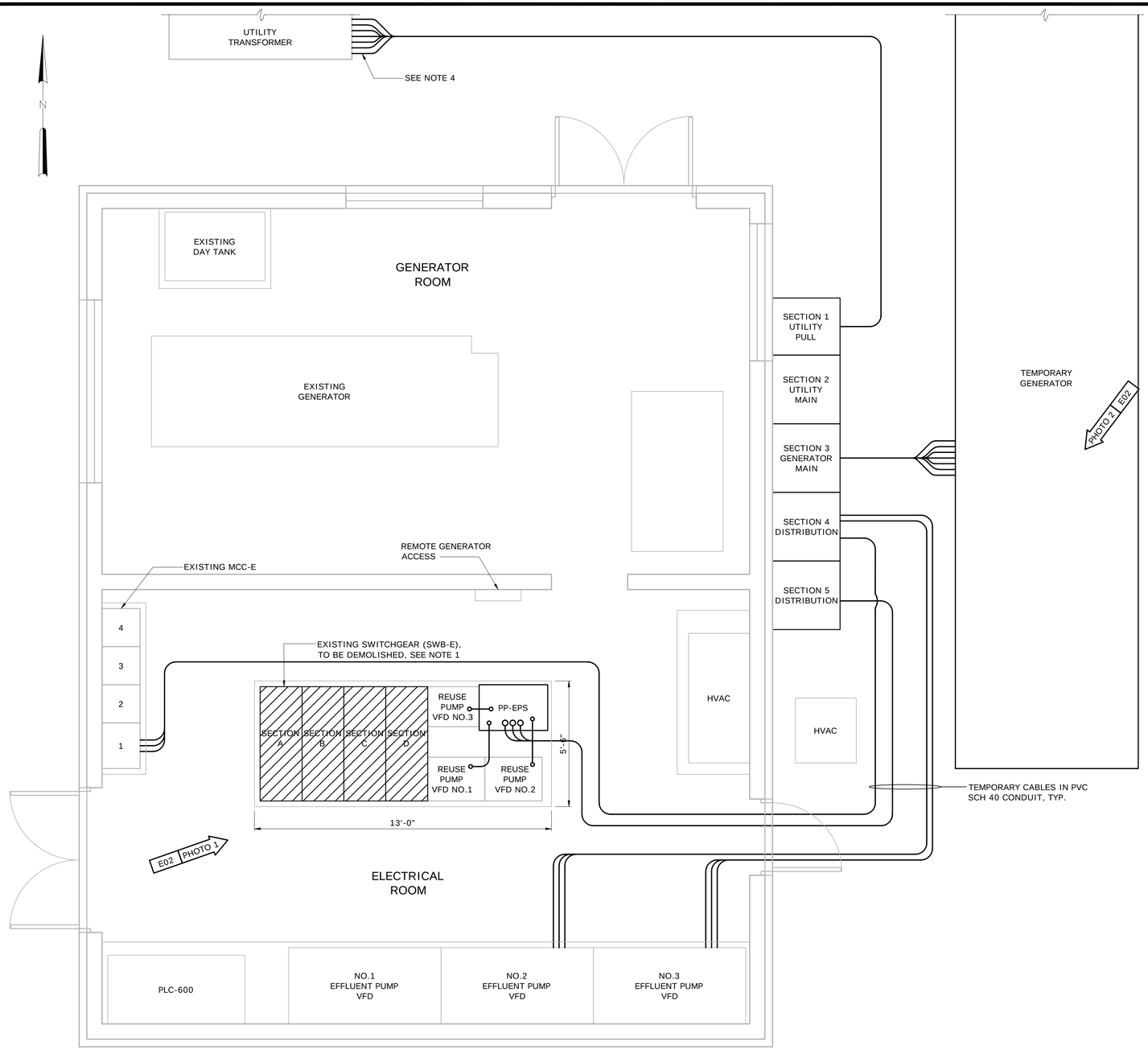


GENERATOR BUILDING - DEMO
3/8" = 1' - 0"

PHOTO 1
NOT TO SCALE

PHOTO 2
NOT TO SCALE

## NOTES:

1. CONTRACTOR SHALL DEMOLISH EXISTING SWITCHGEAR (SWB-E), COMPLETELY. ALL EXISTING SUPPLY AND LOAD CONDUCTORS SHALL BE DE-TERMINATED AND LEFT FOR RECONNECTION TO NEW SWITCHGEAR LINEUP. ALL DEMOLISHED EQUIPMENT WHICH JEA WANTS TO KEEP SHALL BE PROVIDED TO JEA. ALL UNWANTED EQUIPMENT SHALL BE REMOVED FROM SITE BY CONTRACTOR.
2. CONTRACTOR SHALL INSTALL TEMPORARY PORTABLE GENERATOR, SWITCHBOARD, AND TEMPORARY CABLES TO SUPPLY EXISTING LOADS DURING THE PROCESS OF THE SWITCHGEAR REPLACEMENT. GENERATOR SHALL BE PROVIDED BY THE CONTRACTOR (INCLUDING FUEL) AND SHALL BE APPROXIMATELY LOCATED AS INDICATED. PORTABLE GENERATOR CABLES AND TEMPORARY FEEDER CABLES SHALL BE INSTALLED IN PVC SCH 40 CONDUIT ON THE GROUND BETWEEN EACH SOURCE AND EACH LOAD IT WILL BE SUPPLYING. TYPES/QUANTITIES OF CABLES SHALL BE AS INDICATED ON DRAWING E05.
3. CONTRACTOR NOTE, EXISTING MCC-CH'S TEMPORARY POWER SUPPLY IS INDICATED ON DRAWING E03.
4. CONTRACTOR SHALL COORDINATE CONNECTION OF TEMPORARY CABLES WITH JEA ELECTRIC UTILITY. CONDUCTORS SHALL TEMPORARILY BE DOUBLE-LUGGED TO BACK OF TRANSFORMER SECONDARY SPADES.
5. CONTRACTOR SHALL ADEQUATELY TEST ALL TEMPORARY GENERATOR CABLES AND FEEDER CABLES AND PROVE THEY ARE IN SATISFACTORY CONDITION PRIOR TO USE. CONTRACTOR REQUIRED TO OBTAIN ENGINEER'S APPROVAL OF TEST RESULTS BEFORE CONSTRUCTION.

3/8"=1'-0"

12" 0 1 2 4'

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CERTIFICATE OF AUTHORIZATION NO. : 2771

JEA Building Community sm

ARLINGTON EAST WATER RECLAMATION FACILITY
SWITCHGEAR REPLACEMENT

ELECTRICAL
GENERATOR BUILDING PLAN - TEMPORARY & DEMOLITION

DATE: AUGUST 2017
HAZEN NO.: 42000-006
CONTRACT NO.:
DRAWING NUMBER: E02

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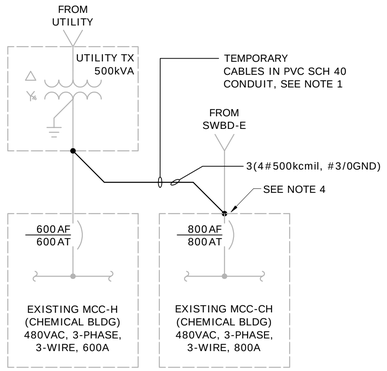
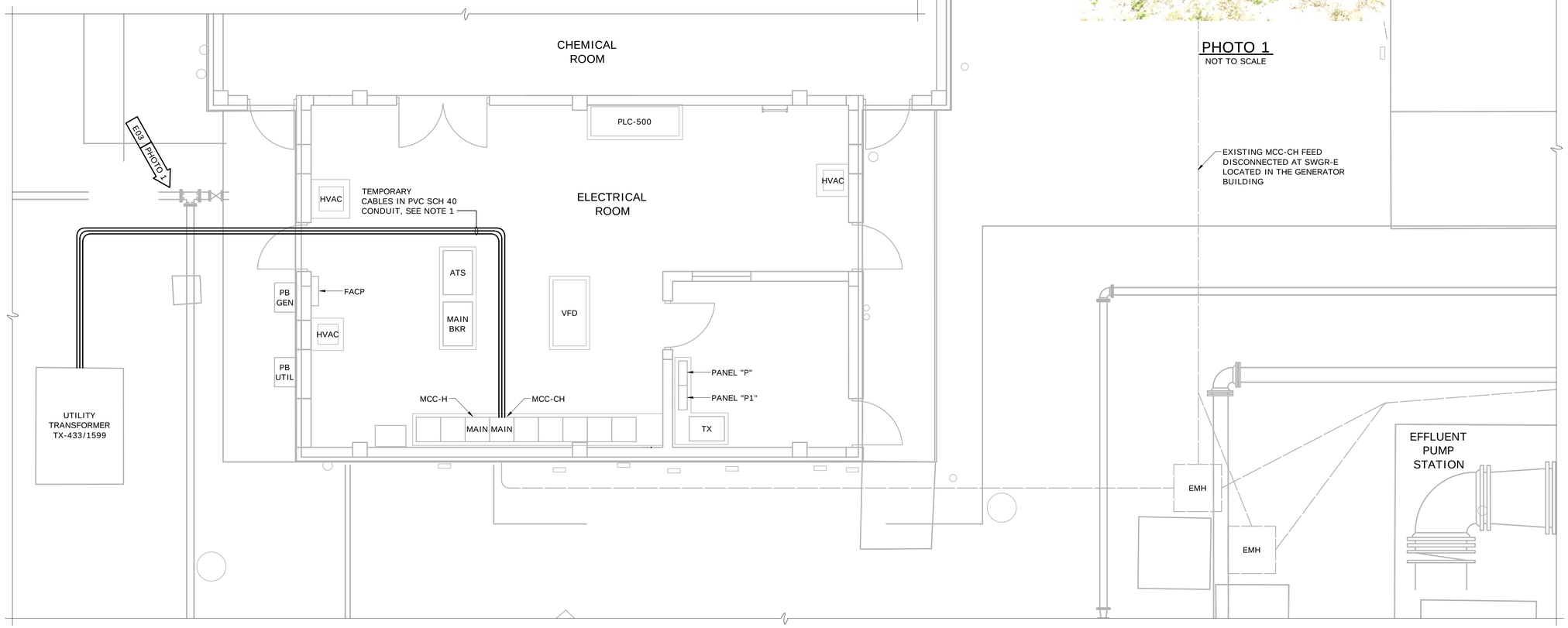



## MCC-CH - TEMPORARY MODIFICATIONS

PARTIAL SINGLE LINE DIAGRAM

## PHOTO 1

NOT TO SCALE




## CHEMICAL BUILDING - TEMPORARY MODIFICATIONS

3" = 1'-0"

3"=1'-0"

2" 0 2 4 6"

## NOTES:

1. CONTRACTOR SHALL INSTALL TEMPORARY FEEDER CABLES FROM EXISTING UTILITY TRANSFORMER TO THE MAIN BREAKER OF MCC-CH AS SHOWN. CABLES SHALL INSTALLED IN PVC SCH 40 CONDUIT, NEATLY ARRANGED ON THE GROUND, CONNECTED TO THE BACK OF THE TRANSFORMER SPADES ON THE SUPPLY SIDE, AND TO THE LINE SIDE OF MCC-CH'S MAIN BREAKER ON THE LOAD SIDE. SIZE/QUANTITY OF CABLES SHALL BE AS INDICATED.
2. COORDINATE ALL TEMPORARY CONNECTIONS TO JEA UTILITY TRANSFORMER WITH JEA ELECTRICAL UTILITY DEPARTMENT.
3. CONTRACTOR SHALL ADEQUATELY TEST ALL TEMPORARY GENERATOR CABLES AND FEEDER CABLES AND PROVE THEY ARE IN SATISFACTORY CONDITION PRIOR TO USE. CONTRACTOR REQUIRED TO OBTAIN ENGINEER'S APPROVAL OF TEST RESULTS BEFORE CONSTRUCTION.
4. CONTRACTOR SHALL DE-TERMINATE EXISTING FEEDERS ON THE LINE SIDE OF THE EXISTING MAIN BREAKER AND SAFELY SECURE CABLES. TERMINATE TEMPORARY CABLES TO ENERGIZE EQUIPMENT. CONTRACTOR TO PROVIDE ANY/ALL LUGS OR CONNECTING MEANS AS REQUIRED.

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| 1 | 90% DESIGN | 05/2017 | J.B.P. |

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|---|---|
| PROJECT ENGINEER: | B. PICKETT |
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| DRAWN BY: | N. SIEBACH |
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ARLINGTON EAST WATER RECLAMATION FACILITY
SWITCHGEAR REPLACEMENT

ELECTRICAL
CHEMICAL BUILDING - TEMPORARY

| | |
|---|---|
| DATE: | AUGUST 2017 |
| HAZEN NO.: | 42000-006 |
| CONTRACT NO.: | |
| DRAWING NUMBER: | E03 |

File: O:\42000-HAL\42000-006\DESIGN\DRAWINGS\ELEC\E03 Saved By: TRAHLAN Save Date: 2017/08/22 4:59 PM
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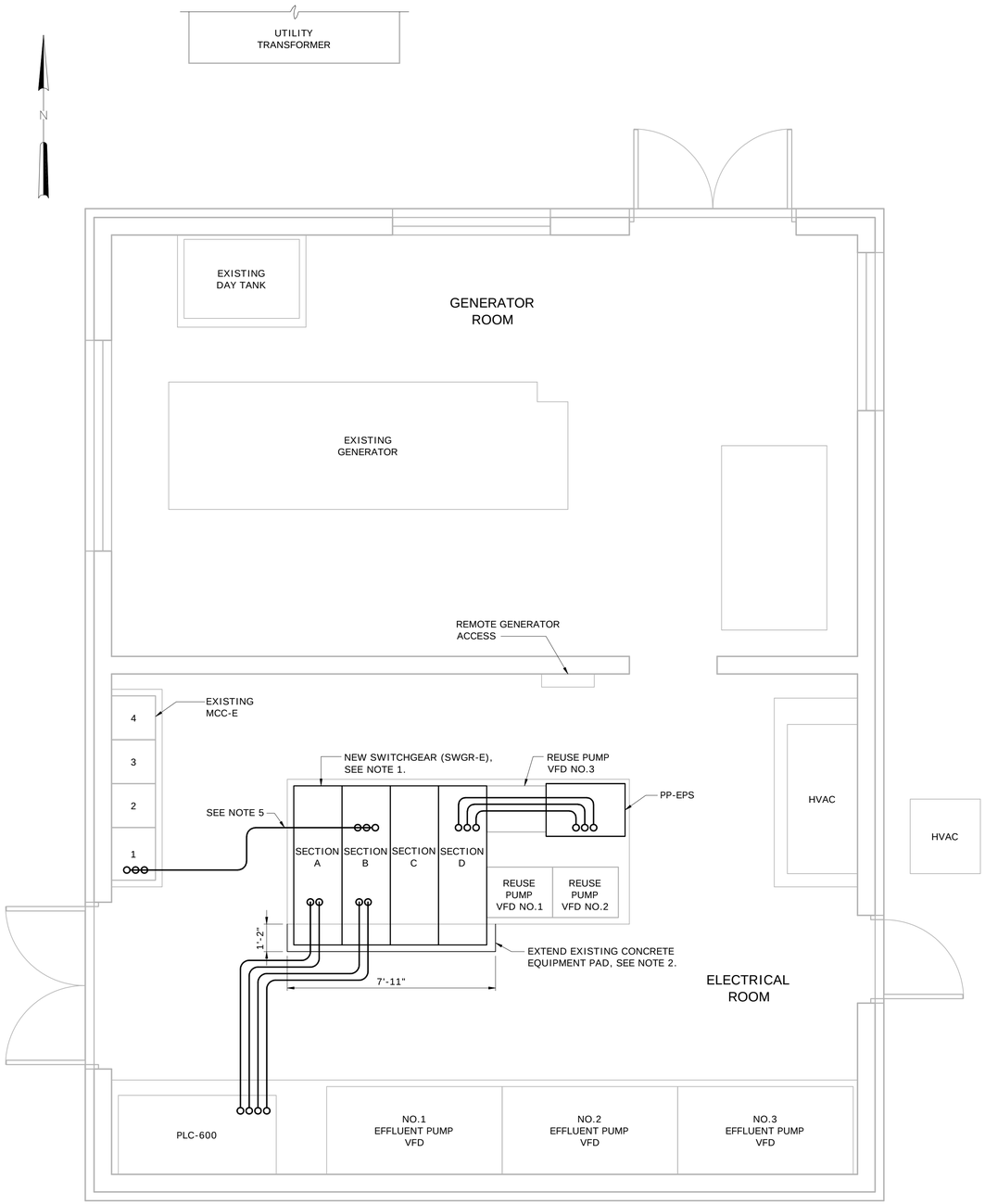


## GENERATOR BUILDING - MODIFIED

3/8" = 1' - 0"

## NOTES:

1. CONTRACTOR SHALL FURNISH AND INSTALL NEW SWITCHGEAR LINEUP SWGR-E, AS INDICATED. NEW SWITCHGEAR SHALL BE PROVIDED WITH THE APPROPRIATE LUGS AND APPROPRIATE CABLE ENTRY DIMENSIONS TO ALLOW EXITING SUPPLY AND FEEDER CABLES TO BE RE-USED, WITHOUT PULLING ANY NEW CONDUCTORS. FIELD MODIFICATIONS TO EXISTING CABLES OR THE NEW SWITCHGEAR ASSEMBLY TO ACCOUNT FOR ERRORS IN UNACCEPTABLE AND WILL RESULT IN REJECTION OF THE SWITCHGEAR LINEUP IN ITS ENTIRETY.
2. EXISTING CONCRETE EQUIPMENT PAD SHALL BE EXTENDED AS REQUIRED TO PROPERLY FACILITATE NEW SWITCHGEAR. EXTENSION OF PAD SHALL BE COORDINATED WITH EXISTING CONDUIT STUB-UPS AND NEW SWITCHGEAR STUB-UP WINDOWS.
3. CONTRACTOR SHALL TEST ALL EXISTING CONDUCTORS AS REQUIRED. AFTER SUCCESSFUL TESTING, ALL EXISTING CONDUCTORS SHALL BE RE-TERMINATED TO NEW SWITCHGEAR LINEUP.
4. CONTRACTOR SHALL FURNISH AND INSTALL NEW CONDUIT AND WIRE TO CONNECT EXISTING MCC-E. ALL NEW CONDUIT SHALL BE INSTALLED EXPOSED, ROUTED OVERHEAD ABOVE THE EQUIPMENT, SUPPORTED FROM THE WALLS OR CEILING, COORDINATE ROUTING OF CONDUITS WITH ENGINEER PRIOR TO INSTALLATION, REFER TO DRAWING E05 FOR FURTHER DETAILS.
5. NEW FEEDER BREAKER FOR MCC-E IS LOCATED IN DIFFERENT SECTION THAN EXISTING GEAR. CONDUCTORS MAY NOT BE LONG ENOUGH FOR REACH NEW CIRCUIT BREAKER. CONTRACTOR SHALL FURNISH AND INSTALL NEW CONDUIT AND WIRE OVERHEAD FOR SECTION B OF NEW SWBR-E TO EXISTING MCC-E AS INDICATED. REFER DRAWING E06 FOR CONDUIT AND WIRE REQUIREMENTS.

480/277 VOLTS
3 PHASE, 4 WIRE

PP-EPS
MAIN LUG ONLY
800A 3P

TYPE: NEMA 1
MOUNT: FREE STANDING

| MODS | DESCRIPTION | WIRE | TRIP | POLE | CKT No. | VOLT-AMPERES A | VOLT-AMPERES B | VOLT-AMPERES C | CKT No. | VOLT-AMPERES A | VOLT-AMPERES B | VOLT-AMPERES C | POLE | TRIP | WIRE | DESCRIPTION | MODS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - | REUSE DELIVERY PUMP NO. 1 | P-0001 | 225 | 3 | 1 | 20,000 | | | 2 | - | | | | | | | |
| | | | | | 3 | | 20,000 | | 4 | | - | | | | | SPACE | - |
| | | | | | 5 | | | 20,000 | 6 | | | - | | | | | |
| - | REUSE DELIVERY PUMP NO. 2 | P-0002 | 225 | 3 | 7 | 20,000 | | | 8 | - | | | | | | | |
| | | | | | 9 | | 20,000 | | 10 | | - | | | | | SPACE | - |
| | | | | | 11 | | | 20,000 | 12 | | | - | | | | | |
| - | REUSE DELIVERY PUMP NO. 3 | P-0003 | 225 | 3 | 13 | 30,000 | | | 14 | - | | | | | | | |
| | | | | | 15 | | 30,000 | | 16 | | - | | | | | SPACE | - |
| | | | | | 17 | | | 30,000 | 18 | | | - | | | | | |
| - | SPARE | | 225 | 3 | 19 | - | | | 20 | - | | | | | | | |
| | | | | | 21 | | - | | 22 | | - | | | | | SPACE | - |
| | | | | | 23 | | | - | 24 | | | - | | | | | |
| - | SPACE | | | | 25 | - | | | 26 | - | | | | | | | |
| | | | | | 27 | | - | | 28 | | - | | | | | SPACE | - |
| | | | | | 29 | | | - | 30 | | | - | | | | | |
| - | SPACE | | | | 31 | - | | | 32 | - | | | | | | | |
| | | | | | 33 | | - | | 34 | | - | | | | | SPACE | - |
| | | | | | 35 | | | - | 36 | | | - | | | | | |
| - | SPACE | | | | 37 | | | | 38 | | | | | | | | |
| | | | | | 39 | | | | 40 | | | | | | | SPACE | - |
| | | | | | 41 | | | | 42 | | | | | | | | |
| - | SPACE | | | | 43 | - | | | 44 | - | | | | | | | |
| | | | | | 45 | | - | | 46 | | - | | | | | SPACE | - |
| | | | | | 47 | | | - | 48 | | | - | | | | | |
| | | | | | TOTAL | 70,000 | 70,000 | 70,000 | | 0 | 0 | 0 | | | | | |
| | | | | | | PHASE TOTAL | | | | TOTAL LOAD (VA) | | | | | | | |
| | | | | | | 70,000 | 70,000 | 70,000 | | 210,000 | | | | | | | |
| | | | | | | | | | | TOTAL LOAD (A) | | | | | | | |
| | | | | | | | | | | 253 | | | | | | | |

**MODIFICATION (MODS) LEGEND:**

EPD - GROUND FAULT CIRCUIT INTERRUPTER (30mA)
GFCI - GROUND FAULT CIRCUIT INTERRUPTER (5mA)
LOD - LOCK-ON DEVICE
LFD - LOCK-OFF DEVICE

**NOTES:**

65K AIC
100kA SPD

3/8"=1'-0"

12" 0 1 2 4'

| REV | ISSUED FOR | DATE | BY |
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JEA Building Community sm

ARLINGTON EAST WATER RECLAMATION FACILITY
SWITCHGEAR REPLACEMENT

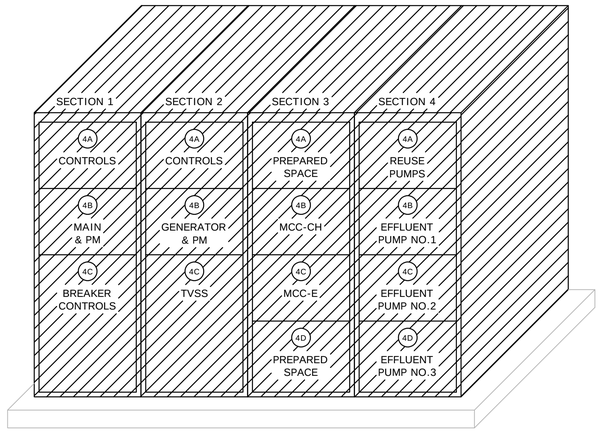
ELECTRICAL
GENERATOR BUILDING PLAN - MODIFIED

DATE: AUGUST 2017
HAZEN NO.: 42000-006
CONTRACT NO.:
DRAWING NUMBER: E04

File: Q:\42000-RAL\42000-006\DESIGN\DRAWINGS\ELEC\E04 Saved By: TRAHLAN Save Date: 2017/08/22 5:21 PM
PLOT DATE: 2017/08/22 5:52:09 PM BY: TRAHLAN

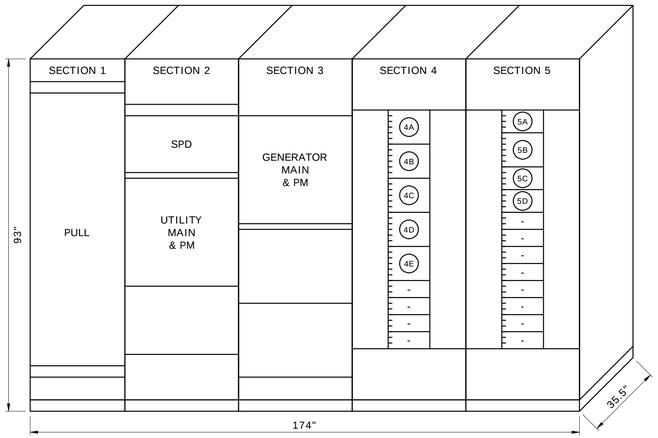
## NOTES:

1. CONTRACTOR SHALL DEMOLISH EXISTING SWITCHGEAR (SWB-E), COMPLETE. REFER TO DRAWING E02 FOR FURTHER DETAILS.
2. REFER TO DRAWING E03 FOR CABLE SIZE/QUANTITY REQUIREMENTS.
3. CONTRACTOR SHALL FURNISH AND INSTALL NEW CONDUIT AND WIRE OVERHEAD, AS A PERMANENT INSTALLATION.
4. TEMPORARY CONDUCTORS NEATLY ARRANGED ON THE GROUND IN PVC SCH 40 CONDUIT.
5. CONTRACTOR PROVIDED TEMPORARY GENERATOR.
6. ALL EQUIPMENT AND CONDUCTORS INDICATED AS TEMPORARY SHALL BE DISCONNECTED AT THE END OF THE PROJECT AND REMOVED.
7. CONTRACTOR SHALL DE-TERMINATE EXISTING FEEDERS ON THE LINE SIDE OF THE EXISTING MAIN BREAKER AND SAFELY SECURE CABLES. TERMINATE TEMPORARY CABLES TO ENERGIZE EQUIPMENT. CONTRACTOR TO PROVIDE ANY/ALL LUGS OR CONNECTING MEANS AS REQUIRED.
8. TEMPORARY SWITCHBOARD SHALL BE PROVIDED WITH CIRCUIT BREAKERS EQUIPPED WITH ADJUSTABLE TRIP UNITS TO ALLOW FOR USE ON BOTH SOUTHWEST WRF AND ARLINGTON EAST WRF PROJECTS. FRAME SIZES SELECTED FOR THE TEMPORARY SWITCH BOARD SHALL BE LARGE ENOUGH FOR EACH APPLICATION.



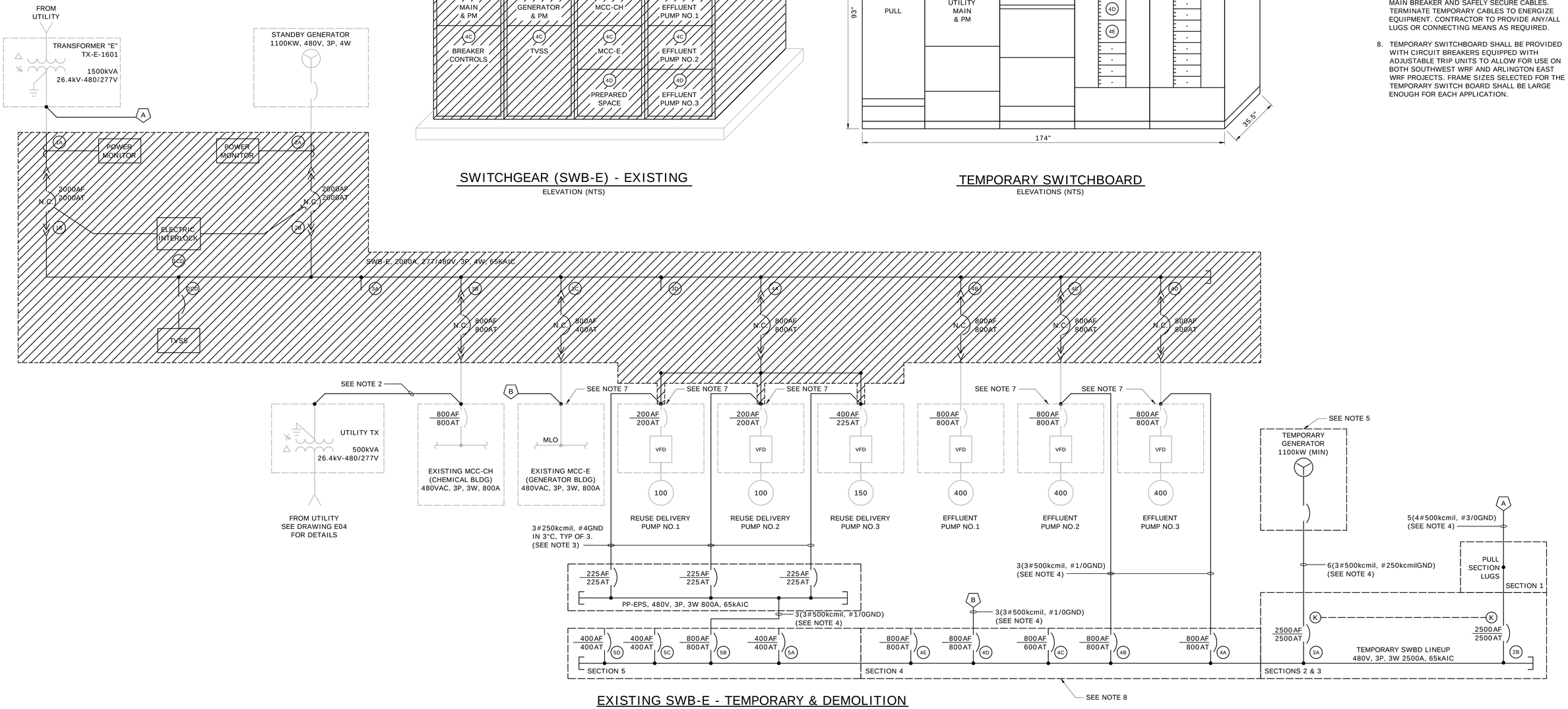

SWITCHGEAR (SWB-E) - EXISTING

ELEVATION (NTS)




TEMPORARY SWITCHBOARD

ELEVATIONS (NTS)




EXISTING SWB-E - TEMPORARY & DEMOLITION

SINGLE LINE DIAGRAM

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| 3 | BIDDING | 08/2017 | J.B.P. |
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| 1 | 90% DESIGN | 05/2017 | J.B.P. |

| | |
|---|---|
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| DRAWN BY: | N. SIEBACH |
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ARLINGTON EAST WATER RECLAMATION FACILITY
SWITCHGEAR REPLACEMENT

ELECTRICAL
SWB-E SINGLE LINE DIAGRAM - TEMPORARY & DEMOLITION

| | |
|---|---|
| DATE: | AUGUST 2017 |
| HAZEN NO.: | 42000-006 |
| CONTRACT NO.: | |
| DRAWING NUMBER: | E05 |

File: I:\42000-RAL\42000-006\DESIGN\DRAWINGS\ELEC\E05 Saved By: TRAHLAN Save Date: 2017/08/22 5:13 PM
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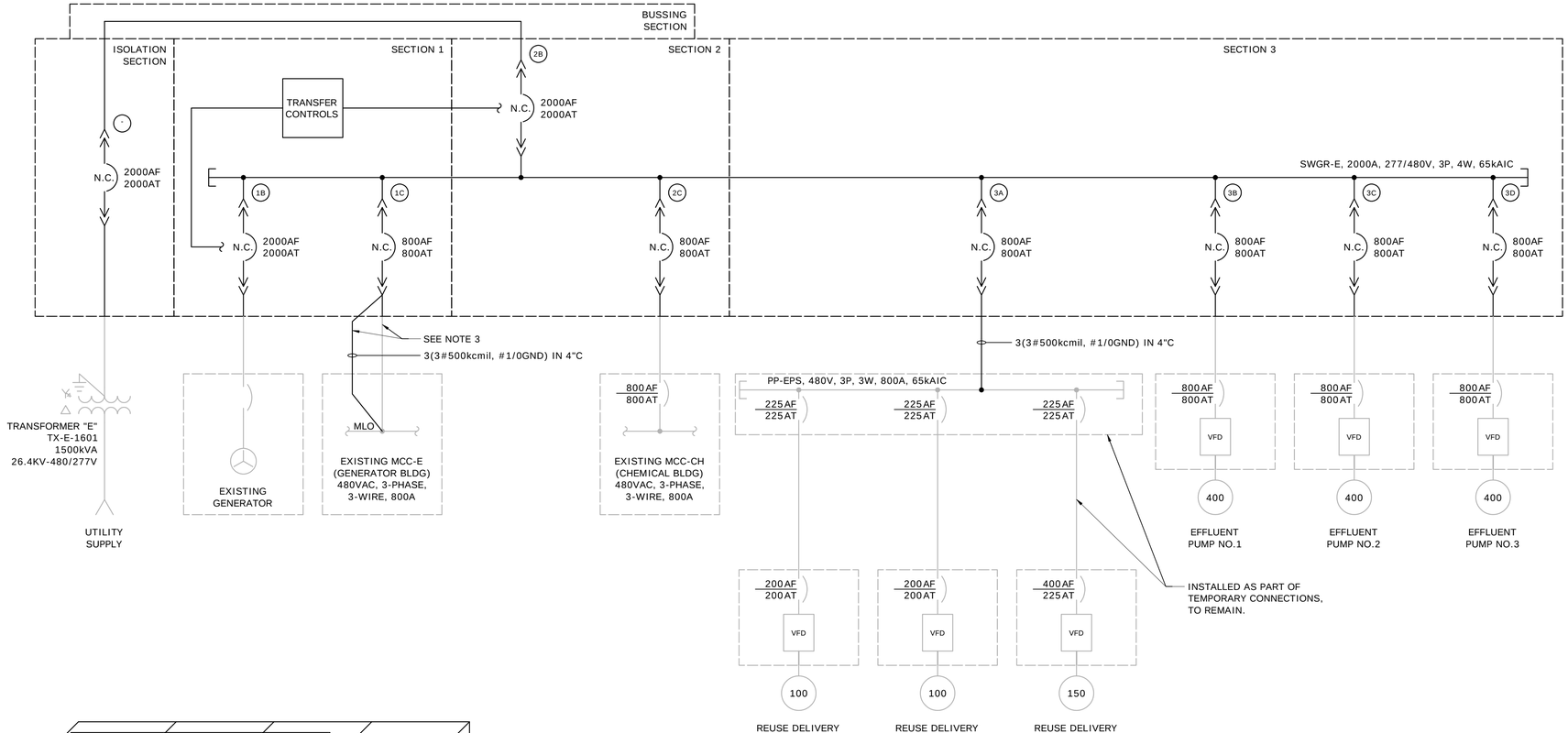
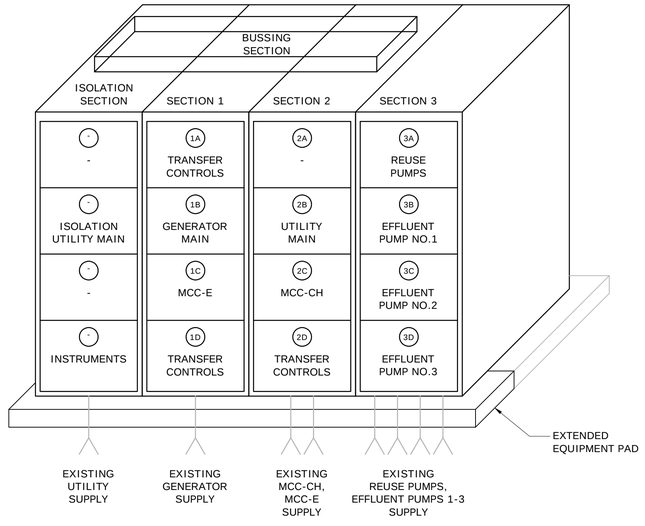
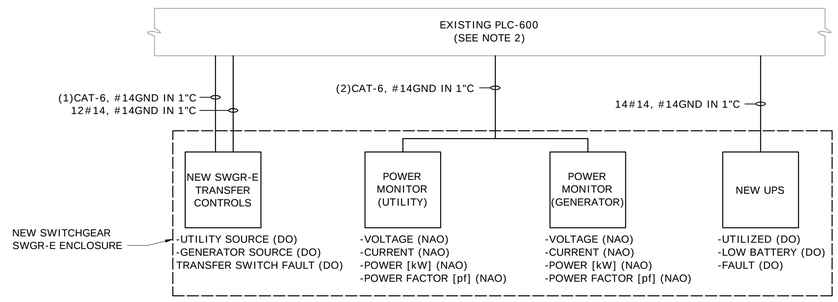



## NEW SWGR-E
SINGLE LINE DIAGRAM



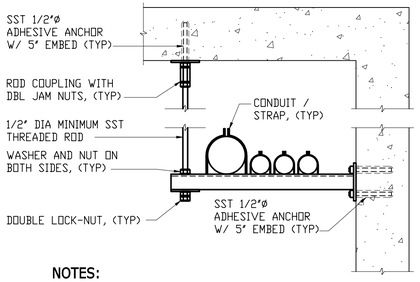

## NEW SWGR-E
ELEVATION (NTS)




## EXISTING PLC-600 CONTROL CONNECTIONS
PARTIAL CONTROL ONE-LINE DIAGRAM

## NOTES:

1. CONTRACTOR SHALL FURNISH AND INSTALL NEW SWITCHGEAR SWGR-E AS INDICATED. REFER TO DRAWING E03 FOR FURTHER DETAILS.
2. NETWORK CONNECTIONS AND I/O FROM NEW POWER MONITORS, NEW TRANSFER CONTROLS, AND THE NEW UPS SHALL BE TERMINATED TO THE EXITING PLC-600 WITHIN THE ELECTRICAL ROOM. ALL INTEGRATION OF NEW SIGNALS INTO THE EXISTING PLC WILL BE PROVIDED BY JEA. ALL TERMINATIONS TO PLC SHALL BE PROVIDED AS PART OF THIS CONTRACT.
3. CONTRACTOR NOTE NEW MCC-E FEEDER BREAKER WITHIN NEW SWGR-E IS LOCATED IN A NEW SECTION. UTILIZE SWITCHGEAR WIREWAYS TO ROUTE EXISTING CONDUCTORS TO NEW FEEDER BREAKER LOCATION. IF REQUIRED, FURNISH AND INSTALL NEW CONDUIT AND WIRE AS INDICATED ON DRAWING E04.

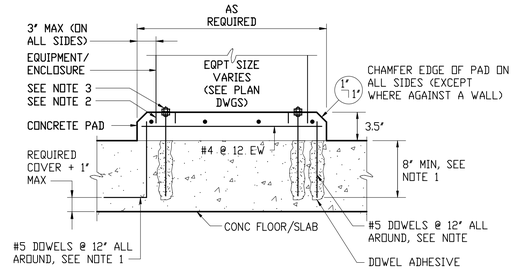



### NOTES:

1. SPACE SUPPORTS AT 5'-0" MAXIMUM. HANGER SPACING SHALL BE BASED ON MAXIMUM LOAD.
2. ALL THREAD ROD SHALL BE USED ONLY FOR DUAL RACK.
3. ALL SUPPORT MATERIALS SHALL BE SST (STAINLESS STEEL).
4. STRUT SHALL BE 12 GAUGE MINIMUM.

**CONDUIT SUPPORT RACK**

1611403




NOTES:

1. DOWELS MAY BE CAST IN WITH 90° HOOK OR ANCHORED WITH DOWEL ADHESIVE AT CONTRACTORS OPTION. WHERE FLOOR IS 8" THICK OR LESS, USE #4 DOWELS EMBEDDED TO WITHIN 2" OF BOTTOM OF FLOOR SLAB. COORDINATE THE PLACEMENT OF DOWELS AND REBAR WITH CONDUIT PENETRATIONS THROUGH THE PAD.
2. THE EQUIPMENT MANUFACTURER SHALL FURNISH LEVELING STEEL CHANNELS WHERE REQUIRED BY THE EQUIPMENT SPECIFICATION. THE CONTRACTOR SHALL INSTALL THE CHANNELS. CHANNELS SHALL BE INSTALLED LEVEL AND PARALLEL TO THE BUILDING LINES. COORDINATION OF THE SIZE AND INSTALLATION OF THESE CHANNELS WITH THE EQUIPMENT AND THE CONCRETE PAD IS ESSENTIAL AND REQUIRED.
3. REMOVE NUT, CUT BOLT FLUSH, PLUG WELD TO STEEL, AND GRIND SMOOTH PRIOR TO SETTING EQUIPMENT, TYP. SEE NOTE 2.
4. COAT DISSIMILAR MATERIALS PER THE CONTRACT DOCUMENTS.
5. STAGGER CHANNEL ANCHORS AND PAD DOWELS.

ELECTRICAL EQUIPMENT PAD

1600001

| REV | ISSUED FOR | DATE | BY |
|---|---|---|---|
| 3 | BIDDING | 08/2017 | J.B.P. |
| 2 | 100% DESIGN | 08/2017 | J.B.P. |
| 1 | 90% DESIGN | 05/2017 | J.B.P. |

PROJECT ENGINEER: B. PICKETT
DESIGNED BY: B. PICKETT
DRAWN BY: N. SIEBACH
CHECKED BY: J. BURKE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

JOSEPH B. PICKETT, PE NO. 74106

Hazen
HAZEN AND SAWYER
6675 CORPORATE CENTER PKWY, STE 330
JACKSONVILLE, FLORIDA 32216
CERTIFICATE OF AUTHORIZATION NO. : 2771

JEA Building Community sm

ARLINGTON EAST WATER RECLAMATION FACILITY
SWITCHGEAR REPLACEMENT

# ELECTRICAL
# SWGR-E SINGLE LINE DIAGRAM - MODIFIED AND STANDARD DETAILS

DATE: AUGUST 2017
HAZEN NO.: 42000-006
CONTRACT NO.:
DRAWING NUMBER: E06

File: O:\42000-RAL\42000-006\DESIGN\DRAWINGS\ELEC\E06 Saved By: TRAHLAN Save Date: 2017/08/22 5:50 PM
Plot Date: 2017/08/22 5:52:27 PM BY: TRAHLAN

JEA

JACKSONVILLE, FLORIDA

# SOUTHWEST WATER RECLAMATION FACILITY
# MAIN BREAKER REPLACEMENT

HAZEN CONTRACT No. 42000-008

AUGUST 2017

SOUTHWEST WATER RECLAMATION FACILITY
5420 118TH STREET
JACKSONVILLE, FL 32244

LOCATION MAP

NOT TO SCALE

## INDEX OF DRAWINGS

### GENERAL

COVER

### ELECTRICAL

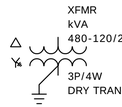
E01 - LEGEND & GENERAL NOTES
E02 - PARTIAL SITE PLAN
E03 - ELECTRICAL & GENERATOR BUILDING - TEMPORARY & DEMOLITION
E04 - ELECTRICAL & GENERATOR BUILDING - MODIFIED
E05 - SWBD-20 SINGLE LINE DIAGRAM - TEMPORARY AND DEMOLITION
E06 - SWBD-20 SINGLE LINE DIAGRAM - MODIFIED

Hazen

HAZEN AND SAWYER
6675 CORPORATE CENTER PARKWAY, SUITE 330
JACKSONVILLE, FLORIDA 32216

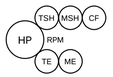
BID SET

## SINGLE-LINE DIAGRAMS



TRANSFORMER


PROTECTIVE RELAY:
NUMBER DENOTES IEEE DEVICE FUNCTION



MOTOR AND TYPICAL ADDITIONAL DEVICES:
TSH: TEMPERATURE SWITCH
MSH: MOTOR SPACE HEATER
CF: COOLING FAN
TE: TEMPERATURE ELEMENT
ME: MOISTURE DETECTOR

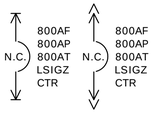
INSTRUMENT TAG:
X DENOTES INSTRUMENT TYPE
Y DENOTES INSTRUMENT NUMBER
SEE DRAWING I1 FOR INSTRUMENT ABBREVIATIONS

FUSE

FUSED DISCONNECT SWITCH

DISCONNECT SWITCH

FUSED DISCONNECT SWITCH



LOW-VOLTAGE POWER CIRCUIT BREAKER:
LEFT: FIXED-MOUNT
RIGHT: DRAWOUT
E.O. DENOTES ELECTRICALLY OPERATED
LSIG DENOTES INSTALLED TRIP FUNCTIONS:
L DENOTES LONG-TIME
S DENOTES SHORT-TIME
I DENOTES INSTANTANEOUS
G DENOTES GROUND FAULT
Z DENOTES ZONE-SELECTIVE INTERLOCKING
CTR DENOTES BREAKER-SPECIFIC CT AND RATIOS

MEDIUM-VOLTAGE DRAWOUT POWER CIRCUIT BREAKER:
E.O. DENOTES ELECTRICALLY OPERATED
BATT. DENOTES BATTERY BACKUP POWER

LOW-VOLTAGE MOLDED CASE CIRCUIT BREAKER
LEFT: THERMAL-MAGNETIC TRIP UNIT
RIGHT: ELECTRONIC TRIP UNIT

MOTOR CIRCUIT PROTECTOR

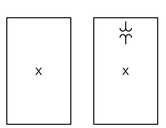

GROUND

CT:
NUMBERS DENOTE CT WINDING RATIO AND CT QUANTITY

GFCT:
NUMBERS DENOTE GFCT WINDING RATIO AND GFCT QUANTITY

PT:
NUMBERS DENOTE PT WINDING VOLTAGES AND PT QUANTITY

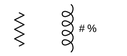

DRAW-OUT ELEMENT



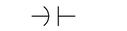
LEFT: PANELBOARD
RIGHT: COMBINATION POWER UNIT
X DENOTES PANEL ID

LIGHTNING ARRESTOR

## SINGLE-LINE DIAGRAMS, CONT'D.



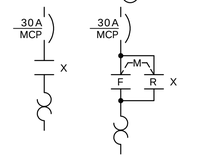
LEFT: RESISTOR
RIGHT: LINE REACTOR:
#% DENOTES IMPEDANCE


CAPACITOR

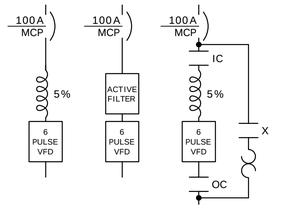
SHUNT TRIP

SURGE PROTECTIVE DEVICE

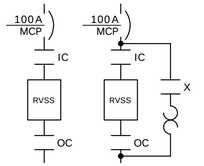
KIRK-KEY INTERLOCK



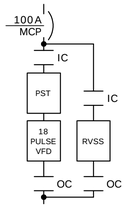
LEFT: FVNR STARTER:
X DENOTES NEMA SIZE
DP DENOTES DEFINITE PURPOSE CONTACTOR
RIGHT: FVR STARTER



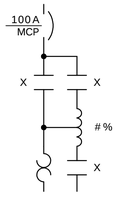
LEFT: VFD WITH LINE REACTOR
MIDDLE: VFD WITH HARMONIC FILTER
RIGHT: VFD WITH LINE REACTOR AND FVNR BYPASS
X DENOTES NEMA SIZE



LEFT: RVSS STARTER
RIGHT: RVSS STARTER WITH FVNR BYPASS
X DENOTES NEMA SIZE



VFD WITH RVSS BYPASS



RVAT STARTER:
X DENOTES NEMA SIZE
#% DENOTES TAP SETTING

## SWITCHES

WALL SWITCH:
X DENOTES TYPE:
NO SUBSCRIPT DENOTES SINGLE-POLE SWITCH
3 DENOTES 3-WAY SWITCH
4 DENOTES 4-WAY SWITCH
M DENOTES MANUAL MOTOR STARTER
# DENOTES CIRCUIT NUMBER
WPCR DENOTES WEATHERPROOF CORROSION RESISTANT


COMBINATION MOTOR STARTER

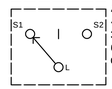
DISCONNECT SWITCH


LOCAL CONTROL STATION

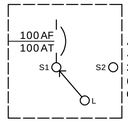
## SINGLE-LINE DIAGRAMS, CONT'D.

GENERATOR

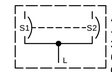
ATS
480V, 800A
3Ø 4W 4P
65kA
OPEN TRANSITION
CONTACTOR-STYLE ATS OR MTS



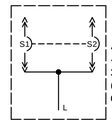
ATS
480V, 800A
3Ø 4W 4P
65kA
OPEN TRANSITION
CONTACTOR-STYLE ATS OR MTS WITH OFF POSITION



ATS
480V, 800A
3Ø 4W 4P
65kA
OPEN TRANSITION
CONTACTOR-STYLE ATS OR MTS, SERVICE-ENTRANCE RATED



ATS
480V, 800AF/800AT
3Ø 4W 4P
65kA
OPEN TRANSITION
MCCB-STYLE ATS OR MTS



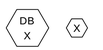
ATS
480V, 800AF/800AT
3Ø 4W 4P
65kA
OPEN TRANSITION
DRAWOUT CB-STYLE ATS OR MTS

## MISC PLAN VIEW SYMBOLS

EQUIPMENT CONNECTION

GROUND RODS:
LEFT: BURIED
RIGHT: IN TESTWELL

DUCTBANK SECTION CUT IDENTIFIER:
DBXX DENOTES DUCTBANK ID
EXX DENOTES DRAWING NUMBER
WHERE SECTION CUT IS LOCATED



DUCTBANK TAG:
X DENOTES DUCTBANK ID

CABLE TRAY TAG:
X DENOTES CABLE TRAY ID
Y DENOTES SCHEDULE REFERENCE

INSTRUMENT TAG:
X DENOTES INSTRUMENT TYPE
# DENOTES INSTRUMENT NUMBER
SEE DRAWING I1 FOR INSTRUMENT ABBREVIATIONS

CONDUIT TAGS:
P DENOTES POWER
C DENOTES CONTROL
I DENOTES INSTRUMENTATION
XXXX DENOTES CONDUIT ID
XXX-XXX DENOTES CONDUIT ID

## EQUIPMENT/DEVICE LOCATION SYMBOLS


LOCATED IN MCC


LOCATED IN STAND-ALONE MOTOR STARTER/CONTROLLER


LOCATED IN FIELD



LOCATED AT PANEL:
X DENOTES PANEL ID:
L DENOTES LOCAL CONTROL STATION

## WIRING


CONDUIT HOME RUN


CONDUIT EXPOSED


CONCRETE ENCASED CONDUIT


CONDUIT CONCEALED


FLEXIBLE CONDUIT


CONCRETE ENCASED DUCTBANK


LEFT: CONDUIT RISE (TURN UP)
RIGHT: CONDUIT DROP (TURN DOWN)

## ABBREVIATIONS

| | |
|---|---|
| AE | ANALYSIS ELEMENT |
| AHU | AIR HANDLING UNIT |
| AIC | AMPERE INTERRUPTING CAPACITY |
| AIT | ANALYSIS INDICATING TRANSMITTER |
| ANSI | AMERICAN NATIONAL STANDARDS INSTITUTE |
| ASCE | AMERICAN SOCIETY OF CIVIL ENGINEERS |
| ASME | AMERICAN SOCIETY OF MECHANICAL ENGINEERS |
| AF | AMPERE FRAME |
| AT | AMPERE TRIP |
| ATS | AUTOMATIC TRANSFER SWITCH |
| BC | BYPASS CONTACTOR |
| BKR | BREAKER |
| (L/V)CP | (LOCAL/VENDOR) CONTROL PANEL |
| CPT | CONTROL POWER TRANSFORMER |
| CT | CURRENT TRANSFORMER |
| DB | DUCTBANK |
| DSW | DISCONNECT SWITCH |
| EHH | ELECTRIC HAND HOLE |
| EMH | ELECTRIC MANHOLE |
| EO | ELECTRICALLY OPERATED |
| ETM | ELAPSED TIME METER |
| ETU | ELECTRONIC TRIP UNIT |
| FAAP | FIRE ALARM ANNUNCIATOR PANEL |
| FACP | FIRE ALARM CONTROL PANEL |
| FS | FLOW SWITCH |
| FSL | FLOW SWITCH LOW |
| FVNR | FULL VOLTAGE NON-REVERSING |
| FVR | FULL VOLTAGE REVERSING |
| GFCI | GROUND FAULT CIRCUIT INTERRUPTER |
| GFCT | GROUND FAULT CURRENT TRANSFORMER |
| GNG | GO-NO GO |
| GND | GROUND |
| HOA | HAND-OFF-AUTO |
| HPU | HYDRAULIC POWER UNIT |
| IC | INPUT CONTACTOR |
| IEEE | INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS |
| ISO | INTERNATIONAL ORGANIZATION FOR STANDARDIZATION |
| JB | JUNCTION BOX |
| LCS | LOCAL CONTROL STATION |
| LP | LIGHTING PANEL |
| LS | LEVEL SWITCH |
| LSL | LEVEL SWITCH LOW |
| LSLL | LEVEL SWITCH LOW-LOW |
| LSH | LEVEL SWITCH HIGH |
| LSHH | LEVEL SWITCH HIGH-HIGH |
| LT | LEVEL TRANSMITTER |
| MFR | MULTI-FUNCTION RELAY |
| MH | MANHOLE |
| MOD | MOTOR OPERATED DAMPER |
| MOG | MOTOR OPERATED GATE |
| MOL | MOTOR OPERATED LOUVER |
| MOV | MOTOR OPERATED VALVE |
| MPR | MOTOR PROTECTION RELAY |
| MTD | MOUNTED |
| MTS | MANUAL TRANSFER SWITCH |
| MWTS | MOTOR WINDING TEMPERATURE SWITCH |
| NC | NORMALLY CLOSED |
| NEC | NATIONAL ELECTRICAL CODE |
| NEMA | NATIONAL ELECTRICAL MANUFACTURERS ASSN |
| NFPA | NATIONAL FIRE PROTECTION ASSOCIATION |
| NO | NORMALLY OPEN |
| NTS | NOT TO SCALE |
| OC | OUTPUT CONTACTOR |
| OL | OVERLOAD |
| PB | PULLBOX |
| PC | PHOTOCELL |
| PCC | POINT OF COMMON COUPLING |
| PE | PRESSURE ELEMENT |
| PIT | PRESSURE INDICATING TRANSMITTER |
| PLC | PROGRAMMABLE LOGIC CONTROLLER |

## ABBREVIATIONS, CONT.

| | |
|---|---|
| PP | POWER PANEL |
| PST | PHASE SHIFTING TRANSFORMER |
| PT | POTENTIAL TRANSFORMER |
| PTT | PUSH TO TEST |
| RCS | REMOTE CONTROL STATION |
| RECP | RECEPTACLE |
| RIO | REMOTE I/O |
| RM | ROOM |
| RTD | RESISTANCE THERMAL DEVICE |
| RTU | REMOTE TELEMETRY UNIT |
| RVAT | REDUCED VOLTAGE AUTO TRANSFORMER |
| RVSS | REDUCED VOLTAGE SOLID STATE |
| SA | SUPPLY AIR |
| S.E. | SERVICE ENTRANCE |
| SP. C. | SPARE CONDUIT |
| SPD | SURGE PROTECTIVE DEVICE |
| SST | STAINLESS STEEL |
| TB | TEST BLOCK |
| TC | TIMED CLOSE |
| TO | TIMED OPEN |
| TSH | TWISTED SHIELDED |
| TX | TRANSFORMER |
| TYP | TYPICAL |
| UPS | UNINTERRUPTIBLE POWER SUPPLY |
| VFD | VARIABLE FREQUENCY DRIVE |
| WPCR | WEATHER PROOF CORROSION RESISTANT |
| WT | WALK THROUGH |
| XFMR | TRANSFORMER |

## NOTES:

1. UNLESS SPECIFICALLY NOTED OTHERWISE, ALL UNDERGROUND CONCRETE ENCASED ELECTRICAL CONDUITS SHALL BE PER STANDARD DETAIL 1611801.
2. THE INSTALLATION OF ALL CONCRETE ENCASED ELECTRICAL CONDUITS SHALL COMPLY WITH ACI 318, SECTION 6.3. CONTRACTOR SHALL SUPPLY EXPANSION JOINT FITTINGS AS REQUIRED FOR THERMAL EXPANSION AND DEFLECTION.
3. BOND ALL NEW CONCRETE ENCASED GROUND CONDUCTORS TO EXISTING GROUND CONDUCTORS IN ALL MANHOLES, PULL BOXES, CABLE TRAYS, AND SIMILAR LOCATIONS WHERE APPLICABLE.
4. UNLESS OTHERWISE SPECIFIED OR NOTED, ALL WALL MOUNTED ELECTRICAL PANELS, ENCLOSURES, AND SIMILAR EQUIPMENT SHALL BE MOUNTED 6'-6" (MAX) FROM THE TOP OF THE PANEL TO FINISHED FLOOR OR GRADE.
5. UNLESS OTHERWISE NOTED, ALL LIGHTING SWITCHES, CONTROL SWITCHES, AND SIMILAR EQUIPMENT SHALL BE MOUNTED WITH THEIR CENTERLINE APPROXIMATELY 4'-0" ABOVE FINISHED FLOOR, SLAB, OR GRADE. THERMOSTATS SHALL BE MOUNTED 4'-4" ABOVE FINISHED FLOOR.
6. A SEPARATE EQUIPMENT GROUNDING CONDUCTOR SHALL BE PROVIDED FOR EACH CIRCUIT (SEPARATE CONDUCTOR IN THE CONDUIT). THE CONDUCTOR SHALL BE TERMINATED AT THE PROPER DEVICE, TERMINAL, OR LUG AT THE POWER SOURCE (MCC GROUND BUS, PANELBOARD GROUND BUS, ETC.). GROUND CONDUCTOR SIZE SHALL BE PER THE LATEST EDITION OF THE NEC.
7. UNLESS SPECIFICALLY NOTED OTHERWISE, EXISTING PAVEMENT SHALL BE SAW CUT AND REMOVED TO ALLOW FOR THE INSTALLATION OF NEW ELECTRICAL DUCTBANKS. AFTER INSTALLATION, REPLACE PAVEMENT WITH NEW TO MATCH ORIGINAL CONDITIONS.

## CONSTRUCTION SEQUENCING AND CONSTRAINTS:

**1. THE FOLLOWING LOADS SHALL BE OPERATIONAL AT ALL TIMES:**

- **a. ALL FOUR (4) UV TRANSFORMERS**
- **b. MCC-6 IN ITS ENTIRETY**
- **c. MCC-21 IN ITS ENTIRETY**
- **d. MCC-23 IN ITS ENTIRETY**

**2. A TEMPORARY PORTABLE GENERATOR (1500kW MINIMUM) SHALL BE PROVIDED BY THE CONTRACTOR DURING CONSTRUCTION.**

**3. A NEW, TEMPORARY SWITCHBOARD LINEUP SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR AS INDICATED HEREIN.**

**4. JEA TO PROVIDE GENERATOR BACKUP FOR THE FOLLOWING LOADS PRIOR TO CONTRACTOR SWITCHING TO TEMPORARY POWER:**

- **a. EFFLUENT PUMP NO.4**
- **b. EFFLUENT PUMP STATION LIGHTING PANEL**
- **c. POST AERATION BLOWER NO.2**

**5. PREFERRED SEQUENCE OF CONSTRUCTION:**

- **a. FURNISH AND INSTALL TEMPORARY GENERATOR AND TEMPORARY SWITCHBOARD.**
- **b. CONNECT ALL EXISTING LOADS LISTED IN STEP 1 AND INDICATED HEREIN TO TEMPORARY SOURCE OF POWER.**
- **c. REMOVE AND INSTALL NEW SWITCHGEAR BREAKERS, POWER METERS, AND TRANSFER CONTROLS.**
- **d. REMOVE ALL TEMPORARY CONNECTIONS AND RESTORE PERMANENT CONNECTIONS.**

**6. COORDINATE ALL DETAILS OF THE SEQUENCE OF CONSTRUCTION WITH JEA/ENGINEER PRIOR TO STARTING ANY WORK.**

**7. MAXIMUM SHUTDOWN LENGTH TO INSTALL AND REMOVE TEMPORARY FACILITIES SHALL BE 2 HOURS, DURING 1am TO 4am, MONDAY THRU WEDNESDAY, AND COORDINATED WITH JEA.**

**8. CONTRACTOR SHALL PROVIDE PERSONNEL TO CONTINUOUSLY MONITOR OF THE TEMPORARY POWER SYSTEM WHILE THE TEMPORARY SYSTEM IS SUPPLYING THE FACILITY. THE PERSONNEL SHALL BE CAPABLE OF MANUALLY STARTING AND MANUALLY TRANSFERRING TO/FROM THE PORTABLE GENERATOR IN CASE OF A UTILITY OUTAGE. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING DIESEL FUEL FOR THE PORTABLE GENERATOR AS REQUIRED.**

| REV | ISSUED FOR | DATE | BY |
|---|---|---|---|
| 4 | BID SET | 08/2017 | J.B.P. |
| 3 | 90% DESIGN | 07/2017 | J.B.P. |
| 2 | 30% DESIGN | 07/2017 | J.B.P. |
| 1 | 10% DESIGN | 06/2017 | J.B.P. |

PROJECT ENGINEER: B. PICKETT
DESIGNED BY: B. PICKETT
DRAWN BY: N. SIEBACH
CHECKED BY: J. BURKE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

JOSEPH B. PICKETT, PE NO. 74106


Hazen
HAZEN AND SAWYER
6675 CORPORATE CENTER PKWY, STE 330
JACKSONVILLE, FLORIDA 32216
CERTIFICATE OF AUTHORIZATION NO. : 2771


JEA Building Community sm

SOUTHWEST WATER RECLAMATION FACILITY
MAIN BREAKER REPLACEMENT

ELECTRICAL
LEGEND & GENERAL NOTES

DATE: AUGUST 2017
HAZEN NO.: 42000-008
CONTRACT NO.:
DRAWING NUMBER: E01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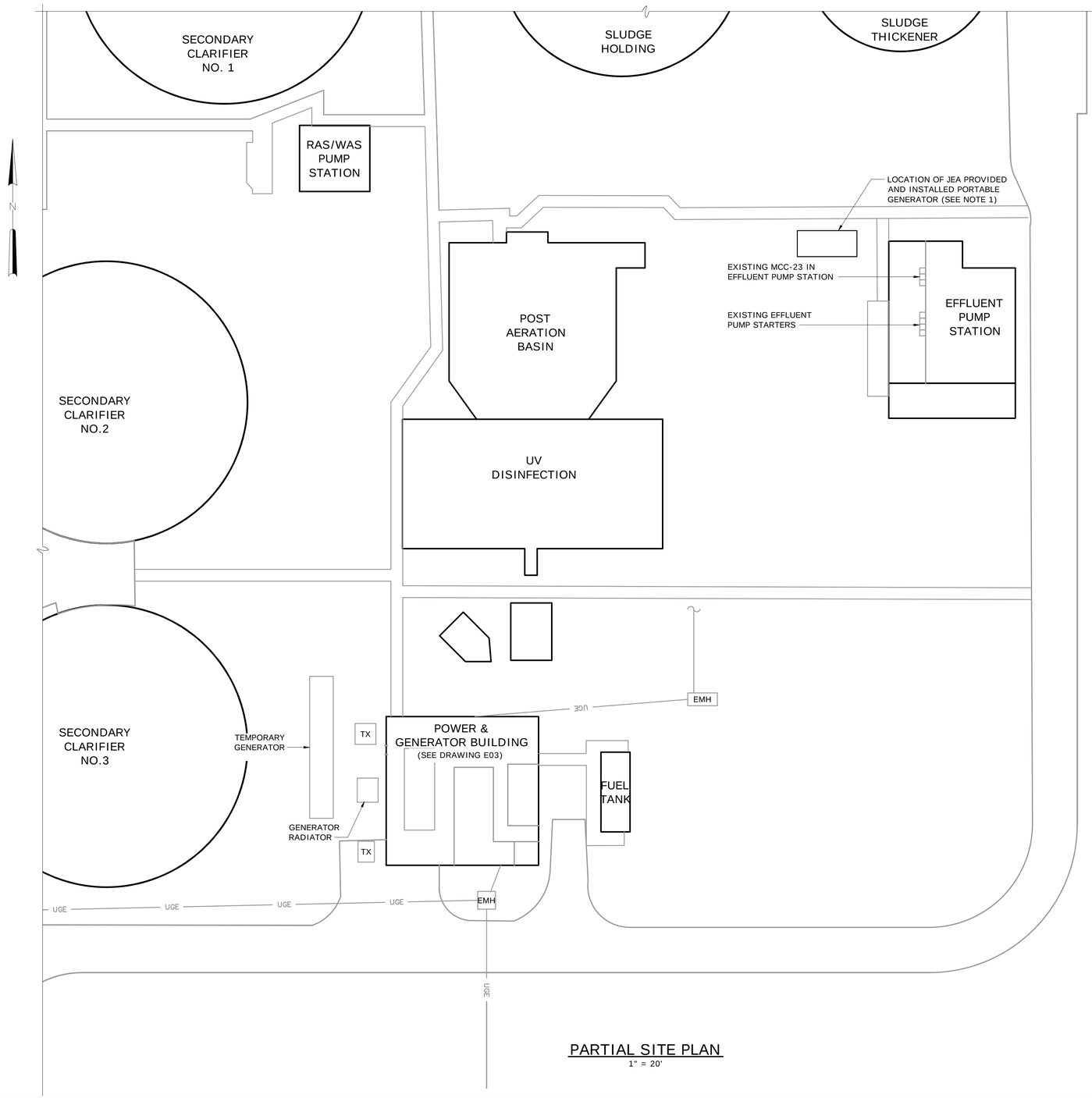


PARTIAL SITE PLAN
1" = 20'

1"=20'-0"  20 10 0 20'

## NOTES:

1. CONTRACTOR NOTE JEA WILL BE PROVIDING TEMPORARY GENERATORS FOR ONE (1) EFFLUENT PUMP, ONE (1) AERATION BLOWER, AND CRITICAL CONTROLS ASSOCIATED WITH THESE PROCESSES. THESE GENERATORS WILL BE PROVIDED, INSTALLED, AND REMOVED BY JEA. CONTRACTOR SHALL COORDINATE WITH JEA TO ENSURE THESE CONNECTIONS ARE IN PLACE PRIOR TO PERFORMING ANY WORK AS PART OF THIS PROJECT.

| REV | ISSUED FOR | DATE | BY |
|---|---|---|---|
| 4 | BID SET | 08/2017 | J.B.P. |
| 3 | 90% DESIGN | 07/2017 | J.B.P. |
| 2 | 30% DESIGN | 07/2017 | J.B.P. |
| 1 | 10% DESIGN | 06/2017 | J.B.P. |

PROJECT ENGINEER: B. PICKETT
DESIGNED BY: B. PICKETT
DRAWN BY: N. SIEBACH
CHECKED BY: J. BURKE
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JEA Building Community sm

SOUTHWEST WATER RECLAMATION FACILITY
MAIN BREAKER REPLACEMENT

ELECTRICAL
PARTIAL SITE PLAN

DATE: AUGUST 2017
HAZEN NO.: 42000-008
CONTRACT NO.:
DRAWING NUMBER: E02

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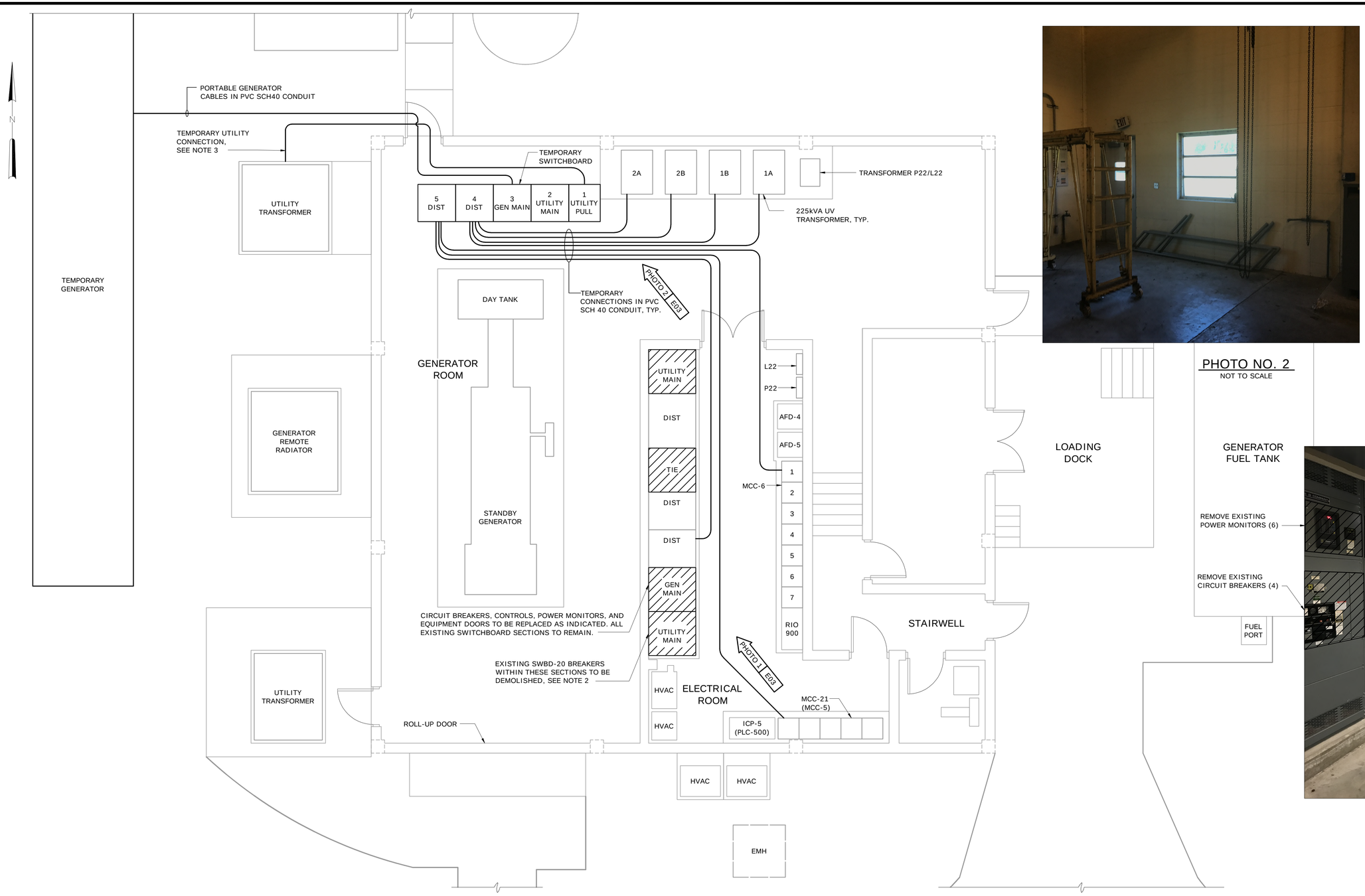


## POWER & GENERATOR BUILDING - TEMPORARY & DEMOLITION

1/4" = 1' - 0"




PHOTO NO. 2

NOT TO SCALE

PHOTO NO. 1

NOT TO SCALE

1/4"=1'-0"

1 0 1 2 3 7'

## NOTES:

1. EXISTING SWBD-20 IS A QED POWER STYLE SWITCHBOARD LINEUP AS MANUFACTURED BY SQUARE D WITH THE FOLLOWING RATINGS: NEMA TYPE 1, 480/277V, 60HZ, 3000A, 3-PHASE, 4-WIRE, PLANT CODE: 85 SERIAL NO: 13320599-005.
2. CONTRACTOR SHALL DEMOLISH EXISTING SWBD-20 CIRCUIT BREAKERS, TRANSFER CONTROLS, EQUIPMENT DOORS, AND POWER MONITORS AS INDICATED. REFER TO DRAWING E05 FOR FURTHER DETAILS. ALL EXISTING SUPPLY CONDUCTORS SHALL BE DE-TERMINATED AND LEFT FOR RECONNECTION TO NEW SWITCHBOARD BREAKERS.
3. CONTRACTOR SHALL COORDINATE CONNECTION OF TEMPORARY CABLES WITH JEA ELECTRIC UTILITY. CONDUCTORS SHALL TEMPORARILY BE DOUBLE-LUGGED TO BACK OF TRANSFORMER SECONDARY SPADES.
4. CONTRACTOR SHALL REMOVE ALL TEMPORARY EQUIPMENT AT COMPLETION OF THE PROJECT AND RELOCATE IT TO THE ARLINGTON EAST WRF SITE. COORDINATE DETAILS WITH JEA.
5. CONTRACTOR SHALL ADEQUATELY TEST ALL TEMPORARY GENERATOR CABLES AND FEEDER CABLES AND PROVE THEY ARE IN SATISFACTORY CONDITION PRIOR TO USE. CONTRACTOR REQUIRED TO OBTAIN ENGINEER'S APPROVAL OF TEST RESULTS BEFORE CONSTRUCTION.

| REV | ISSUED FOR | DATE | BY |
|---|---|---|---|
| 4 | BID SET | 08/2017 | J.B.P. |
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| 1 | 10% DESIGN | 06/2017 | J.B.P. |

PROJECT ENGINEER: B. PICKETT
DESIGNED BY: B. PICKETT
DRAWN BY: N. SIEBACH
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JEA Building Community sm

SOUTHWEST WATER RECLAMATION FACILITY
MAIN BREAKER REPLACEMENT

ELECTRICAL
ELECTRICAL & GENERATOR BUILDING - TEMPORARY & DEMOLITION

DATE: AUGUST 2017
HAZEN NO.: 42000-008
CONTRACT NO.:
DRAWING NUMBER: E03

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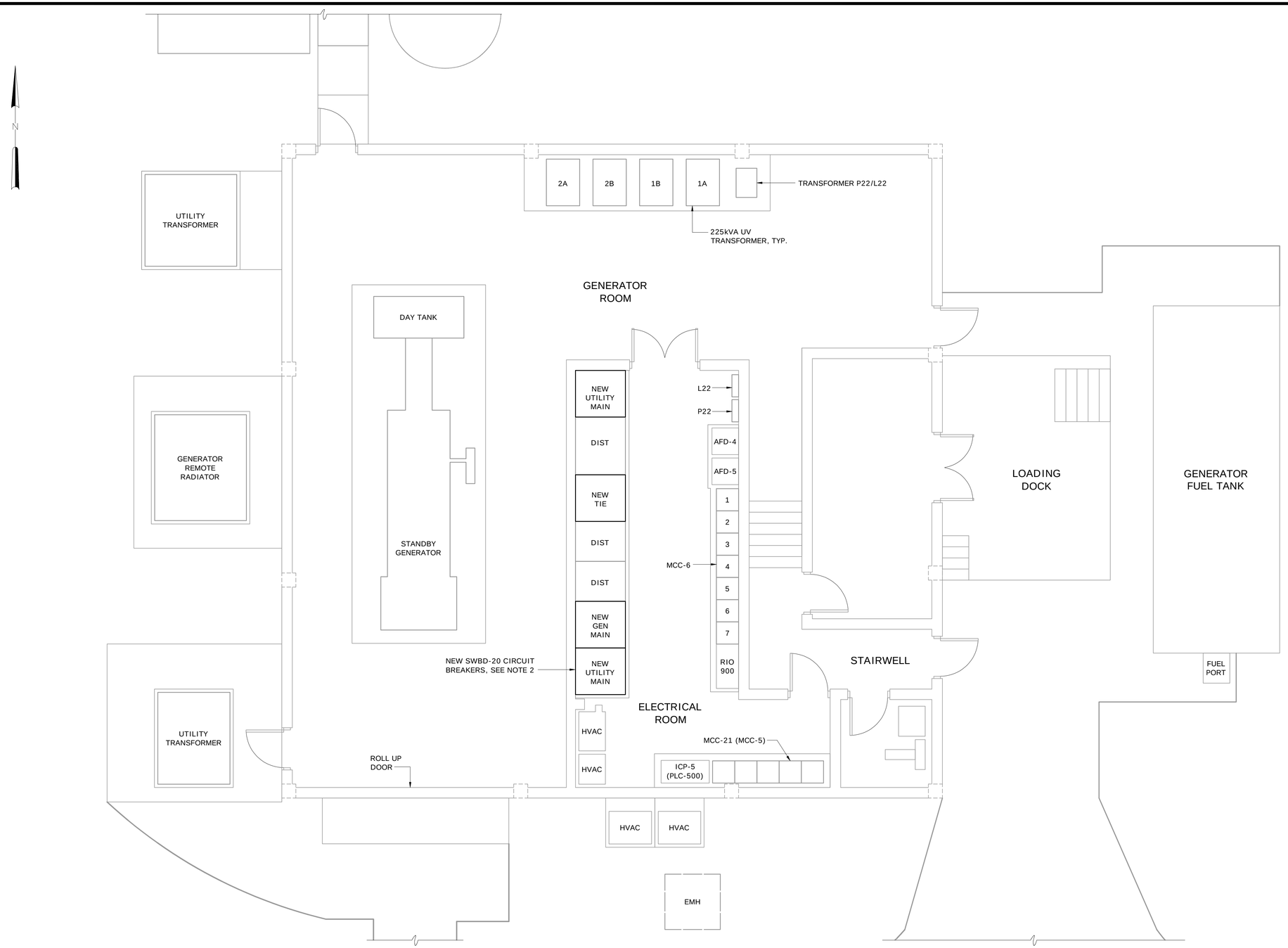


## POWER & GENERATOR BUILDING - PLAN

1/4" = 1' - 0"

1/4"=1'-0" 1 0 1 2 3 7'

## NOTES:

1. CONTRACTOR SHALL FURNISH AND INSTALL NEW SWITCHBOARD CIRCUIT BREAKERS, POWER MONITORS, AND TRANSFER CONTROLS FOR SWBD-20 AS INDICATED. NEW EQUIPMENT SHALL BE PROVIDED WITH THE APPROPRIATE LUGS AND APPROPRIATE CABLE ENTRY DIMENSIONS TO ALLOW EXISTING SUPPLY AND FEEDER CABLES TO BE RE-USED, WITHOUT PULLING ANY NEW CONDUCTORS. FIELD MODIFICATIONS TO ACCOUNT FOR ERRORS IS UNACCEPTABLE AND WILL RESULT IN REJECTION OF THE NEW EQUIPMENT ENTIRELY.
2. CONTRACTOR SHALL TEST ALL EXISTING CONDUCTORS AS REQUIRED. AFTER SUCCESSFUL TESTING, ALL EXISTING CONDUCTORS SHALL BE RE-TERMINATED TO NEW SWITCHBOARD SECTIONS.
3. ALL NEW EQUIPMENT TO BE PROVIDED SHALL BE AS SPECIFIED IN SECTION 16428. SPECIFICATION SECTION 16426 ONLY APPLIES TO THE TEMPORARY SWITCHBOARD.
4. ALL EXISTING SECTIONS OF SWITCHBOARD SWBD-20 SHALL REMAIN AND ONLY COMPONENTS SPECIFICALLY INDICATED HEREIN SHALL BE REPLACED. ALL EXISTING DOORS WHICH ARE PROVIDED WITH NEW EQUIPMENT ( POWER MONITORS, TRANSFER CONTROLS, CIRCUIT BREAKERS, ETC.) WHERE THE NEW EQUIPMENT DOES NOT FILL THE ENTIRE VOID SPACE SHALL BE PROVIDED WITH A NEW DOOR FOR THAT SECTION.

| REV | ISSUED FOR | DATE | BY |
|---|---|---|---|
| 4 | BID SET | 08/2017 | J.B.P. |
| 3 | 90% DESIGN | 07/2017 | J.B.P. |
| 2 | 30% DESIGN | 07/2017 | J.B.P. |
| 1 | 10% DESIGN | 06/2017 | J.B.P. |

| | |
|---|---|
| PROJECT ENGINEER: | B. PICKETT |
| DESIGNED BY: | B. PICKETT |
| DRAWN BY: | N. SIEBACH |
| CHECKED BY: | J. BURKE |
| IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE | 0 1/2" 1" |

JOSEPH B. PICKETT, PE NO. 74106


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JACKSONVILLE, FLORIDA 32216
CERTIFICATE OF AUTHORIZATION NO. : 2771


JEA Building Community sm

SOUTHWEST WATER RECLAMATION FACILITY
MAIN BREAKER REPLACEMENT

ELECTRICAL
ELECTRICAL & GENERATOR
BUILDING - MODIFIED

| | |
|---|---|
| DATE: | AUGUST 2017 |
| HAZEN NO.: | 42000-008 |
| CONTRACT NO.: | |
| DRAWING NUMBER: | E04 |


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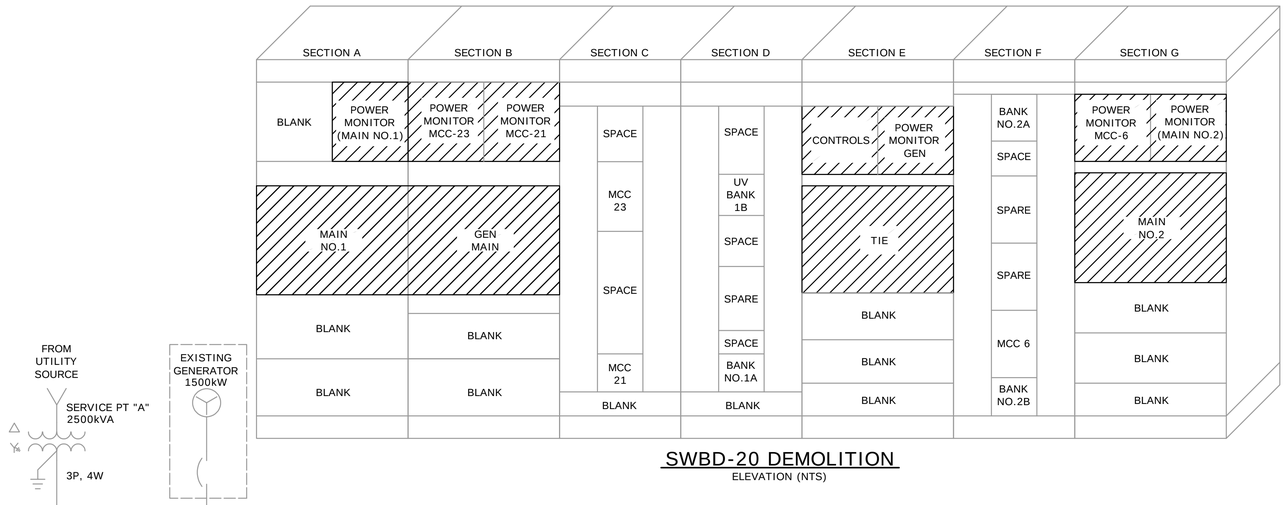
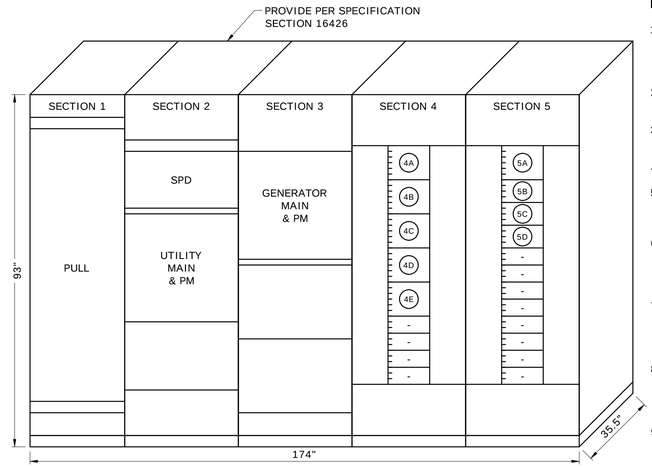



## SWBD-20 DEMOLITION

ELEVATION (NTS)

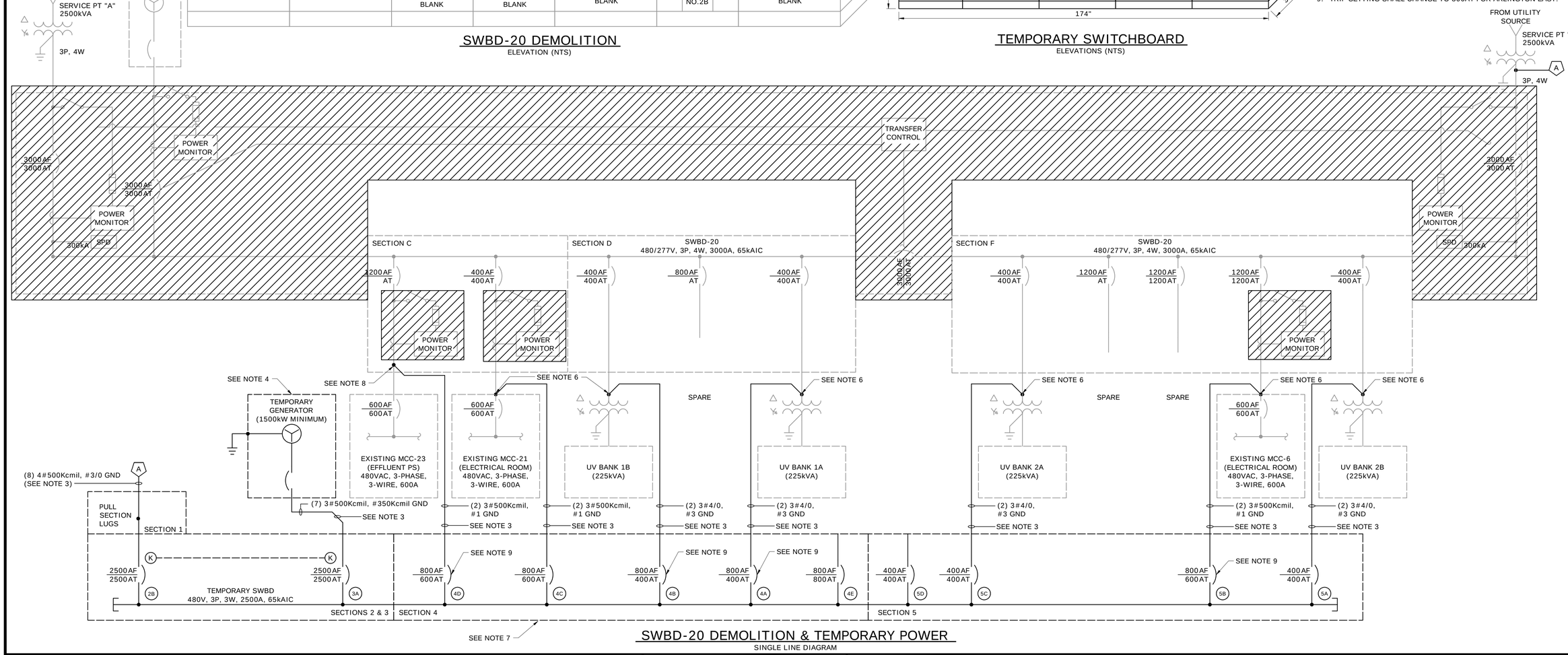



## TEMPORARY SWITCHBOARD

ELEVATIONS (NTS)

## NOTES:

1. EXISTING SWBD-20 IS A QED POWER STYLE SWITCHBOARD LINEUP AS MANUFACTURED BY SQUARE D WITH THE FOLLOWING RATINGS: NEMA TYPE 1, 480/277V, 60HZ, 3000A, 3-PHASE, 4-WIRE, PLANT CODE: 85 SERIAL NO: 13320599-005.
2. CONTRACTOR SHALL DEMOLISH EXISTING POWER MONITORS, CIRCUIT BREAKERS, AND CONTROLS IN SWITCHBOARD AS INDICATED.
3. TEMPORARY CONDUCTORS NEATLY ARRANGED ON THE GROUND IN PVC SCH 40 CONDUIT.
4. CONTRACTOR PROVIDED TEMPORARY GENERATOR.
5. ALL EQUIPMENT AND CONDUCTORS INDICATED AS TEMPORARY SHALL BE DISCONNECTED AT THE END OF THE PROJECT AND RELOCATED TO ARLINGTON EAST WRF. COORDINATE DETAILS WITH JEA.
6. CONTRACTOR SHALL DE-TERMINATE EXISTING FEEDERS ON THE LINE SIDE OF THE EXISTING MAIN BREAKER AND SAFELY SECURE CABLES. TERMINATE TEMPORARY CABLES TO ENERGIZE EQUIPMENT. CONTRACTOR TO PROVIDE ANY/ALL LUGS OR CONNECTING MEANS AS REQUIRED.
7. TEMPORARY SWITCHBOARD SHALL BE PROVIDED WITH CIRCUIT BREAKERS EQUIPPED WITH ADJUSTABLE TRIP UNITS TO ALLOW FOR USE ON BOTH SOUTHWEST WRF AND ARLINGTON EAST WRF PROJECTS. FRAME SIZES SELECTED FOR THE TEMPORARY SWITCHBOARD ONE LARGE ENOUGH FOR EACH APPLICATION.
8. EXISTING MCC-23 IS LOCATED IN ANOTHER BUILDING. FOR THIS TEMPORARY CONNECTION CONTRACTOR SHALL DETERMINATE FEEDER WITHIN SWBD-20 AND TEMPORARILY MECHANICALLY SPLICE TEMPORARY CABLES WITH EXISTING FEEDER USING POLARIS LUGS OF OTHER ENGINEER APPROVED, REVERSIBLE, CONNECTION.
9. TRIP SETTING SHALL CHANGE TO 800AT FOR ARLINGTON EAST.




## SWBD-20 DEMOLITION & TEMPORARY POWER

SINGLE LINE DIAGRAM

| REV | ISSUED FOR | DATE | BY |
|---|---|---|---|
| 4 | BID SET | 08/2017 | J.B.P. |
| 3 | 90% DESIGN | 07/2017 | J.B.P. |
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PROJECT ENGINEER: B. PICKETT
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CERTIFICATE OF AUTHORIZATION NO. : 2771

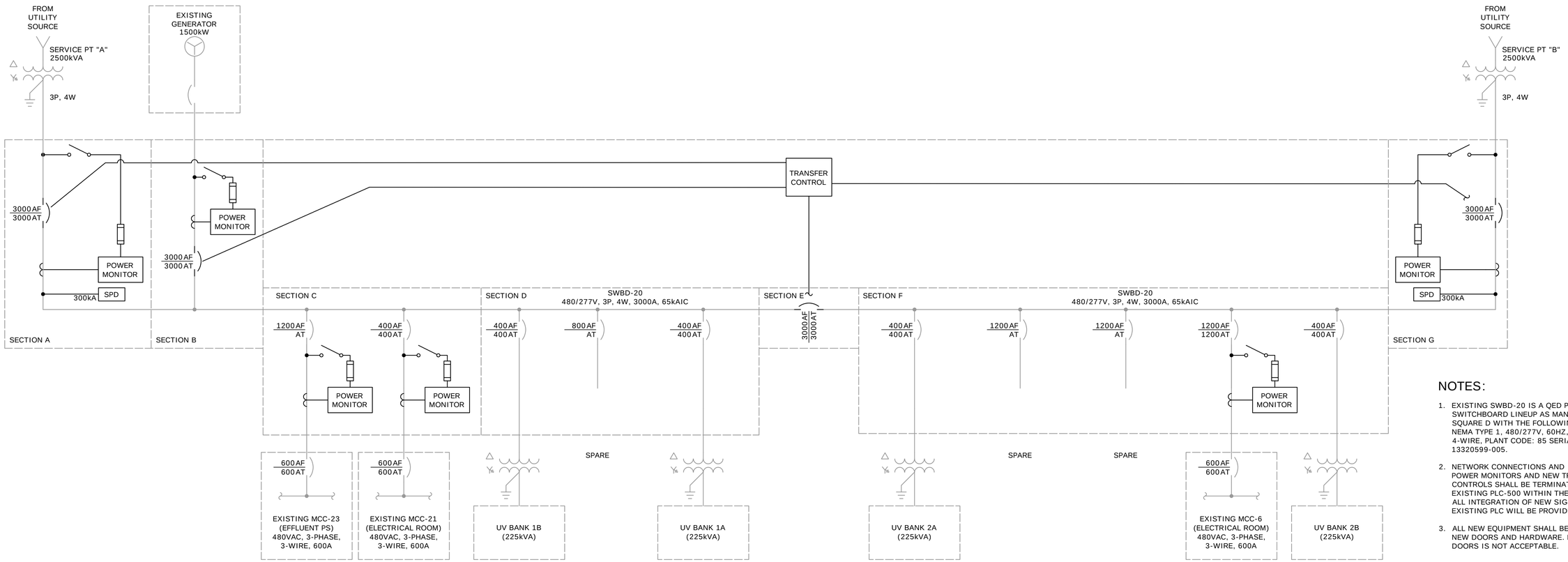
JEA Building Community

SOUTHWEST WATER RECLAMATION FACILITY
MAIN BREAKER REPLACEMENT

ELECTRICAL
SWBD-20 SINGLE LINE DIAGRAM
- TEMPORARY AND DEMOLITION

DATE: AUGUST 2017
HAZEN NO.: 42000-008
CONTRACT NO.:
DRAWING NUMBER: E05

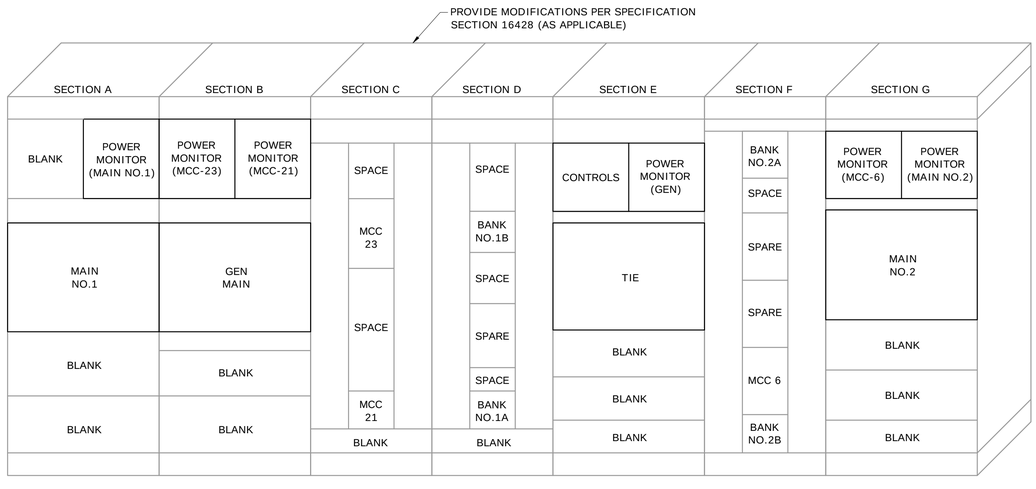
File: G:\42000-RAL\42000-008\DESIGN\DRAWINGS\ELEC\E05 Saved By: TRAHLAN Save Date: 2017/08/22 5:37 PM
PLOT DATE: 2017/08/22 5:45:48 PM By: TRAHLAN



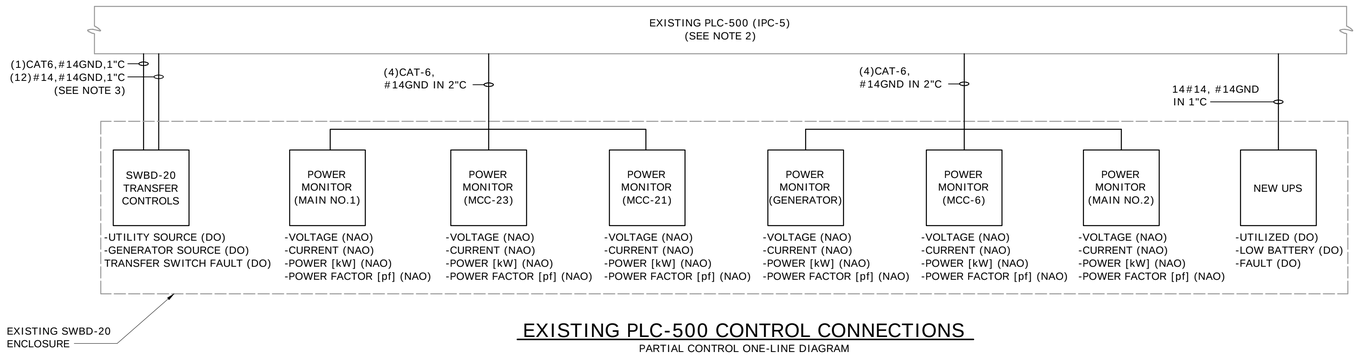

## SWBD-20 MODIFIED
SINGLE LINE DIAGRAM

## NOTES:

1. EXISTING SWBD-20 IS A QED POWER STYLE SWITCHBOARD LINEUP AS MANUFACTURED BY SQUARE D WITH THE FOLLOWING RATINGS: NEMA TYPE 1, 480/277V, 60HZ, 3000A, 3-PHASE, 4-WIRE, PLANT CODE: 85 SERIAL NO: 13320599-005.
2. NETWORK CONNECTIONS AND I/O FROM NEW POWER MONITORS AND NEW TRANSFER CONTROLS SHALL BE TERMINATED TO THE EXISTING PLC-500 WITHIN THE ELECTRICAL ROOM. ALL INTEGRATION OF NEW SIGNALS INTO THE EXISTING PLC WILL BE PROVIDED BY JEA.
3. ALL NEW EQUIPMENT SHALL BE PROVIDED WITH NEW DOORS AND HARDWARE. REUSE OF OLD DOORS IS NOT ACCEPTABLE.




## SWBD-20 MODIFIED
ELEVATION (NTS)




## EXISTING PLC-500 CONTROL CONNECTIONS
PARTIAL CONTROL ONE-LINE DIAGRAM

| REV | ISSUED FOR | DATE | BY |
|---|---|---|---|
| 4 | BID SET | 08/2017 | J.B.P. |
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JEA Building Community sm

SOUTHWEST WATER RECLAMATION FACILITY
MAIN BREAKER REPLACEMENT

ELECTRICAL
SWBD-20 SINGLE LINE DIAGRAM - MODIFIED

DATE: AUGUST 2017
HAZEN NO.: 42000-008
CONTRACT NO.:
DRAWING NUMBER: E06

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**TECHNICAL SPECIFICATIONS FOR THE CONSTRUCTION OF THE**

# SOUTHWEST WATER RECLAMATION FACILITY MAIN BREAKER REPLACEMENT

**BID SET**

**HAZEN PROJECT NO. 42000-008**

**AUGUST 2017**

**HAZEN AND SAWYER, P.C.**

JOSEPH B. PICKETT, PE
No. 74106
ELECTRICAL

**JEA**
**SOUTHWEST WATER RECLAMATION FACILITY**
**MAIN BREAKER REPLACEMENT**
**BID DOCUMENTS**
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01020 Construction Sequencing/Constraints
01025 Measurement and Payment
01035 Modification Procedures
01040 Coordination
01070 Abbreviations
01090 Reference Standards
01300 Submittals
01370 Schedule of Values
01400 Quality Control
01510 Temporary Utilities
01520 Maintenance of Utility Operations During Construction
01530 Protection of Existing Facilities
01540 Demolition and Removal of Existing Structures and Equipment
01541 Field Engineering
01550 Site Access and Storage
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01600 Materials and Equipment
01660 Equipment Testing and Plant Startup
01700 Project Closeout
01720 Project Record Drawings
01730 Operation and Maintenance Manuals


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**DIVISION 17 – INSTRUMENTATION (NOT USED)**

SECTION 01010

SUMMARY OF WORK

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Work to be performed under this Contract shall consist of furnishing and installation of all tools, equipment, materials, supplies, manufactured articles, transportation and services, including fuel, power, water, and essential communications, for the performance of all labor, work, and/or other operations as required at the Southwest Water Reclamation Facility (WRF) in strict accordance with the Contract Documents. The Work shall be complete, and all work, materials, and services not expressly shown or called for in the Contract Documents which may be necessary for the complete and proper construction of the Work in good faith shall be performed, furnished, and installed by the CONTRACTOR as though originally so specified or shown, at no increase in cost to JEA.

B. Wherever the Contract Documents address a third party, i.e., subcontractor, manufacturer, etc., it is to be considered as the CONTRACTOR through the third party.

C. Wherever a reference to number of days is noted, it shall be construed to mean calendar days.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The principal features of the Work to be performed under this Contract include, but not limited to, the following:

1. Temporary installation of power distribution switchboards, portable generator, and cables.

2. Replacement of existing circuit breakers within existing switchboard assembly.

3. Replacement of transfer controls and power monitoring equipment within existing switchboard assembly.

4. Qualified Contractor’s representative on site 24 hours a day during time period plant is utilizing temporary electrical equipment.

5. Testing of temporary equipment prior to energizing, and testing of new equipment.

B. The foregoing description(s) shall not be construed as a complete description of all work required.

C. The Work set forth within these bid documents includes the furnishing of all labor, materials, equipment, services and incidentals for the construction of the improvements, as noted in the total bid including all mechanical, electrical, structural, and all appurtenant work, complete, tested and ready for operation, including temporary facilities required, all in conformance with Contract Document requirements.

D. All work shall be in compliance with all applicable federal, state and local laws and regulations, including those for materials that contain lead. All work shall meet OSHA compliance.

E. The Work shall be performed at the Southwest WRF located at 5420 118th St, Jacksonville, Florida.

1.03 ABANDONMENT AND SALVAGE OF EXISTING FACILITIES

A. The scope of work requires the CONTRACTOR to interface with existing structures, mechanical equipment, electrical facilities and piping which will be abandoned or otherwise removed as part of the work. Prior to beginning any work associated with existing facilities to be abandoned, salvaged, or otherwise removed, the CONTRACTOR shall inform JEA of his intent so that all arrangements can be made with JEA for disconnecting electrical service (where appropriate), isolating pipelines (where possible) or otherwise removing existing facilities from service to the extent possible. The CONTRACTOR shall not proceed without written authorization from JEA.

B. Salvage: JEA may desire to salvage certain items of existing equipment which are to be dismantled and removed during the course of construction. All other items of equipment shall be disposed of off-site by the CONTRACTOR at his expense, in accordance with applicable laws, ordinances and regulations. The disposition of salvable material shall be in accordance with the Contract, the JEA Water and Sewer Standards Manual (latest edition), and as specified herein.

1.04 CONTRACTOR'S USE OF PROJECT SITE

A. The CONTRACTOR's use of the project site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities as noted in the Contract Drawings.

B. Disposal of Debris: All debris shall be disposed of in accordance with the JEA Water and Sewer Standards Manual (latest edition). Debris shall be disposed of in accordance with applicable federal, state, and local regulations. The CONTRACTOR is responsible for determining these regulations and shall bear all costs or retain any profit associated with disposal of these items.

C. The CONTRACTOR shall provide a daily log of deliveries to the project site for the project as described in Section 01550, Site Access and Storage.

1.05 JEA USE OF THE PROJECT SITE

A. JEA may utilize all or part of the facilities during the entire period of construction for the conduct of JEA's normal operations. The CONTRACTOR shall cooperate with JEA to minimize interference with the CONTRACTOR's operations and to facilitate JEA's operations.

1.06 PROJECT MEETINGS

A. Pre-Construction Meeting: A Pre-Construction meeting shall be held in accordance with the Contract.

1. Unless previously submitted to JEA, the CONTRACTOR shall bring to the conference one copy each of the following:

   a. JEA-approved schedule, previously submitted in accordance with the Contract.

   b. Preliminary procurement schedule of major equipment and materials and items requiring long lead time.

   c. Preliminary Shop Drawing/Sample/Substitute or "Or Equal" submittal schedule.

   e. Schedule of Values (lump sum price breakdown) for progress payment purposes.

   f. Preliminary Cash flow.

2. The purpose of the meeting is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:

   a. CONTRACTOR's tentative schedules.

   b. Transmittal, review, and distribution of CONTRACTOR's submittals.

   c. Processing applications for payment.

   d. Maintaining record documents.

   e. Critical work sequencing.

   f. Field decisions and Change Orders.

   g. Use of project site, office and storage areas, security, housekeeping and JEA's needs.

   h. Major equipment deliveries and priorities.

3. JEA will preside at the Pre-Construction meeting and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

B. Progress Meetings: JEA will schedule and hold on-site progress meetings, conducted monthly and as necessary and/or requested by JEA. JEA designated representatives, CONTRACTOR, and all subcontractors active on the site shall be represented at each meeting. CONTRACTOR may at its discretion request attendance by representatives of its suppliers, manufacturers, and other subcontractors.

   1. JEA will preside at the meetings and provide for keeping and distribution of the minutes. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.

2. The CONTRACTOR shall attend meetings held to coordinate work between other contracts that may be on-going on the project site. The General Superintendent, Job Superintendent, and/or other key representatives of each prime CONTRACTOR shall attend these meetings, at JEA's request.

1.07 PERMITS

A. JEA operates this plant under FDEP Permit No: FL0026468.

B. The CONTRACTOR shall pay for and secure all other permits for the work including but not limited to the FDEP National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities.

C. Costs for obtaining permits shall be included in the bid price. JEA will not compensate the CONTRACTOR for permit fees charged by regulatory agencies having jurisdiction over the work.

D. The CONTRACTOR shall furnish to JEA copies of all permits prior to commencement of work requiring permits.

E. The CONTRACTOR shall obtain, keep current and pay all fees for any necessary construction permits from those authorities, agencies, or municipalities having jurisdiction over land areas, utilities, or structures which are located within the Contract limits and which will be occupied, encountered, used, or temporarily interrupted by the CONTRACTOR's operations unless otherwise stated. Record copies of all permits shall be furnished to JEA.

F. When construction permits are accompanied by regulations or requirements issued by a particular authority, agency or municipality, it shall be the CONTRACTOR's responsibility to familiarize himself and comply with such regulations or requirements as they apply to his operations on this Project.

G. CONTRACTOR shall obtain and comply with all trade permits and building permits required. CONTRACTOR will pay for trade and building permits.

H. The CONTRACTOR shall provide any required Performance and Indemnity Bond(s).

1.08 FIELD ENGINEERING

A. Provide Field Engineering Services: Establish elevations, lines, and levels, utilizing recognized engineering survey practices in accordance with Section 01541.

B. If dimensions of equipment or piping locations are not shown on the Drawings, the CONTRACTOR shall coordinate such accordingly with JEA.

1.09 SITE CONDITIONS

A. The CONTRACTOR acknowledges that it has investigated prior to bidding and satisfied itself as to the conditions affecting the Work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, river stages, tides, water tables or similar physical conditions at the site, the conformation and conditions of the

ground, the character of equipment and facilities needed preliminary to and during execution of the Work. The CONTRACTOR further acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, or any contiguous site, as well as from information presented by the Drawings and Specifications made a part of this Contract, or any other information made available to it prior to receipt of Bids. Any failure by the CONTRACTOR to acquaint itself with the available information will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the Work. JEA assumes no responsibility for any conclusions or interpretations made by the CONTRACTOR on the basis of the information made available by JEA.

1.10 DIMENSIONS OF EXISTING FACILITIES

A. Where the dimensions and locations of existing improvements are of critical importance in the installation or connection of new work, the CONTRACTOR shall verify such dimensions and locations in the field prior to the fabrication and/or installation of materials or equipment which are dependent on the correctness of such information.

1.11 CONTRACT DOCUMENTS

A. The Work to be done is shown on the Drawings entitled JEA Southwest Water Reclamation Facility Main Breaker Replacement. The numbers and titles of all Drawings appear on the Drawing Cover Page. All drawings so enumerated shall be considered an integral part of the Contract Documents as defined herein.

B. Certain Document Sections refer to Divisions of the Contract Specifications. Sections are each individually numbered portions of the Specifications (numerically) such as 08110, 13182, 15206, etc. The term Division is used as a convenience term meaning all Sections within a numerical grouping. For example, Division 16 would thus include Sections 16000 through 16999 and would mean all electrical specifications.

1.12 GENERAL ARRANGEMENT

A. Drawings indicate the extent and general arrangement of the work. If any departures from the Drawings are deemed necessary by the CONTRACTOR to accommodate the materials and equipment he proposes to furnish, details of such departures and reasons therefore shall be submitted as soon as practicable to JEA for approval. No such departures shall be made without the prior written approval of JEA. Approved changes shall be made without additional cost to JEA for this work or related work under other Contracts of the Project.

B. The specific equipment proposed for use by the CONTRACTOR on the project may require changes in structures, auxiliary equipment, piping, electrical, mechanical, controls or other work to provide a complete satisfactory operating installation. The CONTRACTOR shall submit to JEA, for approval, all necessary Drawings and details showing such changes to verify conformance with the overall project structural and architectural requirements and overall project operating performance. The Bid Price shall include all costs in connection with the preparation of new drawings and details and all changes to construction work to accommodate the proposed equipment, including increases in the costs of other Contracts.

1.13 ADDITIONAL ENGINEERING SERVICES

A. In the event that the Engineer is required to provide additional engineering services as a result of substitution of materials or equipment which are not "or equal" by the CONTRACTOR, or changes by the CONTRACTOR in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Engineer is required to examine and evaluate any changes proposed by the CONTRACTOR for the convenience of the CONTRACTOR, then the Engineer's charges in connection with such additional services shall be charged to the CONTRACTOR by JEA.

B. Structural design shown on the Contract Drawings is based upon typical weights for major items of equipment as indicated on the Contract Drawings and specified. If the equipment furnished differs from that specified in the Contract Documents such that actual weight exceeds the weight of specified equipment, the CONTRACTOR shall assume the responsibility for all costs of redesign and for any construction changes required to accommodate the equipment furnished, including the Engineer's expenses in connection therewith, provided that the original weight assumptions were correct.

C. In the event that the Engineer is required to provide additional engineering services as a result of CONTRACTOR’s errors, omissions, or failure to conform to the requirements of the Contract Documents, or if the Engineer is required to examine and evaluate any changes proposed by the CONTRACTOR solely for the convenience of the CONTRACTOR, then the Engineer's charges in connection with such additional services shall be charged to the CONTRACTOR by JEA.

1.14 SUBSURFACE DATA

A. Subsurface data are offered in good faith solely for placing the Bidder in receipt of all information available to JEA and in no event is to be considered as part of the Contract Documents.

B. The Bidder must interpret such subsurface data according to his own judgment and acknowledge that he is not relying upon the same as accurately describing the subsurface conditions, which may be found to exist.

1. The test boring logs present factual information of the subsurface conditions at the specific test boring location only. The Bidder should not consider, or conclude, that the subsurface conditions will be consistent between test boring locations.

C. In making this data available, JEA makes no guarantee, either expressed or implied, as to their accuracy or to the accuracy of any interpretation thereof.

1.15 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, or reactant of other classification, must show approval of either the EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with all applicable rules and regulations.

1.16 FIRST AID FACILITIES AND ACCIDENTS

A. First Aid Facilities: The CONTRACTOR shall provide at the site such equipment and facilities as are necessary to supply first aid to any of his personnel who may be injured in connection with the work.

B. Accidents

1. The CONTRACTOR shall promptly report, in writing, to JEA all accidents whatsoever out of, or in connection with, the performance of the work, whether on or adjacent to the site, which cause death, personal injury or property damage, giving full details and statements of witnesses.

2. If death, serious injuries, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to JEA.

3. If any claim is made by anyone against the CONTRACTOR or a Subcontractor on account of any accidents, the CONTRACTOR shall promptly report the facts, in writing, to JEA, giving full details of the claim.

1.17 WEATHER CONDITIONS

A. No work shall be done when the weather is unsuitable. The CONTRACTOR shall take necessary precautions (in the event of impending severe weather, including hurricanes, tropical storms or major rain/wind storms) to protect all work, materials, or equipment from damage or deterioration due to floods, driving rain, and/or wind. JEA reserves the right, to order that additional protection measures over and beyond those proposed by the CONTRACTOR, be taken to safeguard all components of the Project.

B. The mixing and placing of concrete or pavement courses, the laying of masonry, and installation of sewers and water mains shall be stopped during rainstorms, if ordered by JEA; and all freshly placed work shall be protected by canvas or other suitable covering in such manner as to prevent running water from coming in contact with it. Sufficient coverings shall be provided and kept ready at hand for this purpose. The limitations and requirements for mixing and placing concrete, or laying of masonry, in cold weather shall be as described elsewhere in these Specifications.

1.18 PERIODIC CLEANUP: BASIC SITE RESTORATION

A. During construction, the CONTRACTOR shall regularly remove from the site of the work all accumulated debris and surplus materials of any kind which result from his operations. Unused equipment and tools shall be stored at the CONTRACTOR's yard or base of operations for the Project.

B. When the work involves installation of sewers, drains, water mains, manholes, underground structures, or other disturbance of existing features in or across streets, rights-of-way, easements, or private property, the CONTRACTOR shall (as the work progresses) promptly backfill, compact, grade, and otherwise restore the disturbed area to the basic condition which will permit resumption of pedestrian or vehicular traffic and any other critical activity or functions consistent with the original use of the land. The requirements for temporary paving of streets, walks, and driveways are specified

elsewhere. Unsightly mounds of earth, large stones, boulders, and debris shall be removed so that the site presents a neat appearance.

C. The CONTRACTOR shall perform the cleanup work on a regular basis and as frequently as ordered by JEA. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore, such work shall also be accomplished, when ordered by JEA, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.

D. Upon failure of the CONTRACTOR to perform periodic cleanup and basic restoration of the site to JEA's satisfaction, JEA may, upon five days prior written notice to the CONTRACTOR, without prejudice to any other rights or remedies of JEA, cause such work for which the CONTRACTOR is responsible to be accomplished to the extent deemed necessary by JEA, and all costs resulting therefrom shall be charged to the CONTRACTOR and deducted from the amounts of money that may be due him.

1.19 USE OF FACILITIES BEFORE COMPLETION

A. JEA reserves the right to enter and use any portion of the constructed facilities before final completion of the whole work to be done under this Contract. However, only those portions of the facilities which have been completed to JEA's satisfaction, as evidenced by his issuing a Certificate of Substantial Completion to the CONTRACTOR covering that part of the work, shall be placed in service.

B. It shall be JEA's responsibility to prevent premature connections to or use of any portion of the installed facilities by private or public parties, persons or groups of persons, before JEA issues his Certificate of Substantial Completion covering that portion of the work to be placed in service.

C. Consistent with the approved progress schedule, the CONTRACTOR shall cooperate with JEA to accelerate completion of those facilities, or portions thereof, which have been designated for early use by JEA.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01020

CONSTRUCTION SEQUENCING/CONSTRAINTS

PART 1 -- GENERAL

1.01 RELATED WORK DESCRIBED ELSEWHERE

A. Section 01520 – Maintenance of Utility Operations During Construction

1.02 OVERALL SEQUENCE OF CONSTRUCTION

A. Work under the Contract shall be scheduled and performed in such a manner as to result in the least possible disruption to the operation of the existing treatment facilities. Process control modifications shall not be made without first obtaining written permission from the Engineer.

B. Critical events in the sequence of construction are specified herein. The outline sequence of construction does not include all items necessary to complete the work, but is intended to identify the sequence of critical events necessary to minimize disruption to the on-going treatment plant process and to ensure compliance with discharge requirements. It shall be understood by the CONTRACTOR that the critical events identified are not all inclusive and that additional items of work not shown may be required. The sequence of construction is a precedence requirement and does not attempt to schedule the CONTRACTOR's work. It is intended only to indicate which activities must precede other activities in order to minimize interferences and disruptions.

1. Stage I - Mobilization and Preliminary Site Work

a. Mobilize for work - set up field offices and staging area, obtain permits, develop and submit construction schedule, shop drawing schedule and begin shop drawing submittals.

b. Clear and grub areas and install temporary erosion control measures as identified in the contract documents.

2. Stage II – Construction and Start-Up of Facilities, in accordance with Section 01520, “Maintenance of Utility Operations During Construction”

3. Stage III - Project Closeout

a. Complete project closeout in accordance with Section 01700, "Project Closeout".

b. Final acceptance of the project.

C. The existing facilities shall be maintained in an operable condition by the CONTRACTOR during construction (excluded from this requirement are all normal and emergency maintenance functions normally performed by JEA with JEA's staff or by Contract.)

D. At no time shall the CONTRACTOR undertake to close off any pipelines, or open valves, or take any other action which would affect the operation of the existing treatment plant.

E. The following items are subject to construction sequence and time constraint in order to maintain a fully operational plant. The CONTRACTOR shall note that each item of work is subject to the Engineer's review and acceptance.

F. Temporary mechanical, electrical and instrumentation installations/connections may be required to complete a particular aspect of work. All such subject temporary installations shall be subject to review and acceptance by the Engineer. All such temporary work shall be provided at no change in the Contract time or price.

1.03 DETAILED SEQUENCE OF CONSTRUCTION AND CONSTRAINTS

A. The CONTRACTOR shall schedule and perform the work so that the plant and its individual process facilities are maintained in continuous operation during the construction period except during approved plant or process interruptions. All short-term system or partial system shutdowns or diversions shall be submitted to JEA/Engineer in writing. No shutdowns or diversions shall be allowed without written approval from JEA/Engineer.

B. The CONTRACTOR shall submit a detailed, written plan of operation for each work item related to proposed shutdowns to JEA/Engineer for their review and approval. The plan of operation shall be submitted at least 14 days prior to the scheduled commencement date for that work. JEA/Engineer will review and return the plan with comments within 7 days. The CONTRACTOR shall schedule a meeting between the CONTRACTOR, JEA and Engineer to incorporate JEA/Engineer comments and finalize scheduling of the work. A final (revised) written plan of operation shall then be submitted to JEA/Engineer. The final plan shall be submitted to JEA/Engineer at least 3 days prior to the scheduled commencement date for that work. All work shall then be conducted in accordance with this final written plan of operation, unless agreed to in writing between the CONTRACTOR, JEA and Engineer. The written plan of operation shall address the following items:

1. Step-by-step detailed sequence for performing the work.

2. Anticipated duration of each activity.

3. Documentation on all temporary flow diversion equipment to be utilized by the CONTRACTOR, including tapping saddles, line stops, temporary bypass pumps and piping.

4. For temporary bypass pumps, submit the following:

   a. Quantity, manufacturer and model. Provide sufficient number of pumps to provide standby capacity equal to at least 50 percent of required pumping capacity.

   b. System and certified performance curves to demonstrate that pumps are sized correctly. Where multiple pumps shall be operated simultaneously, provide combined pump curves.

c. Type of drive units. For electric drives, submit details on CONTRACTOR's temporary electrical power source. For gasoline-driven units, provide details on fuel storage and manpower to ensure that adequate fuel supply is maintained.

5. Plan and/or schematic drawings to clearly identify work to be performed. Sequence steps shall be identified on drawings using a keynote legend or similar means.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Payment for the various items in the Schedule of Payment items, as further specified herein, shall include all compensation to be received by the CONTRACTOR for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, taxes, materials, commissions, transportation and handling, bonds, permit fees, insurance, overhead and profit, and incidentals appurtenant to the items of Work being described, as necessary to complete the various items of the Work all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). Such compensation shall also include payment for any loss or damages arising directly or indirectly from the Work.

B. The CONTRACTOR's attention is called to the fact that the quotations for the various items of Work are intended to establish a total price for completing the Work in its entirety. Should the CONTRACTOR feel that the cost for any item of Work has not been established by the Schedule of Payment items or this Section, it shall include the cost for that Work in some other applicable bid item, so that its proposal for the project does reflect its total price for completing the Work in its entirety.

1.02 SCHEDULE OF VALUES

A. The CONTRACTOR shall submit a Schedule of Payment Values in accordance with the instructions to bidders and as specified in Section 01370 entitled “Schedule of Values”.

B. The schedule shall be given in sufficient detail for proper identification of Work accomplished. The Schedule of Values shall directly correlate to each activity outlined in the construction progress schedule (specified in the Section 01300, Submittals) unless otherwise specified by JEA to accurately relate construction progress to the requested payment. Each item shall include its proportional share of all costs including the CONTRACTOR's overhead, contingencies and profit. The sum of all scheduled items shall equal the total value of the Contract.

C. The CONTRACTOR shall submit monthly applications for payment using JEA’s prescribed forms and format in accordance with this contract.

1.03 UNIT QUANTITIES SPECIFIED

A. Any tabulated quantities for the various items of work and materials are approximate only and are given solely to be used as a uniform basis for the comparison of bids. JEA and Engineer make no guarantee that the estimated quantities listed are equal or will be equal to final accepted quantities.

B. Quantities actually required to complete the work will be calculated in accordance with applicable Sections of the Specifications for the specific work items. Payment will be made based on the acceptable quantities submitted by the CONTRACTOR and approved by the Engineer multiplied by the Contract Unit Price for each Item.

1.04 MEASUREMENT OF QUANTITIES

A. Measurement of quantities for the various items of work will be in the units found in the applicable or referenced Specification Sections.

PART 2 -- PRODUCTS

2.01 LUMP SUM CONTRACT ITEMS

A. Contract Payment Item Nos. 1, 2, 3 and 4 have been provided in the Proposal (Bid Form) for the Contract as a lump sum price bid as listed below.

B. Where the Specifications and/or Contract Drawings are silent on Payment for work specified under an individual Specification Section or on the Drawings, it is understood that Payment will be made as part of the lump sum price bid.

1. Contract Item No. 1 – Mobilization/Demobilization (Limited to 5% of Grand Total): Payment will be made at the aggregate sum price bid, which aggregate sum shall be full compensation for the CONTRACTOR'S mobilization on site, including but not limited to bonds, insurance, permit fees scheduling, temporary facilities and all other activities necessary to prepare to complete the Contract work.

2. Contract Item No. 2 – All Work associated with the Construction of the Southwest Water Reclamation Facility Main Breaker Replacement Project to make it ready for operation. Shall include, but not be limited to: cleaning, debris disposal, concrete, structural steel, metal fabrications and systems, equipment, electrical, piping, fittings, valves, and all other work necessary for a complete and fully functioning system, as specified and show in the Contract Documents whether specifically mentioned or implied, except that Work specifically included for payment under any other Bid Item.

3. Contract Item No. 3 – Supplemental Work Authorization (SWA): The JEA Representative will issue a written SWA to incorporate cost or schedule changes into the Contract. The SWA shall be used for increases and decreases in the Contract price, within the SWA amount set forth in the Bid, or to make changes in schedule for performance of the Work. An SWA work shall authorize the CONTRACTOR to perform changes in the Work. The CONTRACTOR shall not start on SWA work until the CONTRACTOR receives a fully authorized, written SWA form, signed by the appropriate JEA personnel – the CONTRACTOR shall not consider verbal statements as authorization to proceed with the changes. The CONTRACTOR should not expect that any SWAs will be issued. JEA shall have no obligation to pay for SWA work unless the same is performed pursuant to a written SWA form signed before the SWA work is commenced.

2.02 UNIT PRICE CONTRACT ITEMS

A. Not Applicable

PART 3 -- EXECUTION

3.01 PAYMENT

A. The Total Bid Price for the Contract shall include, as applicable, the following items:

1. Lump Sum Contract item as specified, Item Nos. 1 through 3.

B. Payment for the total bid price shall be in accordance with the requirements of the Contract Documents.

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SECTION 01035

MODIFICATION PROCEDURES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide all labor, materials, equipment and appliances required for the complete execution of additions, modifications and alterations to existing buildings and structures as shown on the Drawings and specified under the various Sections of the Contract Specifications and as required by conditions at the site.

B. The CONTRACTOR shall have examined all work to be performed to the existing buildings and familiarize himself with the nature and extent to which the existing buildings will be damaged, items removed or rearranged due to the work under his Contract and that of other Contracts.

1. Cutting and patching shall conform to the requirements of the General Conditions, Supplemental Conditions, and as specified herein.

2. Patching work shall be performed with similar materials and in the same manner as adjoining work. Joining between old and new work shall be perfect and practically invisible. All due caution shall be taken to obtain a bond between old and new work.

C. Major portions of the work are indicated on the Drawings and the accompanying Specifications thereto. All work must be complete in all respects and executed with high quality workmanship.

D. Work not specifically indicated by details or general notes on the Drawings may include the following:

1. Re-pointing blockwork; removing and replacing broken, cracked, disintegrating and missing blockwork, utilizing mortar, block and finishes.

3. Removing loose rust, sealing or peeling paint from metal surfaces by scraping, sanding or wire brushing; priming and repainting metal surface (inside and outside).

7. Patching, cleaning, sealing and resurfacing concrete floors, walls, lintels, sills and trim and replacing lintels where broken.

8. Cutting and modifying existing openings as necessary to receive new work and providing new lintels, doors, frames, etc.

9. Patching existing doors and frames and refinishing as required.

10. Patching, refinishing and/or replacing ceilings.

1.02 SITE AND BUILDINGS

A. Site Visit: Prior to submission of Bids, the CONTRACTOR shall have visited the site and thoroughly acquainted himself with the exact nature of the work indicated on the Drawings and the Specifications requirements. Failure to comply with the aforementioned requirements shall not constitute a basis for claims for additional compensation.

B. Measurements: Prior to ordering any materials or doing any work, the CONTRACTOR shall verify all measurements, dimensions and other conditions of each building scheduled for work as may be necessary or required in connection with his work. The CONTRACTOR shall be responsible for the correctness of same.

1.03 MATERIALS

A. All materials to perform and complete the work shall be new. Salvaged materials, such as brick, stone copings, granite sills, may be used under certain conditions subject to the approval of JEA.

B. All salvaged materials shall be sound and undamaged. Materials to be reused shall be stored and protected as directed by JEA. Care shall be taken to prevent damage to materials or equipment to be reused.

1.04 SHORING, UNDERPINNING AND BRACING

A. When necessary and required, the CONTRACTOR shall provide underpinning and temporary shoring and bracings, all in accordance with code requirements, and as approved by JEA.

B. Shoring and bracing shall be of such form and so installed as to safely support the work and interfere as little as possible with the progress of the work. Suitable means shall be provided to adjust any settlement in the shoring supports. Temporary shoring shall consist of sound timbers or rolled shapes of required dimensions which shall be removed after necessity for same ceases to exist. All work removed or damaged through installation of temporary shoring or through improper shoring shall be replaced or repaired after the shoring is removed, at no additional cost to JEA.

1.05 WORK PREPARATION AND TEMPORARY ACCESS

A. The CONTRACTOR, before commencing work, shall prepare and submit for approval a progress schedule in accordance with the requirements of Section 01300 entitled "Submittals", in order to coordinate the work of all trades and to insure completion on or before the completion date. JEA reserves the right to revise or modify such schedules as required to expedite each phase of work and to coordinate such work with the partial use of the building for purposes as directed.

B. No facility such as toilets, corridors, etc., shall be barricaded or access restricted without providing other temporary or interim means of access. It is further required that no work specified hereinafter shall disturb or interfere with the operation of the existing mechanical installation until proposed new work has been completed or satisfactorily installed. Exception may be made to this requirement only by written approval from JEA.

C. Detailed sequence of availability of areas within the present buildings where work is to be performed under each Contract shall be in accordance with Section 01520 entitled "Maintenance of Utility Operations During Construction", but may be modified by the CONTRACTOR, upon authorization by JEA as the work progresses.

D. Existing built-in equipment to remain in the final work, but requiring temporary removal for the installation of new construction, alterations, repairs and/or renovations, shall be disconnected by the CONTRACTOR and removed to temporary storage areas designated by JEA. Resetting of existing equipment under this heading shall be performed by the CONTRACTOR including connecting to electric service lines.

E. The CONTRACTOR shall furnish and install all temporary fire exits, fire extinguishers, hose and safety devices as may be required by authorities having jurisdiction.

F. Work within existing buildings to be performed, once started, shall be completed as quickly as practicable and each trade shall determine before work is started that all required materials are at hand or readily obtainable to avoid delays.

G. Shutdowns of existing services within existing buildings which may be occupied during construction will be permitted only upon written approval by JEA subject to at least three weeks notice in writing to JEA in each case. Shutdowns will be limited to times which will result in the least interference with normal operations. Refer to Section 01520 entitled "Maintenance of Utility Operations During Construction" for additional requirements.

1.06 DUST-PROOF PARTITIONS

A. The CONTRACTOR shall furnish and erect all necessary temporary dust-proof partitions where required to protect unaltered portions of existing buildings and structures or as directed by JEA.

B. Partitions shall be constructed of wood studs with plywood on both sides. Partitions shall extend from floor to ceiling with a closure plate at floor and ceiling. The CONTRACTOR shall furnish and install one door in each enclosure complete with hardware attached and keyed as directed. Such enclosures will be required in areas of major demolition work and for protection of existing equipment.

1.07 WEATHER PROTECTION

A. Where exterior walls or roofs are being altered, or disturbed for any adjacent alteration, the CONTRACTOR shall provide temporary weather protection in those areas to keep interior of buildings absolutely dry and unaffected by the weather. The CONTRACTOR will be held responsible for any damage caused by improper protection against weather.

B. Where existing exterior walls or roofs are disturbed due to alterations, disturbances shall be kept to a minimum and walls or roofs shall be repaired and patched in such a manner that the buildings will be absolutely watertight and meet the conditions of the existing roofing flashing and waterproofing bonds and guarantees.

1.08 CUTTING, PATCHING, REPAIRING, AND REFINISHING

A. The CONTRACTOR shall be responsible for cutting all openings in walls, floors and ceilings (indicated to remain) to accommodate alteration work under his Contract in accordance with the requirements of the General Conditions, Supplemental Conditions, and as hereinafter specified. Rough patching and all finish patching shall be by the CONTRACTOR.

1. Where new openings are to occur in existing exterior and interior concrete and masonry bearing walls and structural concrete floor, the CONTRACTOR will be required to notify JEA in writing and shall obtain approval prior to cutting operations. JEA will determine whether such openings affect the structural stability or load bearing capacities of walls and floors.

2. All holes and openings to be cut in existing walls, floors and ceilings of any nature shall be geometrically correct and no larger than necessary to accommodate the new work.

3. No cutting of finished or structural work may be done without the approval of JEA.

B. Major demolition and removal work such as demolition of buildings and structures, complete or nearly complete removal of floors, walls and ceilings indicated on the Drawings, shall be performed by the CONTRACTOR. The CONTRACTOR shall also be responsible for all finish patching operations of holes and openings in existing floors, walls, ceilings and roofs to accommodate the alteration work under the Plumbing, HVAC and Electrical Sections as well as that required for the CONTRACTOR's work hereinafter specified.

C. Each CONTRACTOR and/or his Subcontractors shall provide sleeves, forms and inserts for installation by the CONTRACTOR.

1.09 EXISTING EQUIPMENT AND FURNISHINGS

A. Existing built-in equipment to remain in the final work and requiring temporary removal shall be as hereinbefore specified under Article 1.05, Paragraph D of this Section.

B. Existing appliances and portable equipment such as desks, chairs, tables, etc., shall remain the property of JEA and will be removed from rooms and spaces to be altered by the CONTRACTOR prior to construction and alteration operations, and stored where directed by JEA.

C. All unsalvageable equipment shall become the property of the CONTRACTOR in accordance with the requirements of Section 01540 entitled "Demolition and Removal of Existing Structures and Equipment", and shall be removed from each building and away from the site. Equipment to be retained, or relocated, shall be as shown on the Drawings or as specified.

1.10 SCHEDULE OF INTERIOR FINISHES FOR EXISTING BUILDINGS

A. Unless otherwise specified, all materials required for the work in the existing buildings shall be new, and where required shall match existing adjacent finishes.

B. As indicated on the Drawings, specified or otherwise required to complete the work, the CONTRACTOR shall cut new openings and block up existing openings in floors, walls, partitions and ceilings; remove existing floors; remove, relocate existing and/or install new windows, doors, frames, transoms, access doors, partition sash and trim.

C. The CONTRACTOR shall remove window sash, frame, sill, stool and trim at exterior door openings to be blocked up; remove door, frame and trim and, unless otherwise hereinafter specified or indicated on the Drawings to be blocked up with other materials, window and door openings shall be blocked up with brick and/or masonry block.

1. At door, sash and other openings in interior partitions and walls to be closed, block up such openings with same materials and construction as adjacent, unless otherwise indicated on the Drawings. Plaster and finishes applied at blocked up openings shall finish even and straight, flush with and of the same texture or other surface characteristics of existing adjacent finishes.

D. Existing finishes or subfloor surfaces which are scheduled to receive new floor finishes shall be repaired, patched with concrete, asphalt latex type emulsion and underlayment as required to suit existing surfaces or the new floor surfacing material to be applied.

E. Concrete and floors disturbed by alterations shall be patched to finish even, straight and flush with adjacent surfaces.

F. Where new ceramic tile flooring or base is to be installed over present concrete floors or base, and where a cove exists at the floor, the CONTRACTOR shall cut away part of the cove by grinding or other approved means to the extent required for installation of the new flooring or base.

G. Existing partitions to be removed shall be removed for their entire height.

H. Where existing bases and other trim are removed and grounds are exposed and will not be covered by new finishing materials such as resilient base, new trim, or wall covering, grounds shall be removed and wall surfaces patched with plaster to finished even, straight and flush with adjacent existing plaster surfaces. Where existing plaster ceilings are scheduled to be removed, the ceilings shall be replaced with new metal furring, lathing and plaster finish or acoustical ceilings or other ceiling system as indicated on the Drawings.

I. Where partitions or walls are removed and existing ceiling on each side of the partition or wall is to remain, the gap shall be patched; a vertical break shall be provided if the ceilings are at different levels. Where the ceiling on one side is to remain and a new ceiling is scheduled for the area on the other side, the new ceiling shall be constructed so that the new and existing finished ceiling areas will be at the same level.

J. Existing floors, walls and ceilings shall be cut as required for removal of existing services and for installation of new plumbing, heating, ventilating and air conditioning, and electrical work and related piping, duct work, conduits, fixtures and equipment.

K. In addition to work specifically called for in the finish schedule on the Drawings, all finishes disturbed in the performance of any alterations or new work by any CONTRACTOR shall be patched or repaired to match existing surfaces or finishes. Holes, slots, chases, etc., in floors, walls and ceilings left by the removal of existing, or installation of new piping,

plumbing fixtures, radiators, duct work, registers, grills, conduit, receptacles, switches, lighting fixtures and other items of the other Contracts shall also be patched or repaired by the CONTRACTOR.

L. Existing spaces not listed on the finish schedule on the Drawings may require no work other than complete painting and patching by the CONTRACTOR of surfaces damaged in performance of any work included under this Contract.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01040

COORDINATION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall allow JEA or their agents, and other project CONTRACTORS or their agents, to enter upon the work for the purpose of constructing, operating, maintaining, removing, repairing, altering, or replacing such pipes, sewers, conduits, manholes, wires, poles, or other structures and appliances which may be required to be installed at or in the work. The CONTRACTOR shall cooperate with all aforesaid parties and shall allow reasonable provisions for the prosecution of any other work by JEA, or others, to be done in connection with his work, or in connection with normal use of the facilities.

B. Each CONTRACTOR shall cooperate fully with JEA and all other CONTRACTORS employed on the work, to effect proper coordination and progress to complete the project on schedule and in proper sequence. Insofar as possible, decisions of all kinds required from JEA shall be anticipated by the CONTRACTOR to provide ample time for inspection, or the preparation of instructions.

C. Each CONTRACTOR shall assume full responsibility for the correlation of all parts of his work with that of other CONTRACTORS. Each CONTRACTOR's superintendent shall correlate all work with other CONTRACTORS in the laying out of work. Each CONTRACTOR shall lay out his own work in accordance with the Drawings, Specifications, and instructions of latest issue and with due regard to the work of other CONTRACTORS.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

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SECTION 01070

ABBREVIATIONS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Wherever in these specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these specifications, the following acronyms or abbreviations which may appear in these specifications shall have the meanings indicated herein.

1.02 ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AAMA | Architectural Aluminum Manufacturer's Association |
| AASHTO | American Association of the State Highway and Transportation Officials |
| ACI | American Concrete Institute |
| ACIFS | American Cast Iron Flange Standards |
| ACOE | Army Corps of Engineers |
| ACPA | American Concrete Pipe Association |
| AFBMA | Anti-Friction Bearing Manufacturer's Association, Inc. |
| AGMA | American Gear Manufacturer's Association |
| AHGDA | American Hot Dip Galvanizers Association |
| AI | The Asphalt Institute |
| AIA | American Institute of Architects |
| AISC | American Institute of Steel Construction |
| AISI | American Iron and Steel Institute |
| AITC | American Institute of Timber Construction |
| AMCA | Air Moving and Conditioning Association |
| ANSI | American National Standards Institute, Inc. |
| APA | American Plywood Association |
| API | American Petroleum Institute |
| APHA | American Public Health Association |
| APWA | American Public Works Association |
| ASA | Acoustical Society of America |
| ASAE | American Society of Agriculture Engineers |
| ASCE | American Society of Civil Engineers |
| ASHRAE | American Society of Heating, Refrigerating, and Air-Conditioning Engineers |

| | |
|---|---|
| ASLE | American Society of Lubricating Engineers |
| ASME | American Society of Mechanical Engineers |
| ASMM | Architectural Sheet Metal Manual |
| ASSE | American Society of Sanitary Engineers |
| ASTM | American Society for Testing and Materials |
| AWPA | American Wood Preservers Association |
| AWPI | American Wood Preservers Institute |
| AWS | American Welding Society |
| AWWA | American Water Works Association |
| CEMA | Conveyor Equipment Manufacturer’s Association |
| CMA | Concrete Masonry Association |
| CRSI | Concrete Reinforcing Steel Institute |
| DIPRA | Ductile Iron Pipe Research Association |
| EIA | Electronic Industries Association |
| ETL | Electrical Test Laboratories |
| FBC | Florida Building Code |
| FDEP | Florida Department of Environmental Protection |
| FDOT | Florida Department of Transportation |
| FS | Federal Specifications |
| IEEE | Institute of Electrical and Electronics Engineers |
| IES | Illuminating Engineering Society |
| IPCEA | Insulated Power Cable Engineers Association |
| ISA | Instrument Systems and Automation |
| ISO | International Organization for Standardization |
| MBMA | Metal Building Manufacturers Association |
| MMA | Monorail Manufacturers Association |
| MTI | Marine Testing Institute |
| NAAM | National Association of Architectural Metal Manufacturers |
| NACE | National Association of Corrosion Engineers |
| NBS | National Bureau of Standards |
| NEC | National Electrical Code |
| NEMA | National Electrical Manufacturer's Association |
| NFPA | National Fire Protection Association |
| NIOSH | National Institute of Occupational Safety and Health |
| NIST | National Institute of Standards and Testing |

| | |
|---|---|
| NRCA | National Roofing Contractors Association |
| NSF | National Science Foundation |
| OSHA | Occupational Safety and Health Administration |
| PCA | Portland Cement Association |
| PCM | Program Construction Manager |
| PMT | Program Management Team |
| SMACCNA | Sheet Metal and Air Conditioning Contractors National Association |
| SSPC | Steel Structures Painting Council |
| SSPWC | Standard Specifications for Public Works Construction |
| SFWMD | South Florida Water Management District |
| SJRWMD | St. Johns River Water Management District |
| UL | Underwriters Laboratories, Inc. |

PART 2 -- PRODUCTS

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PART 3 -- EXECUTION

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SECTION 01090

REFERENCE STANDARDS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Wherever reference is made to any published standards, codes, or standard specifications, it shall mean the latest standard code, specification, or tentative specification of the technical society, organization, or body referred to, which is in effect at the date of invitation for Bids.

B. All materials, products, and procedures used or incorporated in the work shall be in strict conformance with applicable codes, regulations, specifications, and standards.

C. A partial listing of codes, regulations, specifications, and standards includes the following:

Air Conditioning and Refrigeration Institute (ARI)

Air Diffusion Council (ADC)

Air Moving and Conditioning Association (AMCA)

The Aluminum Association (AA)

American Architectural Manufacturers Association (AAMA)

American Concrete Institute (ACI)

American Gear Manufacturers Association (AGMA)

American Hot Dip Galvanizers Association (AHDGA)

American Institute of Steel Construction, Inc. (AISC)

American Iron and Steel Institute (AISI)

American National Standards Institute (ANSI)

American Society of Civil Engineers (ASCE)

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)

American Society of Mechanical Engineers (ASME)

American Society for Testing and Materials (ASTM)

American Standards Association (ASA)

American Water Works Association (AWWA)

American Welding Society (AWS)

American Wood-Preserver's Association (AWPA)

Anti-Friction Bearing Manufacturers Association (AFBMA)

Building Officials and Code Administrators (BOCA)

Consumer Product Safety Commission (CPSC)

Factory Mutual (FM)

Federal Specifications

Florida Building Code

Instrument Society of America (ISA)

Institute of Electrical and Electronics Engineers (IEEE)

National and Local Fire Codes

Lightning Protection Institute (LPI)

National Electrical Code (NEC)

National Electrical Manufacturer's Association (NEMA)

National Electrical Safety Code (NESC)

National Electrical Testing Association (NETA)

National Fire Protection Association (NFiPA)

Regulations and Standards of the Occupational Safety and Health Act (OSHA)

Southern Building Code Congress International, Inc. (SBCCI)

Sheet Metal & Air Conditioning Contractors National Association (SMACCNA)

Standard Building Code

Standard Mechanical Code

Standard Plumbing Code

Uniform Building Code (UBC)

Underwriters Laboratories Inc. (UL)

D. Contractor shall, when required, furnish evidence satisfactory to the Engineer that materials and methods are in accordance with such standards where so specified.

E. In the event any questions arise as to the application of these standards or codes, copies shall be supplied on-site by the Contractor.

PART 2 -- PRODUCTS

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PART 3 -- EXECUTION

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SECTION 01300

SUBMITTALS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. This section specifies the means of all submittals. All submittals, whether their final destination is to JEA, or other representatives of JEA, shall be directed through JEA. A general summary of the types of submittals and the number of copies required is as follows:

| Hard Copies to JEA | Type of Submittal |
|---|---|
| 3* | Progress Schedule |
| 3* | Construction Schedule |
| See 01370 | Schedule of Values |
| 1 | Application for Payment |
| 10** | Shop Drawings |
| See 01730 | O&M Manuals |
| 2 | Certificates of Compliance |
| 2 | Warranties |
| 2*** | Product Samples |

** Unless otherwise required in the instructions to bidders.*
*** Unless electronically submitted.*
**** Unless otherwise required in the specific Section where requested.*

1.02 SUBMITTAL PROCEDURES

A. Transmit each submittal with a form acceptable to JEA, clearly identifying the project CONTRACTOR, the enclosed material and other pertinent information specified in other parts of this section. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

B. Revise and resubmit submittals as required, identify all changes made since previous submittals. Resubmittals shall be noted as such.

C. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.03 CONSTRUCTION PROGRESS SCHEDULE

A. The CONTRACTOR shall prepare the construction progress schedule in accordance with JEA standards. The schedule shall be developed in the Primavera P6 format. At least 10 days prior to the Preconstruction meeting, the proposed work schedule shall be submitted by the CONTRACTOR.

B. If the CONTRACTOR desires to make changes in its method of operating which affect the construction progress schedule and related items, it shall notify JEA in writing stating what changes are proposed and the reason for the change. If JEA accepts these changes, in writing, the CONTRACTOR shall revise and submit, without additional cost to JEA, all of the affected portions of the construction progress schedule and associated reports. The construction progress schedule and related items shall be adjusted by the CONTRACTOR only after prior acceptance, in writing by JEA. Adjustments may consist of changing portions of the activity sequence, activity durations, division of activities, or other adjustments as may be required. The addition of extraneous, nonworking activities and activities which add restraints to the construction progress schedule shall not be accepted.

C. Except where earlier completions are specified, schedule dates which show completion of all Work prior to the contract completion date shall, in no event, be the basis for claim for delay against JEA by the CONTRACTOR.

D. Construction progress schedules and related items which contain activities showing negative float or which extend beyond the contract completion date will be accepted only upon the condition that the CONTRACTOR will comply with recovery schedule requirements in accordance with the Contract.

E. If the completion of any activity, whether or not critical, falls more than 100 percent behind its previously scheduled and accepted duration, the CONTRACTOR shall submit for approval a schedule adjustment showing each such activity divided into two activities reflecting completed versus uncompleted work.

F. Shop drawings which are not approved on the first submittal or within the time scheduled, and equipment which does not pass the specified tests and certifications shall be immediately rescheduled.

G. From time to time it may be necessary for the contract schedule of completion time to be adjusted by JEA in accordance with the Contract and other portions of the Contract Documents as may be applicable. Under such conditions, JEA will direct the CONTRACTOR to reschedule the Work or contract completion time to reflect the changed conditions, and the CONTRACTOR shall revise the construction progress schedule and related items accordingly, at no additional cost to JEA.

H. Available float time may be used by JEA.

I. JEA controls the float time and, the before, without obligation to extend either the overall completion date or any intermediate completion dates, JEA may initiate changes that absorb float time only. JEA initiated changes that affect the critical path on the network diagram shall be the sole grounds for extending the completion dates. CONTRACTOR initiated changes that encroach on the float time may be accomplished only with JEA's

concurrence. Such changes, however, shall give way to JEA initiated changes competing for the same float time.

J. To the extent that the construction project schedule, or associated report or any revision thereof shows anything not jointly agreed upon or fails to show anything jointly agreed upon, it shall not be deemed to have been accepted by JEA. Failure to include on a schedule any element of Work required for the performance of this Contract shall not excuse the CONTRACTOR from completing all Work required within any applicable completion date, notwithstanding the review of the schedule by JEA.

K. Review and acceptance of the construction progress schedule, and related reports, by JEA is advisory only and shall not relieve the CONTRACTOR of the responsibility for accomplishing the Work within the contract completion date. Omissions and errors in the construction progress schedule, and related reports shall not excuse performance less than that required by the Contract and in no way make JEA an insurer of the CONTRACTOR's success or liable for time or cost overruns flowing from any shortcomings in the construction progress schedule, and related reports.

L. Three hard copies and one electronic copy shall be submitted with the Application for Payment.

1.04 SCHEDULE OF VALUES

A. The CONTRACTOR shall submit a Schedule of Values for review within the time frame referenced in the instructions to bidders and Section 01370. The schedule shall directly correlate on an item by item basis (unless otherwise accepted/directed by JEA) to each individual activity detailed in the construction progress schedule. The sum of all scheduled items shall equal the total value of the Contract. Reference Section 01025, Measurement and Payment, for further details.

B. The CONTRACTOR shall expand or modify the above schedule and materials listing as required by JEA's initial or subsequent reviews.

1.05 APPLICATION FOR PAYMENT

A. The CONTRACTOR shall submit Application for Payment to JEA monthly for review in accordance with the Contract. The Application shall be submitted on the day of the month directed by JEA for the preceding month’s work.

B. The Application for Payment shall include a listing of monthly labor hours spent on site in electronic format (pdf), updated as-built drawings, invoices for stored material, stored material log and updated EAM worksheets. JEA to provide Application for Payment excel workbook for to be used for compiling data necessary for each Application for Payment.

1.06 SHOP DRAWINGS

A. The CONTRACTOR shall submit for review shop drawings for concrete reinforcement, structural details, piping layout and appurtenances, wiring, color selection charts, materials and equipment fabricated especially for this Contract, and materials and equipment for which such Drawings are specified or specifically requested by JEA. Shop

drawings shall be submitted in accordance with the Contract, except where the number of shop drawings to be submitted is specifically stated in the technical specification.

B. Shop drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the Drawings.

C. When so specified, or if considered by JEA to be acceptable, the manufacturer's specifications, catalog data, descriptive matter, illustrations, etc. may be submitted for review in place of shop drawings. In such case, the requirements shall be as specified for shop drawings, insofar as applicable.

D. The CONTRACTOR shall be responsible for the prompt submittal of all shop drawings so that there shall be no delay to the Work due to the absence of such Drawings. JEA/Engineer will review the shop drawings within 21 calendar days of receipt of such Drawings. Reviewed shop drawings will be returned to the CONTRACTOR by electronic format, posted no later than 21 days after receipt.

E. Time delays caused by rejection of submittals are not cause for extra charges to JEA or time extensions.

F. Requirements: All shop drawings shall be submitted to JEA/Engineer through the CONTRACTOR. The CONTRACTOR is responsible for obtaining shop drawings from his subcontractors and returning reviewed shop drawings to them. All shop drawings shall be prepared on standard size, 18-inch by 24-inch sheets. JEA standard title block from the JEA website shall be used for all shop drawings. All Drawings shall be clearly marked with the name of the project, JEA project number, Engineer project number, JEA, CONTRACTOR, Engineer and building, equipment, or structure to which the drawing applies. Drawings shall be suitably numbered and contain the review stamp by the CONTRACTOR. Each shipment of shop drawings shall be accompanied by a letter of transmittal giving a list of the drawing/specification numbers and the names mentioned above. In addition to the number of copies specified, the CONTRACTOR shall submit one electronic copy in pdf format.

G. Product Data: Where manufacturer's publications in the form of catalogs, brochures, illustrations, or other data sheets are submitted in lieu of prepared shop drawings, such submission shall specifically indicate the particular item offered. Identification of such items and relative pertinent information shall be made with indelible ink. Submissions showing only general information will not be accepted. JEA will reject documents that are not legible copies shall be originals or legible for review.

H. Product data shall include materials of construction, dimensions, performance characteristics, capacities, wiring diagrams, piping and controls, etc.

I. Warranties: When warranties are called for, a sample of the warranty shall be submitted with the shop drawing. The sample warranty shall be the same form that will be used for the actual warranty. Actual warranties shall be originals and notarized. Warranty shall commence at JEA acceptance and shall be in effect for one year unless otherwise specified.

J. Work Prior to Review: No material or equipment shall be purchased, fabricated especially for this Contract, or delivered to the project site until the required shop drawings have been submitted, processed and marked either "FURNISH AS SUBMITTED" or "FURNISH AS CORRECTED". All materials and Work involved in the construction shall be as represented by said Drawings.

K. The CONTRACTOR shall not proceed with any portion of the Work (such as the construction of foundations) for which the design and details are dependent upon the design and details of equipment for which submittal review has not been completed.

L. CONTRACTOR's Review: Only submittals which have been checked and corrected should be submitted to the CONTRACTOR by its subcontractors and vendors. Prior to submitting shop drawings to JEA/Engineer, the CONTRACTOR shall check thoroughly all such shop drawings to satisfy itself that the subject matter thereof conforms to the Drawings and Specifications in all respects. Shop drawings which are correct shall be marked with the date, checker's name and indications of the CONTRACTOR's approval, and then shall be submitted to JEA/Engineer. Other Drawings submitted to JEA/Engineer will be returned to the CONTRACTOR unreviewed.

M. CONTRACTOR's Responsibility: JEA's review of shop drawings will be general and shall not relieve the CONTRACTOR of the responsibility for details of design, dimensions, etc., necessary for proper fitting and construction of the Work required by the Contract and for achieving the specified performance.

N. CONTRACTOR's Modifications: For submissions containing departures from the Contract Documents, the CONTRACTOR shall include proper explanation in his letter of transmittal and shall identify in the relevant specification to which the exception is taken. Should the CONTRACTOR submit for review equipment that requires modifications to the structures, piping, layout, etc. detailed on the Drawings, he shall also submit for review details of the proposed modifications. If such equipment and modifications are accepted, the CONTRACTOR, at no additional cost to JEA, shall do all Work necessary to make such modifications.

O. Substitutions: Substitutions may be submitted in accordance with the Contract.

P. Complete Submittals: Each submittal shall be complete in all aspects incorporating all information and data required to evaluate the products' compliance with the Contract Documents. Partial or incomplete submissions shall be returned to the CONTRACTOR without review.

1.07 WARRANTIES

A. Warranties called for in the Contract Documents shall be originals and submitted to JEA. When warranties are required they shall be submitted prior to request for payment. Warranties shall be original copies and shall be notarized.

1.08 CERTIFICATES

A. Two hard copies and one electronic copy of certificates of compliance and test reports shall be submitted for requested items to JEA prior to request for payment.

1.09 PRODUCT SAMPLES

A. CONTRACTOR shall furnish for review all product samples as required by the Contract Documents or requested by JEA to determine compliance with the specifications.

B. Samples shall be of sufficient size or quantity to clearly illustrate the quality, type, range of color, finish or texture and shall be properly labeled to show complete project identification, the nature of the material, trade name of manufacturer and location of the Work where the material represented by the sample will be used.

C. Samples shall be checked by the CONTRACTOR for conformance to the Contract Documents before being submitted to JEA and shall bear the CONTRACTOR's stamp certifying that they have been so checked. Transportation charges on samples submitted to JEA shall be prepaid by the CONTRACTOR.

D. JEA's review will be for compliance with the Contract Documents, and its comments will be transmitted to the CONTRACTOR with reasonable promptness.

E. Acceptable samples will establish the standards by which the completed Work will be judged.

1.10 OPERATION AND MAINTENANCE MANUALS

A. General: In accordance with Section 01730, the CONTRACTOR shall furnish and deliver to JEA complete Operation and Maintenance (O&M) Manuals for the substantial, complete systems including instructions, technical bulletins, and any other printed matter such as diagrams, prints or drawings, containing full information required for the proper operations, maintenance, and repair of all CONTRACTOR furnished equipment. These requirements are a prerequisite to the operation and acceptance of equipment. Ten (10) weeks prior to the CONTRACTOR's substantial completion date, all O&M manuals shall be submitted in its final form.

B. All O&M manuals shall also be furnished in an electronic file format suitable for downloading into JEA's O&M database system. All manuals and drawings for the vendor provided equipment, sub-system or system shall be in Adobe Portable Document Format (PDF) format, in conformance with the latest version. They shall be PDF Formatted Text and Graphics (formerly Normal) or PDF Searchable Image (formerly Image+Text). If submitted in Searchable Image format, they shall be Optical Character Recognized (OCR'ed) at a 95% confidence level, using Adobe Acrobat Capture or an equivalent product. There shall be links from all Table of Contents entries to the actual occurrence in the body of the manual. Bookmarks shall be created for all linked Table of Contents entries. This requirement applies to all equipment to be furnished on this project.

1.11 RECORD DRAWINGS

A. Record drawings shall be prepared in accordance with "As-Built Drawings" as detailed in the Contract and the JEA Water and Sewer Standards Section 501 and Section 01720 of the Contract Documents.

B. The CONTRACTOR shall mark all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Said Record Drawings shall be supplemented by detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These master Record Drawings of the CONTRACTOR's representation of as-built conditions, including all revisions made necessary by addenda and change orders shall be maintained up-to-date during the progress of the Work.

C. At a minimum the Record Drawings shall be reviewed on the 20th working day of every third month after the month of Award, as well as on completion of Work. Failure to maintain the Record Drawings up-to-date shall be grounds of withholding monthly progress payments until such time as the Record Drawings are brought up-to-date.

D. Record Drawings shall be accessible to JEA/Engineer at all times during the construction period.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

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SECTION 01370

SCHEDULE OF VALUES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The apparent low bidder will prepare and submit a preliminary schedule of values within the time frame referenced in the instructions to bidders. Each item in the schedule includes the complete structure; piping and valves; equipment furnished by equipment manufacturers. All electrical work will be included in the electrical item unless noted otherwise. All field instruments will be included in the instrumentation item unless noted otherwise.

B. Upon request of the Engineer, the apparent low bidder will prepare and submit supporting data which will substantiate the correctness of the Schedule of Values.

C. The Schedule of Values, unless objected to by the Engineer, shall be used as the basis for the CONTRACTOR'S Applications for Payment.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Type Schedule of Values on 8-1/2 inch x 11 inch or 8-1/2 inch x 14 inch white paper furnished by JEA, CONTRACTOR'S standard forms and automated printout will be considered for approval by the Engineer upon CONTRACTOR'S request. Identify schedule with:

1. Title of Project and Location.

2. Engineer and Project number.

3. Name and Address of CONTRACTOR.

4. Contract Designation.

5. Date of Submission.

B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. For each major line item list sub-values of major products or operations under the item and include material and equipment costs. Identify each line item with the number and title of the respective major section of the specifications. The breakdown shall be done in accordance with a form established by the CONTRACTOR and acceptable to the JEA.

D. For the various portions of the Work:

1. Each item shall include a directly proportional amount of the CONTRACTOR'S overhead and profit.

2. For items on which progress payments will be requested for stored materials, break down the value into:

   a. The cost of the materials, delivered and unloaded, with taxes paid. Paid invoices are required for materials upon request by the Engineer.

   b. The total installed value.

E. The sum of all values listed in the schedule shall equal the total Contract Sum.

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

A. The attached Table 01370-1 includes the assets to be accounted for in the Schedule of Values.

B. For each asset or group of assets listed, provide a constructed cost which will include an allocation of construction activities including but not limited to, demolition, sitework, specialties, materials, labor, general conditions, and overhead and profit associated with the construction of the asset.

C. The combined value of the assets will equal the bid price for the project and will require adjustments as necessary due to change orders. The schedule of values will be updated on a monthly basis and will be included in the monthly pay request application for approval.

D. JEA reserves the right to edit this list prior to the first pay application and may add up to 10 percent more items than have been identified in the list.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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**Table 01370-1 Schedule of Assets**

| |
|---|
| Switchboard SWBD-20 Main Breaker A |
| Switchboard SWBD-20 Main Breaker B |
| Switchboard SWBD-20 Tie Breaker |
| Switchboard SWBD-20 Generator Main Breaker |
| Switchboard SWBD-20 Power Monitors (6) |
| Switchboard SWBD-20 Internal Automatic Transfer Controls |

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SECTION 01400

QUALITY CONTROL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall develop and maintain a Quality Control Program in accordance with the Contract and as specified herein to ensure that the Work strictly conforms to all requirements of the Contract Documents. CONTRACTOR shall submit a weekly conformance report on quality control to JEA. The non-conformance report shall indicate deviations of the quality of work from the Quality Control program.

B. The CONTRACTOR shall be responsible for and shall supervise the work of all subcontractors, providing instructors to each when their work does not conform to the requirements of the Quality Control Program and the Contract Documents.

1.02 OBSERVATION AT PLACE OF MANUFACTURE

A. Unless otherwise specified, all products, materials, and equipment shall be subject to observation by JEA at the place of manufacture.

B. The presence of JEA at the place of manufacture however, shall not relieve the CONTRACTOR of the responsibility for furnishing products, materials, and equipment which comply with all requirements of the Contract Documents. Compliance is a duty of the CONTRACTOR, and said duty shall not be avoided by any act or omission on the part of JEA.

1.03 SAMPLING AND TESTING

A. Unless otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered; however, JEA reserves the right to use any generally-accepted system of sampling and testing which, in the opinion of JEA will insure that the quality of the workmanship is in full accord with the Contract Documents.

B. Any waiver by JEA of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial Work, shall not be construed as a waiver of any requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, JEA reserves the right to make independent investigations and tests and failure of any portion of the Work to meet any of the requirements of the Contract Documents, shall be reasonable cause for JEA to require the removal or correction and reconstruction of any such Work in accordance with the Contract.

1.04 SITE INVESTIGATION AND CONTROL

A. The CONTRACTOR shall verify all dimensions in the field and shall check field conditions continuously during construction. The CONTRACTOR shall be solely responsible for any inaccuracies built into the Work due to its failure to comply with this requirement.

B. The CONTRACTOR shall inspect related and appurtenant Work and shall report in writing to JEA any conditions which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the CONTRACTOR within the scope of the Contract.

1.05 INSPECTION AND TESTING

A. Unless otherwise specified, the CONTRACTOR shall employ and pay for the services of an independent testing laboratory for inspection and testing specified in the Contract Documents and for all other inspections and tests required by any permits, codes, or regulations. Copies of all test reports shall be submitted to JEA by the CONTRACTOR within 7 days of receipt of such reports from the testing lab.

B. The work or actions of the testing laboratory shall in no way relieve the CONTRACTOR of its obligations under the Contract. The laboratory testing work will include such inspections and testing required by the Contract Documents, existing laws, codes, ordinances, etc. The testing laboratory will have no authority to change the requirements of the Contract Documents, nor perform, accept or approve any of the CONTRACTOR's Work.

C. The CONTRACTOR shall allow JEA ample time and opportunity for field inspection and testing materials and equipment to be used in the Work. The CONTRACTOR shall advise JEA promptly upon placing orders for materials and equipment so that arrangements may be made, if desired, for inspection before shipment from the place of manufacture. The CONTRACTOR shall at all times furnish JEA and its representatives, facilities including labor, and allow proper time for inspecting and testing materials, equipment, and workmanship. The CONTRACTOR must anticipate that possible delays may occur in the execution of its work due to the necessity of materials and equipment being inspected and accepted for use. The CONTRACTOR shall furnish, at its own expense, all samples of materials required by JEA for testing, and shall make its own arrangements for providing water, electric power, or fuel for the various inspections and tests of structures and equipment.

D. JEA will provide funds as specified on the bid sheet to reimburse the CONTRACTOR at cost to perform all tests, inspections, or investigations undertaken by the order of JEA for the purpose of determining conformance with the Contract Documents if such tests, inspections, or investigations are not specifically required by the Contract Documents, and if conformance is ascertained thereby. Whenever nonconformance is determined by JEA as a result of such tests, inspections, or investigations, the CONTRACTOR shall bear the full cost of any additional tests, inspections, and investigations, which are ordered by JEA to ascertain subsequent conformance with the Contract Documents.

1.06 RIGHT OF REJECTION

A. JEA shall have the right, at all times and places, to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the site. If JEA or its representative, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such materials, no matter in what stage or condition of manufacture, delivery, or erection, may be subsequently rejected by JEA.

B. The CONTRACTOR shall promptly remove rejected articles or materials from the site of the Work after notification of rejection. All costs of removal and replacement of rejected articles or materials as specified herein shall be borne by the CONTRACTOR.

C. An inspection protocol shall be developed between the CONTRACTOR and JEA which shall include inspection criteria, equipment to be inspected, at which point to be inspected, notification time to JEA inspection, etc.

1.07 OTHER CONSTRUCTION CONSIDERATIONS

A. Cutting and Patching: The CONTRACTOR shall perform all cutting and patching of the Work that may be required to make its several parts come together properly and fit it to receive or be received by such other work. The CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and shall only cut or alter work with the written consent of JEA and of the other CONTRACTOR's whose work will be affected.

B. Sleeves and Openings: The CONTRACTOR shall provide all openings, chases, etc., to fit its own work and that of any other subcontractors and CONTRACTOR's. All such openings or chases shown on the Contract Drawings, or reasonably implied thereby, or as confirmed or modified by acceptable shop, setting or erecting drawings, shall be provided by the CONTRACTOR.

C. The CONTRACTOR shall in consultation with JEA develop an inspection protocol which shall include but not be limited to inspection criteria, equipment/work element to be inspected, schedule for inspections, notification schedule to JEA inspectors and other inspection related protocol necessary for the acceptance of the work by JEA.

D. Where pipes or conduits are to pass through slabs or walls, or where equipment frames or supports are to be installed as integral part of an opening, the sleeves, openings, forms or frames shall be furnished by the installer of the pipes, conduits or equipment, but shall be placed by the CONTRACTOR. Where hanger inserts, anchor bolts and similar items are to be embedded in concrete as an integral part of a slab or wall, they shall be furnished by the installer of the pipe or other equipment requiring the hanger, etc, but shall be placed by the CONTRACTOR.

E. Any cost resulting from correction of defective, ill-timed, or mislocated work or for subsequent work which becomes necessary because of omitted openings, chases, sleeves, frames, inserts, etc., shall be borne by the CONTRACTOR or subcontractor responsible therefore. The CONTRACTOR shall not arbitrarily cut, drill, alter, damage, or

otherwise endanger the work of another contractor. In no case shall beams, lintels, or other structural members be cut without the proper authorization of JEA. The nature and extent of any corrective or additional work shall be subject to the acceptance of JEA following consultation with the affected parties.

F. Weather Conditions: Weather protection and storm preparedness shall be undertaken in accordance with the Contract.

G. Fire Protection: The CONTRACTOR shall take all necessary precautions to prevent fires at or adjacent to the Work, including its own buildings and trailers. Adequate fire extinguisher and hose line stations shall be provided throughout the work area. The CONTRACTOR shall procure Burning Permits when required.

## PART 2 -- PRODUCTS

(NOT USED)

## PART 3 -- EXECUTION

### 3.01 BUOYANCY

A. The CONTRACTOR shall be completely responsible for any tanks, pipelines, manholes, foundations or similar improvements that may become buoyant during the construction operations due to groundwater levels. Should there be any possibility of buoyancy, the CONTRACTOR shall take the necessary steps to prevent damage due to floating or flooding, and shall repair or replace said improvements at no additional cost to JEA.

- END OF SECTION -

SECTION 01510

TEMPORARY UTILITIES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. It shall be the CONTRACTOR's responsibility to provide equipment that is adequate for the performance of the Work under this Contract within the time specified. All equipment shall be kept in satisfactory operating condition, shall be capable of safely and efficiently performing the required Work, and shall be subject to review by JEA at any time within the duration of the Contract. All Work hereunder shall conform to the applicable requirements of the OSHA Standards for Construction.

B. The CONTRACTOR shall provide for utilities and services for its own operations, in accordance with the Contract. The CONTRACTOR shall furnish, install and maintain all temporary utilities during the contract period including removal upon completion of the Work.

1.02 POWER AND LIGHTING

A. Power: The CONTRACTOR shall provide all necessary power required for its operations under the Contract at no additional cost to JEA, and shall provide and maintain all temporary power lines required to perform the Work in a safe and satisfactory manner.

B. Construction Lighting: All Work conducted at night or under conditions of deficient daylight shall be suitably lighted to insure proper Work and to afford adequate facilities for inspection and safe working conditions. Temporary lighting shall be maintained during nonworking periods if the area is subject to access by the public or JEA's personnel.

C. Electrical Connections: All temporary connections for electricity shall be subject to review by JEA and shall be removed in like manner at the CONTRACTOR's expense prior to final acceptance of the Work.

D. Separation of Circuits: Unless otherwise permitted by JEA, circuits separate from lighting circuits shall be used for all power purposes.

E. Construction Wiring: All wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. All electrical facilities shall conform to the requirements of Subpart K of the OSHA Safety and Health Standards for Construction.

1.03 WATER SUPPLY

A. General: Except as noted otherwise, the CONTRACTOR shall make arrangements for and pay for all costs for all water used for construction and testing. The CONTRACTOR shall provide and maintain all meters, piping, fittings, adapters, and valving required in accordance with the Contract.

B. Water Connections: The CONTRACTOR shall not make connection to, or draw water from, any fire hydrant or pipeline without first obtaining permission from JEA. For each such connection made, the CONTRACTOR shall first attach to the fire hydrant or pipeline a valve and a meter, of a size and type acceptable to JEA.

C. Removal of Water Connections: Before Final Acceptance of the Work on the project, all temporary connections and piping installed by the CONTRACTOR shall be entirely removed, and all affected improvements shall be restored to their original condition, or better, to the satisfaction of JEA and to the agency owning the affected utility.

D. Fire Protection: The construction and all other parts of the Work shall be connected with the CONTRACTOR's water supply system and shall be adequately protected against damage by fire. Hose connections and hose, water casks, chemical equipment, or other sufficient means shall be provided for fighting fires in the temporary structures and other portions of the Work, and responsible persons shall be designated and instructed in the operation of such fire apparatus so as to prevent or minimize the hazard of fire. The CONTRACTOR's fire protection program shall conform to the requirements of Subpart F of the OSHA Standards for Construction and all local Fire Department Requirements.

1.04 TEMPORARY SANITARY FACILITIES

A. The CONTRACTOR shall provide and maintain adequate and clean sanitary facilities for the construction work force and visitors. The facilities shall comply with local codes and regulations and be situated in an acceptable location.

B. Fixed or portable chemical toilets shall be provided by the CONTRACTOR wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.

C. Such facilities shall be made available when the CONTRACTOR’s first employees arrive on the Work, shall be properly secluded from public observation, and shall be constructed and maintained in suitable numbers and at such points and in such manner as may be required.

D. The CONTRACTOR shall maintain the sanitary facilities in a satisfactory and sanitary condition at all time and shall enforce their use. It shall rigorously prohibit the committing of nuisances on the site of the Work, on the property of JEA, or on adjacent property.

E. JEA shall have the right to inspect any building or other facility erected, maintained, or used by the CONTRACTOR, to determine whether or not the sanitary regulations have been complied with.

F. Sanitary and Other Organic Wastes: The CONTRACTOR shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR's operations shall be disposed of away from the site in a manner satisfactory to the JEA REPRESENTATIVE and in accordance with all laws and regulations pertaining thereto.

1.05 CONFINED SPACES

A. The CONTRACTOR shall provide and maintain a safe working environment in confined spaces. The CONTRACTOR shall follow the applicable requirements of the OSHA Standards for Construction and NIOSH Publications for working in confined spaces.

1.06 TEMPORARY VENTILATION

A. The CONTRACTOR shall provide and maintain adequate ventilation for a safe working environment. In addition, forced air ventilation shall be provided for the curing of installed materials, humidity control and the prevention of hazardous accumulations of dust, gases or vapors.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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SECTION 01520

MAINTENANCE OF UTILITY OPERATIONS DURING CONSTRUCTION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The existing plant will be maintained in continuous operation by JEA during the entire construction period of the Contract as hereinafter specified. The intent of this Section is to outline the minimum requirements necessary to provide continuous treatment, disinfection and disposal of the full effluent flow throughout the construction period.

B. Work shall be scheduled and conducted by the CONTRACTOR so as not to impede any treatment process, reduce the quality of the plant effluent or cause odor or other nuisance except as explicitly permitted hereinafter. In performing the work shown and specified, the CONTRACTOR shall plan and schedule his work to meet the plant and collection system operating requirements, and the constraints and construction requirements as outlined in this Section. No discharge of raw or inadequately treated wastewater shall be allowed. The CONTRACTOR shall pay all civil penalties, costs, assessments, etc., associated with any discharge of raw or inadequately treated wastewater associated with the CONTRACTOR'S work.

C. The CONTRACTOR shall be responsible for coordinating the general construction and the schedules of electrical and related trades and for ensuring that permanent or temporary power and controls are available for all existing, proposed, and temporary facilities that are required to be on line at any given time.

D. The CONTRACTOR has the option of providing additional temporary facilities that can eliminate a constraint, provided it is done without cost to JEA and provided that all requirements of these Specifications are fulfilled. Work not specifically covered in the following paragraphs may, in general, be done at any time during the contract period, subject to the operating requirements and constraints and construction requirements outlined hereinafter. All references to days in this Section shall be consecutive calendar days.

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. Section 01010 – Summary of Work

B. Section 01020 – Construction Sequencing/Constraints

1.03 GENERAL CONSTRAINTS

A. The CONTRACTOR shall schedule the Work so that the plant is maintained in continuous operation. All treatment processes shall be maintained in continuous operation during the construction period except during approved process interruptions. All short-term system or partial systems shutdowns shall be approved by JEA. Long-term process shutdowns and diversions shall conform to the requirements hereinafter specified and shall be minimized by the CONTRACTOR as much as possible. If in the

judgment of JEA, a requested shutdown is not required for the CONTRACTOR to perform the Work, the CONTRACTOR shall utilize approved alternative methods to accomplish the Work. All shutdowns shall be coordinated with and scheduled at times suitable to JEA. Shutdowns shall not begin until all required materials are on hand and ready for installation. Each shutdown period shall commence at a time approved by JEA, in writing. Where required in the Construction Sequence, the CONTRACTOR shall proceed with the Work continuously, (24 hours/day, 7 days/week) start to finish, until the Work is completed and normal plant operation is restored. The CONTRACTOR shall be responsible for, and include in its contract bid amount, all costs associated with necessary work to isolate the existing piping, utilities or facilities to complete the required connections and/or modifications. Necessary work required by the CONTRACTOR shall include, but shall not be limited to, temporary pumping and piping, wet taps, line stops, line plugs, and temporary bulkheads and/or stop logs.

B. The CONTRACTOR shall review all bidding documents and shall be responsible to determine all such connections or modifications, and the scope and cost of all temporary measures required to isolate the work area without the need for a shutdown of the affected facility, process area, piping or utility.

C. Any temporary work, facilities, roads, walks, protection of existing structures, piping, blind flanges, valves, equipment, etc. that may be required within the CONTRACTOR'S work limits to maintain continuous and dependable plant operation shall be furnished by the CONTRACTOR.

D. JEA shall have the authority to order Work postponed, stopped or prohibited that would, in his opinion, unreasonably result in interrupting the necessary functions of the plant operations.

E. If the CONTRACTOR impairs performance or operation of the plant as a result of not complying with specified provisions for maintaining plant operations, then the CONTRACTOR shall immediately make all repairs or replacements and do all work necessary to restore the plant to operation to the satisfaction of JEA. Such work shall progress continuously to completion on a 24-hours per day, seven work days per week basis.

F. The CONTRACTOR shall provide the services of emergency repair crews on call as required.

1.04 GENERAL OPERATING REQUIREMENTS, CONSTRAINTS, AND CONSTRUCTION REQUIREMENTS

A. Access to Plant Site, Roadways, and Parking Areas

1. An unobstructed traffic route through the Main Gate shall be maintained at all times for JEA's operations personnel and maintenance equipment. The CONTRACTOR shall be responsible for providing access to and for preparing and maintaining/approved parking areas.

2. An unobstructed traffic route around the plant site shall be maintained at all times for JEA's operations personnel and maintenance equipment. Vehicular access to the treatment units and buildings for JEA personnel shall be maintained at all times by the CONTRACTOR.

3. The CONTRACTOR shall provide temporary measures to protect the existing pavement by filling over with earthen material or supplying other measures acceptable to JEA, and he shall repair any damage to existing paved surfaces that occurs during the construction period. Any areas disturbed along the shoulders of the access road and interior roads and elsewhere inside and outside of the plant shall be repaired, graded, seeded, etc. as necessary to match pre-existing conditions.

4. The CONTRACTOR shall not undertake the restoration/construction of new roadway (paved, gravel, or asphalt overlay) shown on the Contract Drawings, until all other work on the plant improvements has been completed.

5. It shall be the responsibility of the CONTRACTOR to obtain any permits required from the Florida Department of Transportation and pay all associated fees.

B. Personnel Access: Treatment plant personnel shall have access to all areas which remain in operation throughout the construction period. The CONTRACTOR shall locate stored material, dispose of construction debris and trash, provide temporary walkways, provide temporary lighting, and other such work as directed by JEA to maintain personnel access to areas in operation. Access and adequate parking areas for plant personnel must be maintained throughout construction.

C. Plumbing Facilities: Unless otherwise allowed by JEA, sanitary facilities in the existing structures shall be operational at all times for plant operating personnel. All other building plumbing systems such as roof and floor drains, pumping, etc., shall be maintained for all structures.

D. Building Heating and Ventilating: Building heating and ventilating for the existing plant structures shall be in service for the entire construction period. Additional temporary heating and ventilation shall be provided as required to maintain facilities under construction adequately heated and vented. The temperatures to be maintained in any areas occupied by plant operating personnel such as offices, lunchrooms, locker rooms, bathrooms, etc., shall be at least 65 degrees Fahrenheit. The temperatures to be maintained in all other interior plant areas, whether new, existing or temporary, shall be maintained at a minimum of 55 degrees Fahrenheit.

E. Power, Light and Communications Systems (General): Electric power, lighting service and communications systems shall be maintained in uninterrupted operation in all areas which remain in operation. Individual units may be disconnected as required for replacement, but service shall be available at all times including periods when plant elements are out of service. Shutdown of electrical facilities shall be limited to not more than five (5) hours. JEA may allow longer outages under conditions determined by JEA. All costs associated with use of temporary services or standby engine generators shall be paid by the CONTRACTOR. The Electrical CONTRACTOR shall coordinate shutdowns required with the CONTRACTOR to minimize the total number of shutdowns

required to complete construction. JEA's phone service to and within the plant shall be maintained in continuous operation during construction.

F. Draining Process Pipes and Conduits (General): The contents of all pipes and conduits to be removed, replaced or relocated (or dewatered for a specific purpose) shall be transferred to a suitable facility in a manner approved by JEA through hoses or piping, or by using pumps if hydraulic conditions so require them. The CONTRACTOR shall provide the pumps, piping and hoses at no additional cost to JEA. No uncontrolled spillage of a pipe or conduit shall be permitted. Any spillage, other than potable water, shall be immediately washed down and flushed into the appropriate process flow train.

G. Potable Water System: Potable water service shall be maintained in continuous service at all times during construction except for short term interruptions required for tie-ins. Shutdown of the potable water system shall be fully planned and coordinated with the Plant Superintendent and shall be limited to not more than two (2) hours. Existing fire hydrants within the plant site shall be operational at all times, unless otherwise approved by JEA.

H. Sump Pumps and Sumps: All existing sumps shall be maintained in an operable condition with either existing pumps or temporary pumps. Interim piping, power and controls shall be provided as required by the staged construction sequence.

I. Seal Water and Service Water Piping: A supply of service and seal water and the necessary connections to existing equipment shall be maintained during construction. Interim piping shall be provided as required.

1.05 ELECTRICAL REQUIREMENTS

A. The CONTRACTOR shall maintain operation of existing plant facilities during construction and pay close attention to electrical construction sequencing constraints described or implied in the process requirements.

B. The CONTRACTOR shall comply with, but not be limited to, the following electrical requirements:

1. Coordinate all power shutdowns with JEA and provide temporary equipment to maintain plant operation as required.

2. The following loads shall be operational at all times:

   a. All four (4) UV Transformers.
   b. MCC-6 in its entirety.
   c. MCC-21 in its entirety.
   d. MCC-23 in its entirety.

3. A temporary portable generator (1500kW minimum) shall be provided by the CONTRACTOR during construction.

4. A new, temporary switchboard lineup shall be furnished and installed by the CONTRACTOR as indicated herein.

5. JEA to provide generator backup for the following loads prior to the CONTRACTOR switching to temporary power:

   a. Effluent Pump No. 4
   b. Effluent Pump Station Lighting Panel
   c. Post Aeration Blower No. 2

1.06 PREFERRED SEQUENCE OF CONSTRUCTION

A. Furnish and install temporary generator and temporary switchboard.

B. Connect all existing loads listed herein to temporary source of power.

C. Remove and install new switchgear breakers, power meters, and transfer controls.

D. Remove all temporary connections and restore permanent connections.

1. Coordinate all details of the sequence of construction with JEA/Engineer prior to starting any work.

2. Maximum shutdown length to install and remove temporary facilities shall be two (2) hours, during 1am and 4am, Monday thru Wednesday, and coordinated with JEA.

3. **A qualified person shall be on-site 24 hours a day for all times in which the plant is running on the temporary electrical system**. This individual shall be capable of manually starting and manually transferring to/from the portable generator in case of a utility outage.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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SECTION 01530

PROTECTION OF EXISTING FACILITIES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. CONTRACTOR shall be responsible for the preservation and protection of property adjacent to the work site against damage or injury as a result of his operations under this Contract. Any damage or injury occurring on account of any act, omission or neglect on the part of the CONTRACTOR shall be restored in a proper and satisfactory manner or replaced by and at the expense of the CONTRACTOR to an equal or superior condition than previously existed.

B. CONTRACTOR shall comply promptly with such safety regulations as may be prescribed by JEA or the local authorities having jurisdiction and shall, when so directed, properly correct any unsafe conditions created by, or unsafe practices on the part of, his employees. In the event of the CONTRACTOR's failure to comply, JEA may take the necessary measures to correct the conditions or practices complained of, and all costs thereof will be deducted from any monies due the CONTRACTOR. Failure of JEA to direct the correction of unsafe conditions or practices shall not relieve the CONTRACTOR of his responsibility hereunder.

C. In the event of any claims for damage or alleged damage to property as a result of work under this Contract, the CONTRACTOR shall be responsible for all costs in connection with the settlement of or defense against such claims. Prior to commencement of work in the vicinity of property adjacent to the work site, the CONTRACTOR, at his own expense, shall take such surveys as may be necessary to establish the existing condition of the property. Before final payment can be made, the CONTRACTOR shall furnish satisfactory evidence that all claims for damage have been legally settled or sufficient funds to cover such claims have been placed in escrow, or that an adequate bond to cover such claims has been obtained.

D. The CONTRACTOR shall verify the exact locations and depths of all utilities shown and the CONTRACTOR shall make exploratory excavations of all utilities that may interfere with the Work. All such exploratory excavations shall be performed as soon as practicable after award of Contract and, in any event, a sufficient time in advance of construction to avoid possible delays to the CONTRACTOR's Work. When such exploratory excavations show the utility location as shown to be in error, the CONTRACTOR shall so notify JEA.

E. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.

1.02 PROTECTION OF WORK AND MATERIAL

A. During the progress of the work and up to the date of final payment, the CONTRACTOR shall be solely responsible for the care and protection of all work and materials covered by the Contract.

B. All work and materials shall be protected against damage, injury or loss from any cause whatsoever, and the CONTRACTOR shall make good any such damage or loss at his own expense. Protection measures shall be subject to the approval of JEA.

1.03 BARRICADES, WARNING SIGNS AND LIGHTS

A. The CONTRACTOR shall provide, erect and maintain as necessary, strong and suitable barricades, danger signs and warning lights along all roads accessible to the public, as required by the authority having jurisdiction, to insure safety to the public. All barricades and obstructions along public roads shall be illuminated at night and all lights for this purpose shall be kept burning from sunset to sunrise.

B. The CONTRACTOR shall provide and maintain such other warning signs and barricades in areas of and around their respective work as may be required for the safety of all those employed in the work, JEA's operating personnel, or those visiting the site.

C. In the case of a conflict between this Specification Section and the CONTRACTOR's Safety Plan, the more stringent requirement of the two documents shall govern.

1.04 EXISTING UTILITIES AND STRUCTURES

A. The term existing utilities shall be deemed to refer to both publicly-owned and privately-owned utilities such as electric power and lighting, telephone, water, gas, storm drains, process lines, sanitary sewers and all appurtenant structures.

B. Where existing utilities and structures are indicated on the Drawings, it shall be understood that all of the existing utilities and structures affecting the work may not be shown and that the locations of those shown are approximate only. It shall be the responsibility of the CONTRACTOR to ascertain the actual extent and exact location of existing utilities and structures. In every instance, the CONTRACTOR shall notify the proper authority having jurisdiction and obtain all necessary directions and approvals before performing any work in the vicinity of existing utilities.

C. Prior to beginning any excavation work, the CONTRACTOR shall, through field investigations, determine any conflicts or interferences between existing utilities and new utilities to be constructed under this project. This determination shall be based on the actual locations, elevations, slopes, etc., of existing utilities as determined in the field investigations, and locations, elevation, slope, etc. of new utilities as shown on the Drawings. If an interference exists, the CONTRACTOR shall bring it to the attention of JEA as soon as possible. If JEA agrees that an interference exists, he shall modify the design as required. Additional costs to the CONTRACTOR for this change shall be processed through a Change Order as detailed elsewhere in these Contract Documents.

D. The work shall be carried out in a manner to prevent disruption of existing services and to avoid damage to the existing utilities. Temporary connections shall be provided, as required, to insure uninterruption of existing services. Any damage resulting from the work of this Contract shall be promptly repaired by the CONTRACTOR at his own expense in a manner satisfactory to JEA or the respective authority having jurisdiction over such work. Where it is required by the authority having jurisdiction that they perform their own repairs or have them done by others, the CONTRACTOR shall be responsible for all costs thereof.

E. Where excavations by the CONTRACTOR require any utility lines or appurtenant structures to be temporarily supported and otherwise protected during the construction work, such support and protection shall be provided by the CONTRACTOR. All such work shall be performed in a manner satisfactory to JEA or the respective authority having jurisdiction over such work. In the event the CONTRACTOR fails to provide proper support or protection to any existing utility, JEA may, at his discretion, have the respective authority to provide such support or protection as may be necessary to insure the safety of such utility, and the costs of such measures shall be paid by the CONTRACTOR.

1.05 RESTORATION OF PAVEMENT

A. General: All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents. All pavements which are subject to partial removal shall be neatly saw cut in straight lines.

B. Temporary Resurfacing: Wherever required by JEA, the CONTRACTOR shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time required by JEA before proceeding with the final restoration of improvements.

C. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the CONTRACTOR shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.

1.06 EXISTING UTILITIES AND IMPROVEMENTS

A. General: The CONTRACTOR shall protect all underground utilities and other improvements which may be impaired during construction operations. It shall be the CONTRACTOR's responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The CONTRACTOR shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

B. Where the proper completion of the Work requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is shown, the CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to JEA. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by the CONTRACTOR in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

C. Underground Utilities Shown or Indicated: Existing utility lines that are shown or the locations of which are made known to the CONTRACTOR prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired by the CONTRACTOR.

D. Underground Utilities Not Shown or Indicated: In the event that the CONTRACTOR damages any existing utility lines that are not shown or the locations of which are not made known to the CONTRACTOR prior to excavation, a written report thereof shall be made immediately to JEA. If directed by JEA, repairs shall be made by the CONTRACTOR under the provisions for changes and extra Work contained in the Contract.

E. Maintaining in Service: All oil and gasoline pipelines, power, and telephone or other communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered within the limits of construction shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to JEA are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, wire or cable. The CONTRACTOR shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

1.07 TREES WITHIN PROJECT LIMITS

A. General: The CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs on the project site, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or JEA. All existing trees and shrubs which are damaged during construction shall be replaced by the CONTRACTOR or a certified tree company to the satisfaction of JEA.

B. Protection: The CONTRACTOR shall protect all trees in accordance with the Contract.

C. Trimming: Where required, trim trees in accordance with the Contract.

D. Replacement: The CONTRACTOR shall immediately notify if any tree is damaged by the CONTRACTOR's operations. If, in the opinion of JEA, the damage is such that replacement is necessary, the CONTRACTOR shall replace the tree at its own expense. The tree shall be of a like size and variety as the tree damaged, or, if of a smaller size, the CONTRACTOR shall pay to JEA compensatory payment acceptable to JEA.

1.08 NOTIFICATION BY THE CONTRACTOR

A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way the CONTRACTOR shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than three days nor more than seven days prior to excavation so that a representative of said owners or agencies can be present during such Work if they so desire.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

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# SECTION 01540

# DEMOLITION AND REMOVAL OF EXISTING STRUCTURES AND EQUIPMENT

## PART 1 -- GENERAL

### 1.01 THE REQUIREMENT

A. The CONTRACTOR shall furnish all labor, materials and equipment to demolish buildings and structures and to remove fixtures, anchors, supports, piping and accessories designated to be removed on the Drawings.

### 1.02 SUMMARY

A. This section covers the demolition, removal, and disposal of existing buildings, structures, pavement, curbs, and sidewalk, removal and disposal of asbestos materials, and any existing equipment including electrical, plumbing, heating and ventilating equipment and piping not required for the operation of the rehabilitated plant as indicated on the Drawings and as specified hereinafter.

### 1.03 SUBMITTALS

A. The CONTRACTOR shall submit for review, in accordance with Section 01300 entitled "Submittals" the proposed methods, equipment and operation sequence. Include coordination for shut-off, temporary services, continuation of service and other applicable items to ensure no interruption of plant operations except as hereinbefore specified.

### 1.04 TITLE TO EQUIPMENT AND MATERIALS

A. CONTRACTOR shall have no right or title to any of the equipment, materials or other items to be removed from the existing buildings or structures unless and until said equipment, materials and other items have been removed from the premises. The CONTRACTOR shall not sell or assign, or attempt to sell or assign any interest in the said equipment, materials or other items until the said equipment, materials or other items have been removed.

B. CONTRACTOR shall have no claim against JEA because of the absence of such fixtures and materials.

### 1.05 CONDITION OF STRUCTURES AND EQUIPMENT

A. JEA does not assume responsibility for the actual condition of structures and equipment to be demolished and removed.

B. Conditions existing at the time of inspection for bidding purposes will be maintained by JEA so far as practicable.

C. The information regarding the existing structures and equipment shown on the Drawings is based on visual inspection and a walk-through survey only. JEA will not be responsible for interpretations or conclusions drawn therefrom by the CONTRACTOR.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

3.01 DEMOLITION AND REMOVALS

A. The removal of all equipment and piping, and all materials from the demolition of buildings and structure shall, when released by JEA, shall be done by the CONTRACTOR and shall become the CONTRACTOR's property, unless otherwise noted, for disposition in any manner not contrary to the Contract requirements and shall be removed from the site to the CONTRACTOR's own place of disposal.

B. The Electrical Subcontractor specifically, shall de-energize all panelboards, lighting fixtures, switches, circuit breakers, electrical conduits, motors, limit switches, pressure switches, instrumentation such as flow, level and/or other meters, wiring, and similar power equipment prior to removal. Any electric panels or equipment which are to be retained shall be relocated or isolated by the Electrical Subcontractor specifically, prior to the removal of the equipment specified herein. All existing electrical equipment to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to keep the integrity of the grounding systems.

C. Conduits and wires shall be abandoned or removed where noted or as shown on the Drawings. All wires in abandoned conduits shall be removed. Abandoned conduits concealed in floor or ceiling slabs or in walls, shall be cut flush with the slab or wall at the point of entrance. The conduits shall be suitably plugged and the area repaired in a flush, smooth, approved manner. Exposed conduits and their supports shall be disassembled and removed from the project site. Repair all areas of removal to prevent rust spots on exposed surfaces.

D. The CONTRACTOR shall proceed with the removal of the equipment, piping and appurtenances in a sequence designed to maintain the plant in continuous operation as described in Section 01520 entitled "Maintenance of Utility Operations During Construction", and shall proceed only after approval of JEA.

E. Any equipment piping and appurtenances removed without proper authorization, which are necessary for the operation of the existing facilities, shall be replaced to the satisfaction of JEA at no cost to JEA.

F. Excavation caused by demolitions shall be backfilled with fill free from rubbish and debris.

G. At least 48 hours prior to commencement of a demolition or removal, the CONTRACTOR shall notify JEA in writing of the proposed schedule. No removals shall be started until it is acceptable to JEA.

3.02 PROTECTION

A. Demolition and removal work shall be performed by competent experienced workmen for the various type of demolition and removal work and shall be carried out through to completion with due regard to the safety of JEA employees, workmen on-site and the public. The work shall be performed with as little nuisance as possible.

B. The work shall comply with the applicable provisions and recommendation of ANSI A10.2, Safety Code for Building Construction, all governing codes, and as hereinafter specified.

C. The CONTRACTOR shall make such investigations, explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. The CONTRACTOR shall give particular attention to shoring and bracing requirements so as to prevent any damage to new or existing construction.

D. The CONTRACTOR shall provide, erect, and maintain catch platforms, lights, barriers, weather protection, warning signs and other items as required for proper protection of the public, occupants of the building, workmen engaged in demolition operations, and adjacent construction.

E. The CONTRACTOR shall provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.

F. The CONTRACTOR shall provide and maintain temporary protection of the existing structure designated to remain where demolition, removal and new work is being done, connections made, materials handled or equipment moved.

G. The CONTRACTOR shall take necessary precautions to prevent dust from rising by wetting demolished masonry, concrete, plaster and similar debris. Unaltered portions of the existing buildings affected by the operations under this Section shall be protected by dust-proof partitions and other adequate means. Existing electrical and mechanical equipment to remain shall be protected from damage, dust, and debris.

H. The CONTRACTOR shall provide adequate fire protection in accordance with local Fire Department requirements.

I. The CONTRACTOR shall not close or obstruct walkways, passageways, or stairways and shall not store or place materials in passageways, stairs or other means of egress. The CONTRACTOR shall conduct operations with minimum traffic interference.

J. The CONTRACTOR shall be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided.

3.03 WORKMANSHIP

A. The demolition and removal work shall be performed as described in the Contract Documents. The work required shall be done with care, and shall include all required shoring, bracing, etc. The CONTRACTOR shall be responsible for any damage which may be caused by demolition and removal work to any part or parts of existing structures or items designated for reuse or to remain. The CONTRACTOR shall perform patching, restoration

and new work in accordance with applicable Technical Sections of the Specifications and in accordance with the details shown on the Drawings.

B. All supports, pedestals and anchors shall be removed with the equipment and piping unless otherwise specified or required. Concrete bases, anchor bolts and other supports shall be removed to approximately 1-inch below the surrounding finished area and the recesses shall be patched to match the adjacent areas. Superstructure wall and roof openings shall be closed, and damaged surfaces shall be patched to match the adjacent areas, as specified under applicable Sections of these Specifications, as shown on the Drawings, or as directed by JEA. Wall sleeves and castings shall be plugged or blanked off, all openings in concrete shall be closed in a manner meeting the requirements of the appropriate Sections of these Specifications, as shown on the Drawings, and as directed and approved by JEA.

C. Materials or items designated to remain the property of JEA shall be as hereinafter tabulated. Such items shall be removed with care and stored at a location at the site to be designated by JEA.

D. Where equipment is shown or specified to be removed and relocated, the CONTRACTOR shall not proceed with removal of this equipment without specific prior approval of JEA. Upon approval, and prior to commencing removal operations, the equipment shall be operated in the presence of representatives of the CONTRACTOR and JEA. Such items shall be removed with care, under the supervision of the trade responsible for reinstallation and protected and stored until required. Material or items damaged during removal shall be replaced with similar new material or item. Any equipment that is removed without proper authorization and is required for plant operation shall be replaced at no cost to JEA.

E. Wherever piping is to be removed for disposition, the piping shall be drained by the CONTRACTOR and adjacent pipe and headers that are to remain in service shall be blanked off or plugged and then anchored in an approved manner.

F. Materials or items demolished and not designated to become the property of JEA or to be reinstalled shall become the property of the CONTRACTOR and shall be removed from the property and legally disposed of.

G. The CONTRACTOR shall execute the work in a careful and orderly manner, with the least possible disturbance to the public and to the occupants of the building.

H. In general, masonry shall be demolished in small sections, and where necessary to prevent collapse of any construction, the CONTRACTOR shall install temporary shores, struts, and bracing.

I. Where alterations occur, or new and old work join, the CONTRACTOR shall cut, remove, patch, repair or refinish the adjacent surfaces to the extent required by the construction conditions, so as to leave the altered work in as good a condition as existed prior to the start of the work. The materials and workmanship employed in the alterations, unless otherwise shown on the Drawing or specified, shall comply with that of the various respective trades which normally perform the particular items or work.

J. The CONTRACTOR shall finish adjacent existing surfaces to new work to match the specified finish for new work as shown in the Contract Documents. The CONTRACTOR shall clean existing surfaces of dirt, grease, loose paint, etc., before refinishing.

K. The CONTRACTOR shall cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the respective finishes.

L. The CONTRACTOR shall confine cutting of existing roof areas designated to remain to the limits required for the proper installation of the new work. The CONTRACTOR shall cut and remove insulation, etc., and provide temporary weather tight protection as required until new roofing and flashings are installed.

M. The CONTRACTOR shall remove temporary work, such as enclosures, signs, guards, and the like when such temporary work is no longer required or when directed at the completion of the work.

3.04 MAINTENANCE

A. The CONTRACTOR shall maintain the buildings, structures and public properties free from accumulations of waste, debris and rubbish, caused by the demolition and removal operations.

B. The CONTRACTOR shall provide on-site dump containers for collection of waste materials, debris and rubbish, and he shall wet down dry materials to lay down and prevent blowing dust.

C. At reasonable intervals during the progress of the demolition and removal work or as directed by JEA, the CONTRACTOR shall clean the site and properties, and dispose of waste materials, debris and rubbish.

3.05 EQUIPMENT AND MATERIALS RETAINED BY JEA

A. Equipment and materials to be retained by JEA shall include but may not be limited to:

1. Temporary Switchboard provided by this project.

B. The equipment and materials shall be moved by the CONTRACTOR to storage areas, on the site, to be designated by JEA.

3.06 CLEANUP

A. The CONTRACTOR shall, promptly and on a regular basis, remove from the project site all debris resulting from the demolition and removal operations as it accumulates. Upon completion of the demolition work, all materials, equipment, waste and debris of every sort shall be removed and the premises shall be left clean, neat and orderly.

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SECTION 01541

FIELD ENGINEERING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surveying services required for proper layout of work and record information.

1.02 RELATED SECTIONS

A. Section 01300 – Submittals

B. Section 01400 – Quality Control

C. Section 01700 – Project Closeout

C. Section 01720 – Project Record Drawings

1.03 QUALITY CONTROL

A. A Land Surveyor Registered in the State of Florida shall be used for verifying existing control points and establishing new control points. CONTRACTOR shall be responsible to verify the accuracy of the established control points prior to performing layout.

1.04 SUBMITTALS

A. Submit name, address, and telephone number of Registered Land Surveyor to the Engineer before starting work.

B. On request, submit documentation verifying accuracy of survey work for project boundary and vertical and horizontal control.

C. Submit certificate signed by Surveyor with Project Record Documents certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.

1.05 PROJECT RECORD DOCUMENTS

A. Maintain complete, accurate log of control and survey work as it progresses.

B. Maintain one set of plans that all record drawing information is kept on. These plans shall show the record information within one week of installation of work or information being made available. CONTRACTOR's record drawing markups will be available for review by JEA at any time during the normal workday.

C. Submit record drawing markups as specified in Section 01700 entitled "Contract Closeout" and Section 01720 entitled "Record Drawings".

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

3.01 INSPECTION

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

B. Promptly notify JEA of any discrepancies discovered.

3.02 SURVEY REFERENCE POINTS

A. Protect survey control points prior to starting site work; preserve permanent reference points during construction. Make no changes without prior written notice to JEA.

B. Promptly report to JEA the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Replace dislocated survey control points based on original survey control.

3.03 SURVEY REQUIREMENTS

A. JEA shall provide one bench mark for vertical and horizontal control during construction. CONTRACTOR shall be responsible for laying out the work, shall protect and preserve the established bench mark and shall make no changes or relocations without prior approval of JEA. CONTRACTOR shall report to JEA whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

B. CONTRACTOR shall establish line and levels, locate and lay out by instrumentation and similar appropriate means:

1. Site improvements, including pavements, stakes for grading, fill and topsoil placement, utility locations, slopes, and invert, or centerline, elevations. Submit cut sheets for gravity sewers to JEA three days prior to construction.

2. Grid or axis for structures.

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

4. Piping locations, slopes, and invert, or centerline, elevations.

C. Periodically verify layouts by same means.

D. CONTRACTOR shall provide and incorporate into record drawing markups the horizontal and vertical record locations of improvements, including the following:

1. Corner coordinates of rectangular or square buildings, structures, and tanks.

2. Center coordinates of circular buildings, structures, and tanks.

3. Building floor elevations.

4. Floor elevations of structures and tanks as required to define floor slope.

5. Top elevations of structures and tanks.

6. Channel floor elevations at each change in slope.

7. Channel top elevations.

8. Manhole center coordinates for sanitary sewers, storm sewers, and electrical duct banks.

9. Pipe coordinates at changes in direction.

10. Coordinates of buried valves, tees and fittings.

11. All underground piping invert or centerline elevations including at changes in slope.

12. All underground pipe invert or centerline elevations at tees and crosses.

13. Pipe invert, or centerline, elevations at crossing with other pipe.

14. Invert, or centerline, elevations and coordinates of existing pipe at crossing with underground pipe installed under this project.

15. Invert elevations of manhole pipe inlets and outlets.

16. Duct bank coordinates at changes in direction.

17. Top and bottom elevations of duct banks at manholes and handholes.

18. Other horizontal and vertical record data pertinent to completed Work.

E. Ground surface record/information shall include the following:

1. Spot elevations should be shown at a minimum 100-foot rectangular grid, sufficient to show all the important topographic features.

2. All elevations shown on the construction drawings shall be confirmed or amended on the record drawing markups if finished elevations are different.

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SECTION 01550

SITE ACCESS AND STORAGE

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Access Roads

1. The CONTRACTOR shall construct and maintain such temporary access roads as required to perform the work of this Contract.

2. Access roads, where possible, shall be located over the areas of the future road system.

3. Access roads shall be located within the property lines of JEA unless the CONTRACTOR independently secures easements for his use and convenience. CONTRACTOR shall submit written documentation to JEA for any CONTRACTOR secured easements across privately held property. Easement agreement shall specify terms and conditions of use and provisions for site restoration. A written release from the property owner certifying that all terms of the easement agreement have been complied with the CONTRACTOR shall be furnished to JEA prior to final payment.

4. Existing access roads used by the CONTRACTOR shall be suitably maintained by the CONTRACTOR at his expense during construction. CONTRACTOR shall not be permitted to restrict JEA access to existing facilities. JEA may direct CONTRACTOR to perform maintenance of existing access roads when JEA determines that such work is required to insure all weather access by JEA.

B. Parking Areas: Each CONTRACTOR shall construct and maintain suitable parking areas for his construction personnel on the project site where approved by JEA.

C. Restoration: At the completion of the work, the surfaces of land used for access roads and parking areas shall be restored by each CONTRACTOR to its original condition and to the satisfaction of JEA. At a minimum, such as restoration shall include establishment of a permanent ground cover adequate to restrain erosion for all disturbed areas.

D. Traffic Regulations: CONTRACTOR shall obey all traffic laws and comply with all the requirements, rules and regulations of the Florida Department of Transportation and other local authorities having jurisdiction to maintain adequate warning signs, lights, barriers, etc., for the protection of traffic on public roadways.

E. Storage of Equipment and Materials

1. CONTRACTOR shall store his equipment and materials at the job site in accordance with the requirements of the General Conditions, the Supplemental Conditions, Section 01600 and as hereinafter specified. All equipment and materials shall be

stored in accordance with manufacturer's recommendations and as directed by JEA, and in conformity to applicable statutes, ordinances, regulations and rulings of the public authority having jurisdiction. Where space or strip heaters are provided within the enclosure for motors, valve operators, motor starters, panels, instruments, or other electrical equipment, the CONTRACTOR shall make connections to these heaters from an appropriate power source and operate the heaters with temperature control as necessary until the equipment is installed and being operated according to its intended use.

2. CONTRACTOR shall enforce the instructions of JEA regarding the posting of regulatory signs for loadings on structures, fire safety, and smoking areas.

3. CONTRACTOR shall not store materials or encroach upon private property without the written consent of the owners of such private property.

4. CONTRACTOR shall not store unnecessary materials or equipment on the job site, and shall take care to prevent any structure from being loaded with a weight which will endanger its security or the safety of persons.

5. Materials shall not be placed within ten (10) feet of fire hydrants. Gutters, drainage channels and inlets shall be kept unobstructed at all times.

6. CONTRACTOR shall provide adequate temporary storage buildings/facilities, if required, to protect materials or equipment on the job site.

7. JEA shall not be responsible for the unloading or receipt of materials delivered to the project site. CONTRACTOR shall retain full responsibility to coordinate and schedule the delivery, unloading and placement of equipment in storage during the normal time of work.

8. If the CONTRACTOR requires additional staging area than shown on the Drawings, the CONTRACTOR shall obtain such areas from off-site sources at no additional cost to JEA.

9. Upon completion of the Contract, the CONTRACTOR shall remove from the storage areas all of its equipment, temporary fencing, surplus materials, rubbish, etc., and restore the areas.

F. JEA's Facilities

1. The CONTRACTOR shall not enter any of JEA's existing facilities without the expressed written authorization from JEA or JEA's project representative.

2. Except for the CONTRACTOR's superintendent, no CONTRACTOR's personnel shall enter the Operations Building.

3. Where the CONTRACTOR is required to perform work in an existing JEA's facility, the CONTRACTOR's superintendent shall notify JEA and request a meeting to discuss the limits of work.

4. The CONTRACTOR, subcontractors, suppliers, and others shall park only in the CONTRACTOR's project staging area.

1.02 CONTRACTOR'S SITE ACCESS

A. The Work is located at the Southwest WRF, which maintains a perimeter fence and security gates. Unless otherwise required by JEA, delivery and employee access will be via the east 118th Street entrance to the site.

1.03 SAFETY AND PROTECTION DEVICES

A. It shall be the sole responsibility of the CONTRACTOR to protect persons from injury and to avoid property damage. Adequate barricades, construction signs, torches, red lanterns, and guards as required shall be placed and maintained during the progress of the construction work for the protection of the public in compliance with the Contract and all Federal, OSHA and local ordinances.

B. The CONTRACTOR shall have unit responsibility for and be required to make good, at its own expense, all damage to property or adjacent properties caused in the execution of this Contract.

C. The CONTRACTOR shall take all necessary precautions for the safety of its employees on the job and shall comply with all applicable provisions of Federal, State, County, and municipal safety laws and regulations to prevent accidents or injury to persons on, about, or adjacent to the premises where the Work is being performed.

D. In the event the CONTRACTOR's tools or materials delivered to the premises are stolen or damaged, it shall be responsible for such theft.

1.04 SECURITY BADGE IDENTIFICATION SYSTEM

A. The CONTRACTOR shall have a security badge identification system only for its Superintendent(s).

B. The I.D. badges shall be made of plastic or laminated plastic material. A recent photo of the employee shall be visible on the badge. Badges shall be issued and retrieved daily by the CONTRACTOR. All text shall be typewritten or printed by computer. The badges shall include the following information:

| | |
|---|---|
| First Line: | The words CONTRACTOR (or VISITOR for vendors etc.) shall be printed in all caps across the top of the badge. |
| Second Line: | The name of the CONTRACTOR. |
| Third Line: | The name and phone number (preferably a cell phone number) of the CONTRACTOR’s on-site manager or superintendent for the project. |
| Fourth Line: | Employee Name. |
| Fifth Line: | A unique badge control number for each badge. |

C. CONTRACTOR shall obtain separate site access privileges and ID for Superintendent(s) from JEA.

1.05 CONTRACTOR DELIVERY LOGS

A. The CONTRACTOR shall provide a daily log of deliveries to the site for the project. The daily log shall include deliveries received each day with the driver's name and truck license number, in addition to expected deliveries for the following day. The log shall be submitted to JEA at the end of each week. This log will be used by JEA at its discretion for security purposes at the site. **The CONTRACTOR shall receive deliveries only at designated locations, in accordance with the Contract.**

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01560

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide temporary environmental controls in accordance with the Contract and as specified herein.

1.02 EXPLOSIVES AND BLASTING

A. The use of explosives on the Work will not be permitted.

1.03 DUST ABATEMENT

A. The CONTRACTOR shall furnish all labor, equipment, and means required and shall carry out effective measures wherever and as often as necessary, as determined by the JEA REPRESENTATIVE, to prevent its operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity. The CONTRACTOR shall be responsible for any damage resulting from any dust originating from its operations. The dust abatement measures shall be continued until the CONTRACTOR is relieved of further responsibility by the JEA REPRESENTATIVE. No separate payment will be allowed for dust abatement measures and all costs thereof shall be included in the CONTRACTOR'S bid price.

1.04 RUBBISH CONTROL

A. During the progress of the Work, the CONTRACTOR shall keep the site of the Work and other areas used by it in a neat and clean condition, and free from any accumulation of rubbish. The CONTRACTOR shall dispose of all rubbish and waste materials of any nature occurring at the Work site, and shall establish regular intervals of collection and disposal of such materials and waste. The CONTRACTOR shall also keep its haul roads free from dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the particular requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.

1.05 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, paint, fuel, solvent or reactant of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. The handling, storage, use and disposal of all such chemicals and disposal of residues shall be in strict accordance with the contract, all applicable rules and regulations of Federal, State and local jurisdictional agencies and the printed instructions of the manufacturer and all regulatory requirements.

Copies of antidote literature shall be kept at the storage site and at the CONTRACTOR'S job site office. A supply of antidotes shall be kept at the CONTRACTOR'S office.

1.06 NOISE CONTROL

A. Noise resulting from the CONTRACTOR'S work shall not exceed the noise levels and other requirements stated in local ordinances. The CONTRACTOR shall be responsible for curtailing noise resulting from its operation. It shall, upon written notification from the JEA REPRESENTATIVE or noise control officers, make any repairs, replacements, adjustments, additions and furnish mufflers when necessary to fulfill requirements.

1.07 EROSION ABATEMENT AND WATER POLLUTION

A. It is imperative that any CONTRACTOR dewatering operation not contaminate or disturb the environment of the properties adjacent to the Work. The CONTRACTOR shall, therefore, schedule and control its operations to confine all runoff water from disturbed surfaces, water from dewatering operations that becomes contaminated with silt, muck and other deleterious matter, fuels, oils, bitumens, calcium chloride, chemicals and other polluting materials.

B. The CONTRACTOR shall construct temporary stilling basin(s) of adequate size and provide all necessary temporary materials, operations and controls including, but not limited to, filters, coagulants, screens, and other means necessary to attain the required discharge water quality.

C. The CONTRACTOR shall be responsible for providing, operating and maintaining materials and equipment used for conveying the clear water to the point of discharge. All pollution prevention procedures, materials, equipment and related items shall be operated and maintained until such time as the dewatering operation is discontinued. Upon the removal of the materials, equipment and related items, the CONTRACTOR shall restore the area to the condition prior to its commencing work.

D. The CONTRACTOR shall be responsible for acquiring all applicable permits for discharge of waters as necessary, except as may have otherwise been provided in other sections of these specifications.

1.08 PRECAUTIONS DURING ADVERSE WEATHER

A. During adverse weather, and against the possibility thereof, the CONTRACTOR shall take all necessary precautions so that the Work may be properly done and satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building paper shelters, or other acceptable means. The CONTRACTOR shall be responsible for all changes caused by adverse weather.

B. The JEA REPRESENTATIVE may suspend construction operations at any time when, in its judgment, the conditions are unsuitable or the proper precautions are not being taken, whatever the weather conditions may be, in any season.

1.09 HURRICANE AND STORM WARNINGS

A. The CONTRACTOR shall take all precautions necessary to protect the job site during hurricane and storm watches and warnings.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

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# SECTION 01600

# MATERIALS AND EQUIPMENT

## PART 1 -- GENERAL

### 1.01 THE REQUIREMENT

A. The word “Products," as used herein, is defined to include purchased items for incorporation into the Work, regardless of whether specifically purchased for project or taken from CONTRACTOR’S stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of Work. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

B. The CONTRACTOR shall supply materials and equipment in accordance with the Contract, the JEA Water and Sewer Standards and as specified herein.

### 1.02 QUALITY ASSURANCE

A. Source Limitations: To the greatest extent possible for each unit of Work, the CONTRACTOR shall provide products, materials, or equipment of a singular generic kind from a single source.

B. Compatibility of Options: Where more than one choice is available as options for CONTRACTOR’S selection of a product, material, or equipment, the CONTRACTOR shall select an option which is compatible with other products, materials, or equipment already selected. Compatibility is a basic general requirement of product/material selections.

C. JEA Standards: Products shall conform and meet the criteria as specified in the latest edition and revision of the JEA publications, including but not limited to the following:

- Water and Sewer Standards Manual - JEA’s most recent publications can be found at their website:

  *https://www.jea.com/Working_With_JEA/Engineering_and_Construction/Reference_Materials/Water_and_Sewer_Standards.aspx*

### 1.03 DESIGN

A. Equipment and appurtenances shall be designed in conformity with the ASME, AIEE, NEMA and other generally accepted applicable standards and shall be rugged construction and of sufficient strength to withstand all stresses which may occur during fabrication, testing, transportation, installation and all conditions of operation. All bearings and moving parts shall be adequately protected by bushings or other acceptable means against wear, and

provision shall be made for adequate lubrication by readily accessible devices. Details shall be designed for appearance as well as utility. Protruding members, joints, corners, gear covers, etc., shall be finished in appearance.

B. All exposed welds on machinery shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.

1.04 PRODUCT DELIVERY-STORAGE-HANDLING

A. The CONTRACTOR shall deliver, handle, and store products in accordance with supplier's written recommendations and by means and methods that will prevent damage, deterioration, and loss including theft. Delivery schedules shall be coordinated with JEA to minimize long-term storage of products at site and overcrowding of construction spaces. In particular, the CONTRACTOR shall notify JEA in advance of deliveries and provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other sources of loss.

B. The CONTRACTOR shall provide a daily log of deliveries to the Southwest Water Reclamation Facility site for the project per Section 01550.

1.05 TRANSPORTATION AND HANDLING

A. Products shall be transported by methods to avoid product damage and shall be delivered in undamaged condition in supplier's unopened containers or packaging, dry.

B. The CONTRACTOR shall provide equipment and personnel to handle products, materials, and equipment including those provided by JEA, by methods to prevent soiling and damage.

C. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

1.06 STORAGE AND PROTECTION

A. Products shall be stored in accordance with supplier's written instructions, with seals and labels intact and legible. Sensitive products shall be stored in weather-tight enclosures and temperature and humidity ranges shall be maintained within tolerances required by supplier's written instructions.

B. For exterior storage of fabricated products, they shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering; ventilation shall be provided to avoid condensation.

C. Loose granular materials shall be stored on solid surfaces in a well-drained area and shall be prevented from mixing with foreign matter.

D. Storage shall be arranged to provide access for inspection. The CONTRACTOR shall periodically inspect to assure products are undamaged and are maintained under required conditions.

E. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

1.07 MAINTENANCE OF STORAGE

A. Stored products shall be periodically inspected on a scheduled basis. The CONTRACTOR shall maintain a log of inspections and shall make said log available to JEA on request.

B. The CONTRACTOR shall verify that storage facilities comply with supplier's product storage requirements.

C. The CONTRACTOR shall verify that supplier-required environmental conditions are maintained continually.

D. The CONTRACTOR shall verify that surfaces of products exposed to the elements are not adversely affected and that any weathering of finishes is acceptable under requirements of Contract Documents.

1.08 MAINTENANCE OF EQUIPMENT STORAGE

A. For mechanical and electrical equipment in long-term storage, the CONTRACTOR shall provide a copy of the supplier's service instructions to accompany each item, with notice on enclosed instruction shown on exterior of package.

B. Equipment shall be serviced on a regularly scheduled basis, and a log of services shall be maintained and submitted as a record document to JEA. JEA representative shall witness services provided by CONTRACTOR.

1.09 LUBRICANTS

A. During testing and prior to acceptance, the CONTRACTOR shall furnish all lubricants necessary for the proper lubrication of all equipment furnished under this Contract. CONTRACTOR shall conform to JEA standards and JEA approved sources for lubricants.

1.10 SPECIAL TOOLS

A. For each type of equipment furnished by it, the CONTRACTOR shall provide a complete set of all special tools (including calibration and test equipment) which may be necessary for the adjustment, operation, maintenance and disassembly of such equipment.

B. Special tools shall be delivered at the same time as the equipment to which they pertain. The CONTRACTOR shall properly store and safeguard such special tools until completion of the Work, at which time they shall be delivered to JEA.

1.11 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

1.12 FASTENERS

A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the CONTRACTOR in accordance herewith. Bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.

B. All bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be Type 316 Stainless Steel unless otherwise specified on the Drawings. If no material is indicated on the Drawings, such items shall be furnished Type 304 Stainless Steel.

C. Unless otherwise specified, stud, tap, and machine bolts shall be of the best quality refined bar iron. Hexagonal nuts of the same quality of metal as the bolts shall be used.

1.13 SALVAGED AND EXCAVATED MATERIALS

A. In the absence of special provisions in other Sections of the Specifications, salvage materials, equipment or supplies that occur are the property of JEA and shall be cleaned and stored as directed by JEA.

B. All excavated materials needed for backfilling operation shall be stored on site. Where additional area is needed for stockpiling, it shall be obtained by the CONTRACTOR.

1.14 EQUIPMENT AND MATERIALS

A. All equipment, materials, instruments or devices incorporated in this project shall be new and unused, unless indicated otherwise in the Contract Documents. Equipment and materials to be incorporated into the work shall be delivered sufficiently in advance of their installation and use to prevent delay in the execution of the work, and they shall be delivered as nearly as feasible in the order required for executing the work.

B. The Contractor shall protect all equipment and materials from deterioration and damage, including provisions for temporary storage buildings as needed and as specified in Section 01550 entitled "Site Access and Storage". Storage of equipment and materials shall be in locations completely protected from flooding, standing water, excessive dust, falling rock, brush fire, etc. Storage areas shall be located sufficiently distant from all construction activities and the movement of construction vehicles to minimize the potential for accidental damage. Any equipment or materials of whatever kind which may have become damaged or deteriorated from any cause shall be removed and replaced by good and satisfactory items at the Contractor's expense for both labor and materials.

1.15 INSTALLATION OF EQUIPMENT

A. Equipment and materials shall be installed in accordance with the requirements of the General Conditions, Supplemental Conditions and the respective Specification Sections.

B. Concrete foundations for equipment shall be of approved design and shall be adequate in size, suitable for the equipment erected thereon, properly reinforced, and tied into floor slabs by means of reinforcing bars or dowels. Foundation bolts of ample size and strength shall be provided and properly positioned by means of suitable templates and secured during placement of concrete. Foundations shall be built and bolts installed in accordance with the manufacturer's certified drawings.

C. Before mounting equipment on a foundation, the Contractor shall clean the top surface; if necessary, rough it with a star chisel and clean again; and clean out all foundation bolt sleeves. The Contractor shall provide a sufficient number of stainless steel plate shims about 2-inches wide and 4-inches long, and of a varying thickness from 1/8 to 1/2 inch. A combination of these shims shall be placed next to each foundation bolt to bring the bottom of the bedplate or frame about 1/8 inch above the final setting. The equipment shall be lowered by changing the combination of shims. Using stainless steel shim stock of various thicknesses, continue to level the equipment a little at a time and in rotation until it is at the correct elevation in both directions. When the equipment is level, tighten down on the foundation bolts a little at a time in rotation to make certain the equipment remains level and does not shift on the shims. A preliminary alignment check shall be made before grout is placed.

D. Equipment shall be set, aligned and assembled in conformance with manufacturer's drawings or instructions. Run out tolerances by dial indicator method of alignment shall be plus or minus .002 inches, unless otherwise directed by JEA.

E. All blocking and wedging required for the proper support and leveling of equipment during installation shall be furnished by the Contractor. All temporary supports shall be removed, except stainless steel wedges and shims, which may be left in place with the approval of JEA.

F. Each piece of equipment or supporting base, bearing on concrete foundations, shall be bedded in grout. The Contractor shall provide a minimum of 1-1/2-inch thick grouting under the entire baseplate supporting each pump, motor drive unit and other equipment. Grout shall be non-shrink grout, as specified under Section 03315 entitled "Grout".

G. When motors are shipped separately from driven equipment, the motors shall be received, stored, meggered once a month, and the reports submitted to JEA. After driven equipment is set, the motors shall be set, mounted, shimmed, millrighted, coupled and connected complete. Motors shall then be turned once per month and documented by the Contractor to JEA.

1.16 CONNECTIONS TO EQUIPMENT

A. Connections to equipment shall follow manufacturer's recommendations as to size and arrangement of connections and/or as shown in detail on the Drawings or approved Shop Drawings. Piping connections shall be made to permit ready disconnection of equipment with minimum disturbance of adjoining piping and equipment.

B. The Electrical Contractor or Contractor if no electrical contract exists shall be responsible for bringing proper electrical service to each item of equipment requiring electrical service as shown on the Drawings or approved Shop Drawings. Electrical connections to equipment requiring electrical service shall be made by the Electrical Contractor, unless otherwise indicated on the Drawings or in the Technical Specifications.

C. The HVAC Contractor or Contractor if no HVAC Contract exists shall bring and connect HVAC service to all equipment items requiring same as shown on the Drawings. Electrical connections to equipment requiring electrical service shall be made by the Electrical Contractor, unless otherwise indicated on the Drawings or in the Technical Specifications.

D. The Plumbing Contractor or Contractor if no plumbing contract exists shall bring and connect plumbing service to all equipment items requiring same as shown on the Drawings.

1.17 IDENTIFICATION TAGS FOR EQUIPMENT AND INSTRUMENTS

A. All process equipment, pumps, blowers, valves, gates and process instruments that are identified by a tag number on the Process and Instrumentation Diagrams (P&IDs on Instrumentation contract drawings) shall have an identification tag at the device.

B. The identification tag shall show a unique tag number for the device (e.g., MOG-101), and the common name of the device (e.g., Screenings Channel Isolation Gate No. 1).

C. The identification tag shall be either lamacoid tag with white background and black core letters, or non-corrosive metal tags, ASTM A240 Grade 430 stainless steel with a bright annealed finish.

D. Characters on identification tags shall be 3/16” high and surface cut deep unless otherwise noted. Characters shall be cut into the lamacoid tags with a hardened steel router bit and into stainless steel tags with a diamond tip cutter.

E. Identification tags shall be buffed around the perimeter to remove any sharp edges or corners.

F. Identification tags shall be attached to the equipment item, valve, or instrument with 0.9 mm diameter wire or stainless steel screws.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

# SECTION 01660

# EQUIPMENT TESTING AND PLANT STARTUP

## PART 1 -- GENERAL

### 1.01 THE REQUIREMENT

A. Equipment testing and startup are requisite to satisfactory completion of the contract and, therefore, shall be completed within the time specified for substantial completion.

B. The CONTRACTOR shall allow sufficient time in his construction schedule to complete equipment testing, troubleshooting, corrections, and startup based upon the general sequence set forth in Section 01520 entitled "Maintenance of Utility Operations During Construction".

C. As construction of the project proceeds through the final stages of completion associated with each construction phase, the CONTRACTOR shall, in accordance with the requirements set forth in the Contract Documents, attend to the following items for the equipment and facilities scheduled to be placed into service:

1. Schedule equipment manufacturer's visits to site.

2. Calibrate instruments, controls and controlled equipment.

3. Perform required testing, adjusting, and balancing of project components.

4. Schedule start-up and initial operation.

5. Furnish skilled personnel during initiation operation.

6. Perform JEA operation and maintenance training.

D. Refer to other Divisions for further requirements regarding this Section.

### 1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01520 - Maintenance of Utility Operations During Construction

### 1.03 EQUIPMENT TESTING

A. The CONTRACTOR shall provide the services of an experienced and authorized representative of the supplier of each item of equipment (excluding minor items of equipment specifically exempted by JEA in writing), who shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation prior to startup. In each case, the CONTRACTOR shall arrange to have the supplier's representative revisit the job site as often as necessary until any and all trouble is corrected and the equipment installation and operation are satisfactory to JEA.

B. The CONTRACTOR shall require that each supplier's representative test performance of his equipment and furnish to JEA a written report addressed to JEA, certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, and has been tested, operated satisfactorily under full-load conditions, is ready for operation, and JEA's operating personnel have been instructed in the operation, maintenance and lubrication of the equipment.

C. The CONTRACTOR shall be responsible for scheduling all operations testing. The CONTRACTOR is advised that JEA and JEA's operating personnel will witness operations testing.

D. The CONTRACTOR shall furnish all personnel, chemicals, fuel, oil, grease, and all other necessary equipment, facilities, and services required for conducting tests.

1.04 EQUIPMENT START-UP SERVICES

A. Equipment start-up period, for the training of plant personnel, shall begin after satisfactory completion and acceptance of the field tests and coincidentally with the completion date for the part of the work for which the equipment is included in accordance with the construction schedule. If the equipment is not covered by a certificate of substantial completion for a part of the work, the period shall begin upon substantial completion of the project.

B. During the equipment start-up period and in accordance with the sequence of construction and schedule, the CONTRACTOR shall furnish, at no additional cost to JEA the services of factory trained representatives of the equipment manufacturers for the equipment designated in the Specifications to:

1. Assist in the start-up and operations of the equipment.

2. Assist in the training of plant personnel, designated by JEA in the proper operation and maintenance of the equipment.

C. JEA shall:

1. Provide the necessary plant personnel to be instructed in the operation and maintenance of the equipment. JEA's personnel shall operate all equipment.

2. Pay for all fuel, power and chemicals consumed beyond quantities specified in the Contract Documents. The CONTRACTOR shall pay for fuel, power, and chemicals consumed up to the date of "certified substantial completion" except as otherwise specified herein.

D. CONTRACTOR shall be available to promptly repair all work during the equipment startup so as to cause minimum disruption to the plant operation.

E. Upon completion of a minimum of ten (10) consecutive and continuous days of satisfactory operation, or the number of days called for in the Technical Specifications, JEA will assume operation and operating cost of the equipment associated with the completed phase of work. If the equipment malfunctions during this start-up period, the start-up period will be repeated until satisfactory operation is achieved.

F. In the event a system, equipment or component proves defective or is unable to meet specified performance criteria, the CONTRACTOR shall replace the defective item and the guarantee period called for in the Contract Documents for the item shall start after satisfactory replacement and testing of the item.

1.05 PLANT STARTUP

A. The startup of a treatment plant is a highly complex operation requiring the combined technical expertise of the CONTRACTOR, suppliers, subcontractors, and JEA. The CONTRACTOR shall provide the effective coordination of all parties necessary for the successful startup during each phase of the sequence of work.

B. It is not the intent of JEA to instruct the CONTRACTOR in the startup of equipment for the plant; however, JEA will be available prior to and during startup to provide technical support to the CONTRACTOR. Treatment process startup shall be provided by JEA personnel.

C. Not less than 3 months prior to startup of facilities associated with each phase of the work, the CONTRACTOR shall submit to JEA for review, a detailed schedule of operations which will be necessary to effect a successful initial operation and sustained period of operation for the duration of the required startup period.

D. Startup of completed work shall not commence until all required leakage tests, disinfection, and equipment tests have been completed to the satisfaction of JEA.

E. The control system startup shall be coordinated with process startup activities and shall be extended as required until all plant processes are fully operational and to satisfy JEA that all control system contract requirements have been fulfilled in accordance with the Contract Documents. Refer to Section 17070 entitled "Control and Information System Testing – General" for additional requirements.

F. All defects in materials or workmanship which appear during this test period shall be immediately corrected by the CONTRACTOR. Time lost for equipment repairs, wiring corrections, control point settings, or other reasons which actually interrupt the startup may, at the discretion of JEA, be justifiable cause for extending the startup test duration.

G. During the startup, the CONTRACTOR shall provide the services of authorized representatives of the suppliers, in addition to those services required under operations testing, as necessary, to correct faulty equipment operation.

1.06 DEMONSTRATION AND INSTRUCTION

A. The supplier's representative shall instruct JEA's operating personnel in correct operation and maintenance procedures. The instruction shall demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment. Such instruction shall be scheduled in accordance with the sequence of each phase of the work at times arranged with JEA at least 2 weeks in advance and shall be provided while the respective representative's equipment is fully operational. On-site instruction shall be given by qualified persons who have been made familiar in advance with the equipment and systems in the plant. Training shall not commence until O&M Manuals have been accepted by JEA as specified in Sections 01300 and 01730.

B. The CONTRACTOR shall notify and distribute training session agenda and training material to JEA at least 14 days in advance of each equipment test or JEA training session.

C. Training shall be provided to four (4) separate shifts of JEA's personnel between the hours of 6:00 A.M. and 6:00 P.M. as necessary.

D. Provide professional video recording of all training sessions. Completed, labeled DVDs shall be provided to JEA for each type of training session.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01700

PROJECT CLOSEOUT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Final Cleaning

1. At the completion of each phase of the work and prior to startup, as scheduled the CONTRACTOR shall remove all rubbish from and about the site of the completed work, and all temporary structures, construction signs, tools, scaffolding, materials, supplies and equipment which he or any of his Subcontractors may have used in the performance of the work. CONTRACTOR shall broom clean paved surfaces and rake clean other surfaces of grounds.

2. CONTRACTOR shall thoroughly clean all materials, equipment and structures; all marred surfaces shall be touched up to match adjacent surfaces; dirty filters and burned out lights replaced as required; all glass surfaces cleaned and floors cleaned and polished so as to leave work in a clean and new appearing condition.

3. CONTRACTOR shall maintain cleaning until project, or portion thereof, is occupied by JEA.

B. Spare Parts and Special Tools

1. As soon as practicable after approval of the list of equipment, the CONTRACTOR shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies, with current unit prices and source or sources of supply.

2. Prior to equipment startup, CONTRACTOR shall also furnish a list of parts, and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified to be furnished as part of the Contract and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 120 days for the particular installation.

3. All parts shall be securely boxed and tagged, and clearly marked on the box and individually for identification as to the name of manufacturer or supplier, applicable equipment, part number, description and location in the equipment. All parts shall be protected and packaged for a shelf life of at least ten (10) years.

4. CONTRACTOR shall furnish at no additional cost to JEA with each piece of equipment as a minimum, one (1) complete set, or the number of sets called for in the Technical Specifications, of suitably marked special tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment prior to equipment startup.

5. Any special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, and maintenance of any equipment shall be furnished with the respective equipment. CONTRACTOR shall submit, for approval by JEA, a complete list of the special tools and appliances to be furnished and instructions for their use. Such tools and appliances shall be furnished in approved painted steel cases properly labeled and equipped with good grade cylinder locks and duplicate keys prior to equipment startup.

6. Spare parts for startup of equipment shall be furnished and provided by the CONTRACTOR. The forms appended to this section shall be submitted to list spare parts to be supplied during startup.

7. It is the intent of JEA to purchase spare parts for normal operation of the equipment delivered under this contract via normal maintenance operations.

C. Final Cleanup; Site Rehabilitation

1. Before final acceptance, the CONTRACTOR shall wash and clean all exposed surfaces which have become soiled or marked, and shall remove from the site of work all accumulated debris and surplus materials of any kind which result from his operation, including construction equipment, tools, sheds, sanitary enclosures, etc. The CONTRACTOR shall leave all equipment, fixtures, and work, which he has installed, in a clean condition. The completed project shall be turned over to JEA in a neat and orderly condition.

2. The site of the work shall be rehabilitated or developed in accordance with other sections of the Specifications and the Drawings. In the absence of any portion of these requirements, the CONTRACTOR shall completely rehabilitate the site to a condition and appearance equal or superior to that which existed just prior to construction, except for those items whose permanent removal or relocation was required in the Contract Documents or ordered by JEA.

3. The CONTRACTOR shall:

   a. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

   b. Use each type of cleaning material on only those surfaces recommended by the cleaning material manufacturer.

   c. Use only materials which will not create hazards to health or property.

D. Final Inspection

1. Final cleaning and repairing shall be so arranged as to be finished upon completion of the construction work. The CONTRACTOR will make his final cleaning and repairing, and any portion of the work finally inspected and accepted by JEA shall be kept clean by the CONTRACTOR, until the final acceptance of the entire work.

2. When the CONTRACTOR has finally cleaned and repaired the whole or any portion of the work, he shall notify JEA that he is ready for final inspection of the whole or a portion of the work, and JEA will thereupon inspect the work. If the work is not found satisfactory, JEA will order further cleaning, repairs, or replacement.

3. When such further cleaning or repairing is completed, JEA, upon further notice, will again inspect the work. The "Final Payment" will not be processed until the CONTRACTOR has complied with the requirements set forth, and JEA has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents.

E. Project Close Out

1. As construction of the project enters the final stages of completion, the CONTRACTOR shall, in concert with accomplishing the requirements set forth in the Contract Documents, attend to or have already completed the following items as they apply to his contract:

   a. Scheduling equipment manufacturers' visits to site.

   b. Required testing of project components.

   c. Scheduling start-up and initial operation.

   d. Scheduling and furnishing skilled personnel during initial operation.

   e. Correcting or replacing defective work, including completion of items previously overlooked or work which remains incomplete, all as evidenced by JEA's "Punch" Lists.

   f. Attend to any other items listed herein or brought to the CONTRACTOR's attention by JEA.

2. Just before JEA's Certificate of Final Completion is issued, the CONTRACTOR shall accomplish the cleaning and final adjustment of the various building components as specified in the Specifications and as follows:

   a. Clean all glass and adjust all windows and doors for proper operation.

   b. Clean all finish hardware after adjustment for proper operation.

   c. Touch up marks or defects in painted surfaces and touch up any similar defects in factory finished surfaces.

   d. Wax all resilient flooring materials.

   e. Remove bitumen from gravel stops, fascias, and other exposed surfaces.

   f. Remove all stains, marks, fingerprints, soil, spots, and blemishes from all finished surfaces, tile, stone, brick, and similar surfaces.

3. Final Submittals: In addition, and before the Certificate of Final Completion is issued, the CONTRACTOR shall submit to JEA certain records, certifications, etc., which are specified elsewhere in the Contract Documents. A partial list of such items appears below, but it shall be the CONTRACTOR's responsibility to submit any other items which are required in the Contract Documents:

   a. Test results of project components.

   b. Performance Affidavits for equipment.

   c. Certification of equipment or materials in compliance with Contract Documents.

   d. Operation and maintenance instructions or manuals for equipment.

   e. One set of neatly marked-up drawings showing as-built changes and additions to the work under his Contract.

   f. Any special guarantees or bonds (Submit to JEA).

4. The CONTRACTOR's attention is directed to the fact that required certifications and information under Item 3 above, must actually be submitted earlier in accordance with the sequence of construction and other Sections of the Specifications.

F. Grease, Oil, Chemicals and Fuel

1. All grease, oil, chemicals and fuel required for testing of the equipment shall be furnished by the CONTRACTOR.

G. Maintenance and Guarantee

1. The CONTRACTOR shall comply with all maintenance and guarantee requirements of the Contract Documents.

2. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the CONTRACTOR which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the CONTRACTOR shall have obtained a statement in writing from the affected private or public agency releasing JEA from further responsibility in connection with such repair or resurfacing.

3. The CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from JEA. If the CONTRACTOR fails to make such repairs or replacements promptly, JEA reserves the right to do the Work and the CONTRACTOR and its surety shall be liable to JEA for the cost thereof.

H. Punch Lists

1. JEA will make its final inspection whenever the CONTRACTOR has notified JEA that the work is ready for the inspection. Any work not found acceptable and requiring cleaning, repair and/or replacement will be noted on the punch list. Work that has

been inspected and accepted by JEA shall be maintained by the CONTRACTOR, until final acceptance of the entire project.

2. Whenever the CONTRACTOR has completed the items on the punch list, it shall again notify JEA that it is ready for final inspection. This procedure will continue until the entire project is accepted by JEA. The final Application for Payment will not be processed until the entire project has been accepted by JEA and all of the requirements in previous Article E.3 “Final Submittals” have been satisfied.

I. Closeout Timetable: The CONTRACTOR shall establish dates for equipment testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow JEA, and their authorized representatives sufficient time to schedule attendance at such activities.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01660 - Equipment Testing and Plant Startup

B. Section 01720 - Record Drawings

C. Section 01730 - Operations and Maintenance Manuals

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

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SECTION 01720

PROJECT RECORD DRAWINGS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall keep and maintain, at the job site, one record copy of all drawings, specifications, addenda, change orders, and other modifications to the Contract, approved shop drawings, and field test records.

B. The CONTRACTOR shall mark the drawings to indicate all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings. Said record drawing markups shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These master record drawing markups of the CONTRACTOR'S representation of as-built conditions, including all revisions made necessary by addenda and change orders shall be maintained up-to-date during the progress of the Work.

C. Project record drawing markups shall be maintained and updated by the CONTRACTOR on a month-to-month basis.

D. Record drawing markups shall be accessible to JEA at all times during the construction period.

E. Periodic payments shall not be processed prior to JEA's review and acceptance of record drawing markups development for the pay period submitted.

F. Final payment will not be acted upon until the CONTRACTOR has prepared and delivered record drawing markups to JEA. Said up-to-date record drawing markups shall be in the form of a set of prints 22 x 34 inch in size with carefully plotted information overlaid in red ink.

G. Upon substantial completion of the Work and prior to final acceptance, the CONTRACTOR shall finalize and deliver a complete set of record drawing markups to JEA conforming to the construction records of the CONTRACTOR. This set of drawings shall consist of corrected drawings showing the reported location of the Work. The information submitted by the CONTRACTOR and incorporated by JEA into the Record Drawings will be assumed to be correct, and the CONTRACTOR shall be responsible for the accuracy of such information, and shall bear the costs resulting from the correction of incorrect data furnished to JEA.

1.02 RELATED REQUIREMENTS

A. Section 01300 - Submittals

B. Section 01700 - Project Closeout.

C. All record “as-built” documents shall be prepared in accordance with and shall include all information required by JEA and any additional requirements listed herein.

1.03 RECORDING

A. Label each document "PROJECT RECORD" in neat large printed letters.

B. Record information concurrently with the progress of construction.

C. Legibly mark drawings to record actual construction

1. Incorporate changes made by Field Order, Change Order, or Construction Change Directive.

2. Incorporate details generated during the construction phase not shown on the original Contract Drawings.

1.04 SUBMITTAL

A. Prior to Final Completion, submit Record Documents to JEA.

B. Accompany submittal with a transmittal letter in duplicate, containing:

1. Date.

2. Project title and number.

3. CONTRACTOR’S name and address.

4. Title and number of each record document.

5. Signature of CONTRACTOR or its authorized representative.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01730

OPERATION AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Description

B. Quality Assurance

C. Format and Contents

1.02 SUBMITTALS

A. Written operations and maintenance instructions are required for all equipment items supplied for this project. The amount of detail shall be commensurate with the complexity of the equipment item. Pictorial cuts of equipment are required for operator reference in servicing.

B. Information not applicable to the specific piece of equipment installed on this project shall be struck from the Manual by the CONTRACTOR. Information provided shall include a source of replacement parts and names of service representatives, including addresses and telephone numbers.

C. In accordance with the provisions of Section 01300 submit the following:

1. Preliminary Operation and Maintenance Manuals: The Contractor shall submit five (5) complete preliminary Operations and Maintenance (O&M) Manuals for each item of equipment at the same time the equipment is delivered to the project site.

2. Final Operation and Maintenance Manuals: Furnish to JEA five (5) printed copies and five (5) electronic searchable PDF copies of an Operation and Maintenance Manual for all substantially complete equipment and associated control systems furnished and installed. The final manuals shall incorporate all JEA's review comments associated with the preliminary operation and maintenance Manual.

D. Operating and Maintenance Data shall be prepared and submitted in accordance with the requirements as listed in *JEA Water & Sewer Standards Section 445 – Pump Station Operation and Maintenance Data Submission Requirements*. See Appendix E for worksheet to be used for data submission.

E. Periodic payments shall not be processed prior to JEA's review and acceptance of EAM Worksheet development for the pay period submitted.

1.03 FORMAT AND CONTENTS

A. Each operations and maintenance manual shall contain the following information:

1. Storage instructions and requirements (short term and long term)

2. Installation instructions

3. Assembly and erection drawings/details

4. Dimensional drawings

5. Wiring diagrams including all control and lightning systems

6. Equipment data summary table (see sample form at the end of this section)

7. Equipment preventative maintenance data summary (see sample form at the end of this section)

8. Manufacturer's operating manual/instructions including equipment start-up, normal operation, shutdown, and emergency operation

9. Manufacturer's maintenance instructions including equipment calibration and adjustment, preventive and repair maintenance, and lubrication instructions

10. Trouble shooting guide

11. Parts diagram/list

12. Spare parts list (these are parts that the manufacturer recommends having readily available for use during preventative maintenance or are normal wear items)

13. Recommended lubricant types (lubrication schedule shall be included with the preventative maintenance data summary)

14. Tools list (any tools that will be required for preventative maintenance, disassembly, or re-assembly of the equipment)

15. Single line schematic

16. List of electrical relay settings and control and alarm contact settings.

17. Applicable software (if required)

18. Software manuals (if required)

19. Warranty

20. Contact information for the contractor, manufacturer, manufacturer's representative and nearest service representative

B. Any equipment that contains multiple components (for example a pump and motor), the above information shall be provided for each component.

C. For valve operation and maintenance manuals, provide one valve schedule giving valve number, location, fluid, and fluid destination for each valve installed. Group all valves in same piping systems together in the schedule. Obtain a sample of the valve numbering system from JEA.

D. All operation and maintenance manual material shall be printed on 8-1/2”x11” or 11”x17” paper.

E. Each manual shall be bound together in appropriate three-ring binders. Each binder shall be provided with front cover with the following information, as a minimum:

1. JEA logo

2. Project name

3. Date (Month / Year)

4. Equipment name

5. Applicable specification section

6. Manufacturer’s name

7. Contractor’s name

F. Each manual shall also be provided with a binder edge cover that contains, at a minimum, the project name, date and equipment name.

G. Each manual shall be divided into sufficient sections to facilitate ease of use and reference of the manual. Sections shall be identified using heavy section dividers with reinforced holes and numbered plastic index tabs; tabs with section titles shall be acceptable. A detailed table of contents shall be provided. At a minimum, the following sections shall be provided:

1. Equipment technical data summary

2. Storage / installation instructions

3. Operation instructions

4. Maintenance instructions

5. Dimensional/assembly drawings, diagrams, and parts lists

6. Wiring drawings and diagrams

7. Contact information

8. Warranty

H. All operating and maintenance material that comes bound by the equipment manufacturer shall be left in its original bound state. Cross-reference the appropriate sections of the Contractor's operations and maintenance manual to the manufacturers' bound manuals.

I. Label binders Volume 1, 2, and so on, where more than one binder is required. Include the table of contents for the entire set, identified by volume number, in each binder.

J. When manufacturer’s manuals and diagrams contain information applicable to multiple models or configurations, the information not applicable to this specific installation shall be stricken.

K. The final operations and maintenance manual shall reflect the most current edition of the shop drawing accepted by the Engineer. Any field changes or modifications shall also be included.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 16000

BASIC ELECTRICAL REQUIREMENTS

## PART 1 -- GENERAL

### 1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, materials, tools, and equipment, and perform all work and services necessary for, or incidental, to the furnishing and installation of all electrical work as shown on the Drawings, and as specified in accordance with the provisions of the Contract Documents and completely coordinate with the work of other trades involved in the general construction. Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation shall be furnished and installed as part of this work. The Contractor shall obtain approved Shop Drawings showing wiring diagrams, connection diagrams, roughing-in and hook up details for all equipment and comply therewith. All electrical work shall be complete and left in operating condition in accordance with the intent of the Drawings and the Specifications for the electrical work.

B. The electrical scope of work for this project primarily includes, but is not limited to, the following:

1. Furnish and install temporary electrical equipment to facilitate all work as specified herein and as indicated on the Drawings. All temporary installations shall be in accordance with Article 590 of the NEC. Remove all temporary facilities provided at the end of construction.

2. Remove and dispose of existing low voltage switchgear circuit breakers (after JEA is supplied with all equipment they prefer to keep from the demolition).

3. Furnish and install new low voltage switchgear circuit breakers including main breakers, tie breaker, generator breaker, and automatic transfer controls.

4. Remove existing and furnish and install new power monitors.

5. Provide new switichgear doors for all new switchgear components.

6. Furnish and install all aboveground raceway systems including conduit, fittings, boxes, supports, and other pertinent components.

7. Furnish and install all low voltage wire and cable resulting in a complete and operable electrical system. This includes temporary and permanent installations.

8. Provide a minimum of one (1) skilled worker 24 hours a day, 7 days a week, for the duration of the plant being on temporary power. Person shall be qualified to manually transfer to/from the portable generator in the event of a utility outage.

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9. Other electrical work as specified herein and indicated on the Drawings.

C. All material and equipment must be the product of an established, reputable, and approved manufacturer; must be new and of first class construction; must be designed and guaranteed to perform the service required; and must bear the label of approval of the Underwriters Laboratories, Inc., where such approval is available for the product of the listed manufacturer as approved by the Engineer.

D. When a specified or indicated item has been superseded or is no longer available, the manufacturer's latest equivalent type or model of material or equipment as approved by the Engineer shall be furnished and installed at no additional cost to the Owner.

E. Where the Contractor's selection of equipment of specified manufacturers or additionally approved manufacturers requires changes or additions to the system design, the Contractor shall be responsible in all respects for the modifications to all system designs, subject to approval of the Engineer. The Contractor's bid shall include all costs for all work of the Contract for all trades made necessary by such changes, additions or modifications or resulting from any approved substitution.

F. Furnish and install all stands, racks, brackets, supports, and similar equipment required to properly serve the equipment which is furnished under this Contract, or equipment otherwise specified or indicated on the Drawings.

1.02 EQUIPMENT LOCATION

A. The Drawings show the general location of feeders, transformers, outlets, conduits, and circuit arrangements. Because of the small scale of the Drawings, it is not possible to indicate all of the details involved. The Contractor shall carefully investigate the structural and finish conditions affecting all of his work and shall arrange such work accordingly; furnishing such fittings, junction boxes, and accessories as may be required to meet such conditions. The Contractor shall refer to the entire Drawing set to verify openings, special surfaces, and location of other equipment, or other special equipment prior to roughing-in for panels, switches, and other outlets. The Contractor shall verify all equipment dimensions to ensure that proposed equipment will fit properly in spaces indicated.

B. Where outlets are shown near identified equipment furnished by this or other Contractors, it is the intent of the Specifications and Drawings that the outlet be located at the equipment to be served. The Contractor shall coordinate the location of these outlets to be near the final location of the equipment served whether placed correctly or incorrectly on the Drawings.

1.03 LOCAL CONDITIONS

A. The Contractor shall examine the site and become familiar with conditions affecting the work. The Contractor shall investigate, determine, and verify locations of any overhead or buried utilities on or near the site, and shall determine such locations in conjunction with all public and/or private utility companies and with all authorities having jurisdiction. All costs, both temporary and permanent to connect all utilities, shall be included in the Bid. The Contractor shall be responsible for scheduling and coordinating with the local utility for temporary and permanent services.

B. In addition, the Contractor shall relocate all duct banks, lighting fixtures, receptacles, switches, boxes, and other electrical equipment as necessary to facilitate the Work included in this project. Costs for such work shall be included in the Bid.

C. The Contractor is responsible for coordinating all electric utility equipment installations with the serving electric utility. The Contractor shall furnish and install all electric utility equipment required by the electric utility to be installed by the Contractor whether specifically shown on the Drawings or not.

D. The Contractor is responsible for ensuring all electric utility equipment and construction installed by the Contractor is furnished and installed in accordance with the electric utility's design specifications and requirements. The Contractor is fully responsible for coordinating his scope of work with the electric utility. Any additional required electric utility construction or equipment not specified herein or shown on the Drawings shall be supplied by the Contractor at no additional cost to the Owner.

E. The contact person at the serving electrical utility is:

Jimmy Lyon
Electrical Maintenance Coordinator
JEA Electrical Utility
904.665.6852
lyonjl@jea.com

1.04 SUBMITTALS

A. The Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Operation and Maintenance Manuals

3. Spare Parts List

4. Proposed Testing Methods and Reports of Certified Shop Tests.

5. Reports of Certified Field Tests.

6. Manufacturer's Representative's Certification.

B. Submittals shall be sufficiently complete in detail to enable the Engineer to determine compliance with Contract requirements.

C. Submittals will be approved only to the extent of the information shown. Approval of an item of equipment shall not be construed to mean approval for components of that item for which the Contractor has provided no information.

D. Some individual Division 16 specification sections may require a Compliance, Deviations, and Exceptions (CD&E) letter to be submitted. If the CD&E letter is required and shop drawings are submitted without the letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications

by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

1.05 APPLICABLE CODES AND REQUIREMENTS

A. Conformance

1. All work, equipment and materials furnished shall conform with the existing rules, requirements and specifications of the following:

a. Insurance Rating Organization having jurisdiction

b. The serving electrical utility company

c. The currently adopted edition of the National Electrical Code (NEC)

d. The National Electric Manufacturers Association (NEMA)

e. The Institute of Electrical and Electronic Engineers (IEEE)

f. The Insulated Cable Engineers Association (ICEA)

g. The American Society of Testing Materials (ASTM)

h. The American National Standards Institute (ANSI)

i. The requirements of the Occupational Safety Hazards Act (OSHA)

j. The National Electrical Contractors Association (NECA) Standard of Installation

k. National Fire Protection Association (NFPA)

l. International Electrical Testing Association (NETA)

m. All other applicable Federal, State and local laws and/or ordinances.

2. All material and equipment shall bear the inspection labels of Underwriters Laboratories, Inc., if the material and equipment is of the class inspected by said laboratories.

B. Nonconformance

1. Any paragraph of requirements in these Specifications, or Drawings, deviating from the rules, requirements and Specifications of the above organizations shall be invalid and their (the above organizations) requirements shall hold precedent thereto. The Contractor shall be held responsible for adherence to all rules, requirements and specifications as set forth above. Any additional work or material necessary for adherence will not be allowed as an extra, but shall be included in the Bid. Ignorance of any rule, requirement, or Specification shall not be allowed as an excuse for nonconformity. Acceptance by the Engineer does not relieve the

Contractor from the expense involved for the correction of any errors which may exist in the drawings submitted or in the satisfactory operation of any equipment.

C. Certification

1. Upon completion of the work, the Contractor shall obtain certificate(s) of inspection and approval from the National Board of Fire Underwriters or similar inspection organization having jurisdiction and shall deliver same to the Engineer and the Owner.

1.06 PERMITS AND INSPECTIONS

A. The Contractor shall coordinate with JEA to obtain the appropriate permits and inspections as applicable to the scope of the project.

1.07 TEMPORARY LIGHTING AND POWER

A. The Contractor shall reference the Contract Drawings. At a minimum, the Contractor shall provide a portable 1500kW (minimum) standby generator to keep the required loads fully operational during the required outages outlined in the Contract Documents. Contractor is responsible for the complete installation of all connections for all temporary power sources to the loads to meet this requirement.

1.08 TESTS

A. Upon completion of the installation, the Contractor shall perform tests for operation, load (Phase) balance, overloads, and short circuits. Tests shall be made with and to the satisfaction of the Owner and Engineer.

B. The Contractor shall perform all field tests and shall provide all labor, equipment, and incidentals required for testing and shall pay for electric power required for the tests. All defective material and workmanship disclosed shall be corrected by the Contractor at no cost to the Owner. The Contractor shall show by demonstration in service that all circuits and devices are in good operating condition. Test shall be such that each item of control equipment will function not less than five (5) times.

C. Refer to each individual specification section for detailed test requirements.

D. The Contractor shall complete the installation and field testing of the electrical installation at least one (1) week prior to the start-up and testing of all other equipment. During the period between the completion of electrical installation and the start-up and testing of all other equipment, the Contractor shall make all components of the Work available as it is completed for their use in performing Preliminary and Final Field Tests.

E. Before each test commences, the Contractor shall submit a detailed test procedure, and also provide test engineer resume, manpower and scheduling information for the approval by the Engineer. In addition, the Contractor shall furnish detailed test procedures for any of his equipment required as part of the field tests of other systems.

1.09 INFRARED INSPECTION

A. Just prior to the final acceptance of a piece of equipment, the Contractor shall perform an infrared inspection to locate and correct all heating problems associated with electrical equipment terminations.

B. The infrared inspection shall apply to all new equipment and existing equipment that is in any way modified under this Contract. All heating problems detected with new equipment furnished and installed under the Scope of this Contract shall be corrected by the Contractor. All problems detected with portions of existing equipment modified under this Contract shall also be corrected by the Contractor.

C. Any issues detected with portions of existing equipment that were not modified under this Contract are not the responsibility of the Contractor. Despite the Contractor not being held responsible for these problems, the Contractor shall report them to the Owner and Engineer immediately for resolution.

D. The infrared inspection report shall include both digital and IR pictures positioned side by side. Both the digital and IR pictures shall be clear and high quality. Fuzzy, grainy, or poorly illuminated pictures are not acceptable. The IR picture shall be provided with a temperature scale beside it, and an indication of the hot spot temperature in each picture. Reports shall be furnished in a 3-ring binder, with all pages printed in full color, with equipment assemblies separated by tabs.

1.10 PROTECTIVE DEVICE SETTING AND TESTING

A. The Contractor shall provide the services of a field services organization to adjust, set, calibrate and test all protective devices in the electrical system. The organization shall be a subsidiary of or have a franchise service agreement with the electrical equipment manufacturer. The qualifications of the organization and resumes of the technicians as well as all data forms to be used for the field testing shall be submitted.

B. All protective devices in the electrical equipment shall be set, adjusted, calibrated and tested in accordance with the manufacturers' recommendations, the coordination study, and best industry practice.

C. Proper operation of all equipment associated with the device under test and its compartment shall be verified, as well as complete resistance, continuity and polarity tests of power, protective and metering circuits. Any minor adjustments, repairs and/or lubrication necessary to achieve proper operation shall be considered part of this Contract.

D. All solid state trip devices shall be checked and tested for setting and operation using manufacturers recommended test devices and procedures.

E. Circuit breakers and/or contactors associated with the above devices shall be tested for trip and close functions with their protective device.

F. When completed, the Contractor shall provide a comprehensive report for all equipment tested indicating condition, readings, faults and/or deficiencies in same. Inoperative or defective equipment shall be brought immediately to the attention of the Engineer.

G. Prior to placing any equipment in service, correct operation of all protective devices associated with this equipment shall be demonstrated by field testing under simulated load conditions.

1.11 POWER SYSTEM STUDIES

A. The Contractor will provide the Power System studies and properly set all protective devices in accordance with the results of the studies. Studies shall include a comprehensive coordination study and arc flash risk assessment. Studies shall be signed and sealed by a Professional Engineer registered in the State of Florida.

B. Power system studies shall be performed and provided to Engineer for review. After approval of power system study, labels shall be furnished and installed on all electrical equipment as applicable.

1.12 SCHEDULES AND FACILITY OPERATIONS

A. Since the equipment testing required herein shall require that certain pieces of equipment be taken out of service, all testing procedures and schedules must be submitted to the Engineer for review and approval two (2) weeks prior to any work beginning. When testing has been scheduled, the Engineer must be notified 48 hours prior to any work to allow time for load switching and/or alternation of equipment. In addition, all testing that requires temporary shutdown of facility equipment must be coordinated with the Owner/Engineer so as not to affect proper facility operations.

B. At the end of the workday, all equipment shall be back in place and ready for immediate use should a facility emergency arise. In addition, should an emergency condition occur during testing, at the request of the Owner, the equipment shall be placed back in service immediately and turned over to Owner personnel.

C. In the event of accidental shutdown of Owner equipment, the Contractor shall notify Owner personnel immediately to allow for an orderly restart of affected equipment.

D. Maintaining the operation of these facilities during the duration of the construction period is essential and required. The Contractor shall furnish and install temporary equipment as required to maintain facility operation. Reference the Construction Sequencing and Constraint notes on the Contract Drawings for further details.

1.13 MATERIALS HANDLING

A. Materials arriving on the job site shall be stored in such a manner as to keep material free of rust and dirt and so as to keep material properly aligned and true to shape. Rusty, dirty, or misaligned material will be rejected. Electrical conduit shall be stored to provide protection from the weather and accidental damage. Rigid non-metallic conduit shall be stored on even supports and in locations not subject to direct sun rays or excessive heat. Cables shall be sealed, stored, and handled carefully to avoid damage to the outer covering or insulation and damage from moisture and weather. Adequate protection shall be required at all times for electrical equipment and accessories until installed and accepted. Materials damaged during shipment, storage, installation, or testing shall be replaced or repaired in a manner meeting with the approval of the Engineer. If space heaters are provided in a piece of electrical equipment, they shall be temporarily

connected to a power source during storage. The Contractor shall store equipment and materials in accordance with Section 01550, Site Access and Storage.

1.14 WARRANTIES

A. Unless otherwise specified in an individual specification section, all equipment and electrical construction materials furnished and installed under Division 16 shall be provided with a three (3) year warranty by the Contractor. This warranty includes all parts and labor supplied by the Contractor, inclusive.

1.15 TRAINING

A. Unless otherwise specified in an individual specification section, all training for equipment furnished and installed under Division 16 shall be provided as indicated herein.

PART 2 -- PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Unless otherwise indicated, the materials to be provided under this Specification shall be the products of manufacturers regularly engaged in the production of all such items and shall be the manufacturer's latest design. The products shall conform to the applicable standards of UL and NEMA, unless specified otherwise. International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured, and labeled in compliance with IEC standards is not acceptable.

B. All items of the same type or ratings shall be identical. This shall be further understood to include products with the accessories indicated.

C. All equipment and materials shall be new, unless indicated or specified otherwise.

D. The Contractor shall submit proof if requested by the Engineer that the materials, appliances, equipment, or devices that are provided under this Contract meet the requirements of Underwriters Laboratories, Inc., in regard to fire and casualty hazards. The label of or listing by the Underwriters Laboratories, Inc., will be accepted as conforming to this requirement.

2.02 SUBSTITUTIONS

A. Unless specifically noted otherwise, any reference in the Specifications or on the Drawings to any article, service, product, material, fixture, or item of equipment by name, make, or catalog number shall be interpreted as establishing the type, function, and standard of quality and shall not be construed as limiting competition. The Contractor, in such cases may, at his option use any article, device, product, material, fixture, or item of equipment which in the judgment of the Engineer, expressed in writing, is equal to that specified.

2.03 CONCRETE

A. The Contractor shall furnish all concrete required for the installation of all electrical work, Concrete shall be Class A unless otherwise specified. Concrete and reinforcing steel shall meet the appropriate requirements of Division 3 of the Specifications.

B. The Contractor shall provide concrete equipment pads for all free standing electrical apparatus and equipment located on new or existing floors or slabs. The Contractor shall provide all necessary anchor bolts, channel iron sills, and other materials as required. The exact location and dimensions shall be coordinated for each piece of equipment well in advance of the scheduled placing of these pads. Equipment pads shall be 4 inches high unless otherwise indicated on the Drawings and shall conform to standard detail for equipment pads shown on the Contract Drawings. Equipment pads shall not have more than 3" excess concrete beyond the edges of the equipment.

C. The Contractor shall provide concrete foundations for all free standing electrical apparatus and equipment located outdoors or where floors or slabs do not exist and/or are not or provided by others under this Contract. The Contractor shall provide all necessary anchor bolts, channel iron sills, and other materials as required. The location and dimensions shall be coordinated for each piece of equipment well in advance of the scheduled placing of the foundations. Equipment foundations shall be constructed as detailed on the Drawings or if not detailed on the Drawings shall be 6 inches thick minimum reinforced with #4 bars at 12-inch centers each way placed mid-depth. Concrete shall extend 6 inches minimum beyond the extreme of the equipment base and be placed on a compacted stone bed (#57 stone or ABC) 6 inches thick minimum.

2.04 RUBBER INSULATING MATTING

A. Rubber insulating matting shall be furnished and installed on the floor and in front of each piece of electrical equipment that is located indoors and installed under this Contract. Rubber insulating matting shall not be installed outdoors. The mat shall be long enough to cover the full length of the equipment. The mat shall be 1/4 inch thick with beveled edges, canvas back, solid type with corrugations running the entire length of the mat. The matting shall meet OSHA requirements and the requirements of ASTM D-178 for Type 2, Class 2 insulating matting. Matting shall be 36 inches wide, minimum. However, matting width shall be no less than the NEC working clearance for the equipment with which it is associated.

B. Matting shall be provided for the following equipment:

- Modified switchgear, SWBD-20

PART 3 -- EXECUTION

3.01 CUTTING AND PATCHING

A. Coordination

1. The Work shall be coordinated between all trades to avoid delays and unnecessary cutting, channeling and drilling. Sleeves shall be placed in concrete for passage of conduit wherever possible.

B. Damage

1. The Contractor shall perform all chasing, channeling, drilling and patching necessary to the proper execution of his Contract. Any damage to the building, structure, or any equipment shall be repaired by qualified mechanics of the trades involved at the Contractor's expense. If, in the Engineer's judgment, the repair of damaged equipment would not be satisfactory, then the Contractor shall replace damaged equipment at his own expense.

C. Existing Equipment

1. Provide a suitable cover or plug for openings created in existing equipment as the result of work under this Contract. For example, provide round plugs in equipment enclosures where the removal of a conduit creates a hole and the enclosure. Covers and plugs shall maintain the NEMA rating of the equipment enclosure. Covers and plugs shall be watertight when installed in equipment located outdoors.

3.02 EXCAVATION AND BACKFILLING

A. The Contractor shall perform all excavation and backfill required for the installation of all electrical work. All excavation and backfilling shall be in complete accordance with the applicable requirements of Division 2 and as indicated on the Drawings.

3.03 CORROSION PROTECTION

A. Wherever dissimilar metals, except conduit and conduit fittings, come into contact, the Contractor shall isolate these metals as required with neoprene washers, nine (9) mil polyethylene tape, or gaskets.

- END OF SECTION -

SECTION 16111

CONDUIT

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install conduits and conduit fittings to complete the installation of all electrically operated equipment as specified herein, indicated on the Drawings, and as required.

B. Requirements for conduit clamps, support systems, and anchoring are not included in this Section. Reference Section 16190, Electrical Supporting Devices, for these requirements.

C. Reference Section 16000, Basic Electrical Requirements.

1.02 CODES AND STANDARDS

A. Conduits and conduit fittings shall be designed, manufactured, and/or listed to the following standards as applicable:

1. American National Standards Institute (ANSI)

a. ANSI B1.20.1 – Pipe Threads, General Purpose

b. ANSI C80.1 – Electrical Rigid Steel Conduit

c. ANSI C80.5 – Electrical Rigid Aluminum Conduit

d. ANSI FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

2. Underwriters Laboratories (UL)

a. UL 1 – Standard for Flexible Metal Conduit

b. UL 6 - Electrical Rigid Metal Conduit-Steel

c. UL 6A – Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel

d. UL 360 – Standard for Liquid-tight Flexible Metal Conduit

e. UL 467 – Grounding and Bonding Equipment

f. UL 514B – Conduit, Tubing, and Cable Fittings

g. UL 651 – Standard for Schedule 40 and 80 Conduit and Fittings

h. UL 1479 – Standard for Fire Tests of Penetration Fire Stops

i. UL 1660 – Liquid-tight Flexible Nonmetallic Conduit

3. National Electrical Manufacturer's Association (NEMA)

a. NEMA RN 1 – PVC Externally Coated Galvanized Rigid Steel Conduit

b. NEMA TC-2 – Electrical PVC Conduit

c. NEMA TC-3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing

B. Others

1. ACI-318 – Building Code Requirements for Structural Concrete

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300 – Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets for conduits and fittings.

2. Conduit identification methods and materials.

3. Evidence of training for all personnel that will install PVC coated rigid metal conduit.

1.05 DEFINITIONS

A. Conduits are categorized by the circuit type of the wiring to be installed inside. Conduits are defined as follows:

1. Power Conduits – Conduits that carry AC or DC power wiring from a source to a load. Conduits that carry lighting and receptacle wiring.

2. Control Conduits – Conduits that carry AC or DC discrete control wiring between devices and/or equipment. Conduits that carry fiber optic cables between devices and/or equipment.

3. Instrumentation Conduits – Conduits that carry AC or DC analog signal wiring between devices and/or equipment.

## PART 2 – PRODUCTS

### 2.01 GENERAL

A. Conduit and conduit fitting products are specified in the text that follows this article. Reference Part 3 herein for the application, uses and installation requirements of these conduits and conduit fittings.

B. All metallic conduit fittings shall be UL 514B and UL 467 Listed, and constructed in accordance with ANSI FB 1. All metallic conduit fittings for use in Class I Division I hazardous areas shall be UL 1203 Listed. All non-metallic fittings shall be UL 651 Listed and constructed in accordance with NEMA TC-3.

C. Flexible conduit couplings for use in Class I Division I hazardous areas shall have threaded stainless steel end fittings and a flexible braided core. Flexible braid shall be constructed of stainless steel where available in the conduit trade size required for the application. Where stainless steel braid is not available, the braid shall be provided with a PVC coating. No other braid types or materials are acceptable.

D. Where threading is specified herein for conduit fitting connections, the fittings shall be manufactured to accept conduit that is threaded to ANSI B1.20.1 requirements.

E. Conduit expansion fittings for all conduit materials of construction shall be capable of 4 inches of movement along the axis of the conduit for trade sizes 2 inches or less. Expansion fittings shall be capable of 8 inches of movement along the axis of the conduit for trade sizes greater than 2 inches.

F. Conduit deflection fittings for all conduit materials of construction shall be provided with a flexible neoprene outer jacket that permits up to ¾ inch of expansion/contraction along the axis of the conduit as well as up to ¾ inch of parallel misalignment between the conduit axes. Outer jacket shall be secured to the conduit hubs by stainless steel clamps.

G. Conduit seals shall either be Listed and labeled for 40% fill, or conduit reducing fittings and a trade size larger conduit seal shall be provided to achieve 25% or less fill within the seal. Percentage fill calculation shall be based on the conductors to be installed. Conduit seals shall be provided with breathers and/or drains where required by the NEC.

H. Conduit insulating bushings shall be constructed of plastic and shall have internal threading.

I. Additional conduit and conduit fitting requirements are specified in the articles that follow based on the specific conduit material of construction to be used.

2.02 RIGID NONMETALLIC CONDUIT AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be Schedule 40 or 80 (dependent on application) polyvinyl chloride (PVC) construction, manufactured in accordance with NEMA TC-2, UL 651 Listed, and suitable for conductors with 90 degree C insulation.

B. Conduit Bodies for use with Rigid Nonmetallic Conduit

1. Conduit bodies shall be constructed of PVC. Conduit hubs shall be integral to the conduit body and shall be smooth inside to accept a glued conduit connection.

2. Conduit body shall be provided with cover that is affixed in place by stainless steel screws which thread directly into the conduit body. Covers that utilize wedge nuts or any other method of attachment to the conduit body are not acceptable. Covers shall be provided with matching gasket.

C. Conduit Couplings and Unions for use with Rigid Nonmetallic Conduit

1. Conduit couplings and unions shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection.

D. Conduit Expansion and Deflection Fittings for use with Rigid Nonmetallic Conduit

1. Conduit expansion fittings and conduit deflection fittings shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection.

E. Conduit Termination Fittings for use with Rigid Nonmetallic Conduit

1. Conduit hubs shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection. Hubs shall have external threads and an accompanying PVC locknut, and shall be watertight when assembled to an enclosure.

2. Conduit locknuts shall be constructed of zinc plated steel. Locknuts shall have internal threading. Locknuts constructed of PVC and locknuts with integral gasket or seal are not acceptable.

3. Conduit end bells shall be constructed of PVC and shall be smooth inside to accept a glued conduit connection. End bell shall have a smooth inner surface that curves outward towards the edge of the fitting.

2.03 RIGID ALUMINUM CONDUIT AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be made of heavy wall high strength 6063 alloy aluminum with temper designation T1. Conduit shall be manufactured in accordance with ANSI C80.5, and shall be UL 6A Listed.

2. Conduit shall be provided with factory-cut 3/4 inch per foot tapered threads at each end in accordance with ANSI B1.20.1. Threads shall be cut prior to galvanizing to ensure corrosion protection adequately protects the threads. Conduit shall be provided with a matching coupling on one end and a color-coded thread protector on the other.

B. Conduit Bodies for use with Rigid Aluminum Conduit

1. Conduit bodies shall be constructed of copper-free aluminum which is coated with an aluminum enamel finish. Conduit bodies shall have integral threaded conduit hubs.

2. Conduit bodies for Class I Division I hazardous areas shall be provided with integrally threaded covers constructed of copper-free aluminum which is coated with an aluminum enamel finish.

3. Conduit bodies for all other areas shall be provided with stamped copper-free aluminum covers that are affixed in place by stainless steel screws which thread directly into the conduit body. Covers that utilize wedge nuts or any other method of attachment to the conduit body are not acceptable. Covers shall be provided with matching gasket.

C. Conduit Couplings, Nipples, and Unions for use with Rigid Aluminum Conduit

1. Couplings and nipples shall be threaded and shall be constructed of heavy wall high strength 6063 alloy aluminum with temper designation T1. Split-type couplings that use compression to connect conduits are not acceptable.

2. Unions shall be threaded, rain-tight, and constructed of copper-free aluminum which is coated with an aluminum enamel finish.

D. Conduit Expansion and Deflection Fittings for use with Rigid Aluminum Conduit

1. Conduit expansion fittings and conduit deflection fittings shall be constructed of copper-free aluminum which is coated with an aluminum enamel finish. Expansion and deflection fittings shall have threaded conduit connections.

2. Expansion fittings shall have an integral bonding jumper and deflection fittings shall have an external bonding jumper.

E. Conduit Seals for use with Rigid Aluminum Conduit

1. Conduit seals shall be constructed of copper-free aluminum which is coated with an aluminum enamel finish. Conduit seals shall have threaded conduit connections.

F. Conduit Termination Fittings for use with Rigid Aluminum Conduit

1. Conduit hubs shall be constructed of copper-free aluminum and shall have threaded connections to the conduit and enclosure. Hubs shall have a plastic insulated throat and shall be watertight when assembled to an enclosure.

2. Conduit locknuts shall be constructed of copper-free aluminum. Locknuts shall have internal threading. Locknuts with integral gasket or seal are not acceptable. Locknuts shall have integral bonding screw where required for proper bonding.

3. Conduit bonding bushings shall be constructed of copper-free aluminum. Bonding bushings shall have a threaded conduit connection. Bonding bushing shall be provided with properly sized set screw for connecting bonding conductor and an integral plastic insulator rated for 150 degrees C located in the throat.

2.04 LIQUID TIGHT FLEXIBLE METAL CONDUIT (LFMC) AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be manufactured using a single strip of hot dip galvanized high strength steel alloy, helically formed into a continuously interlocked flexible metal conduit. Trade size 1-1/4 inch and smaller conduits shall be provided with an integrally woven copper bonding strip.

2. Conduit shall be covered with an outside PVC jacket that is UV resistant, moisture-proof, and oil-proof. Conduit shall be UL 360 Listed.

B. Conduit Termination Fittings for use with LFMC

1. Conduit termination fittings shall be constructed of either 304 stainless steel or an electro-galvanized malleable iron alloy which is coated on the exterior with a 40 mil (minimum) PVC jacket and coated on the interior with a 2 mil (minimum) layer of urethane. PVC coated fittings shall have a sealing sleeve constructed of PVC which covers the connection to conduit.

2. Termination fittings shall have a threaded end with matching locknut and sealing ring for termination to equipment, and shall have an integral external bonding lug where required for proper bonding. Termination fittings shall have a plastic insulated throat and shall be watertight when assembled to the conduit and equipment.

2.05 LIQUID TIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC) AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be constructed of rigid polyvinyl chloride (PVC), fabricated to provide flexibility. Conduit shall be covered with an outside PVC jacket that is UV resistant, moisture-proof, and oil-proof. Conduit shall be UL 1660 Listed.

B. Conduit Termination Fittings for use with LFNC

1. Conduit termination fittings shall be constructed PVC and shall have a threaded end with matching locknut and sealing ring for termination to equipment. Termination fittings shall be watertight when assembled to the conduit and equipment.

2.06 FLEXIBLE METAL CONDUIT (FMC) AND ASSOCIATED FITTINGS

A. Conduit

1. Conduit shall be manufactured using a single strip of hot dip galvanized high strength steel alloy, helically formed into a continuously interlocked flexible metal conduit. Conduit shall be UL 1 Listed.

B. Conduit Termination Fittings for use with FMC

1. Conduit termination fittings shall be constructed of an electro-galvanized malleable iron alloy. Fittings shall have a threaded end with matching locknut for termination to equipment, and a compression-style connection to the associated conduit.

2.07 CONDUIT BENDS

A. Rigid conduit bends, both factory fabricated and field fabricated, shall meet the same requirements listed in the articles above for the respective conduit type and material of construction.

B. Conduit bend radii for standard radius bends shall be no less than as follows:

| TRADE SIZE (inches) | 3/4 | 1 | 1-1/4 | 1-1/2 | 2 | 2-1/2 | 3 | 3-1/2 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MIN. RADIUS (inches) | 4-1/2 | 5-3/4 | 7-1/4 | 8-1/4 | 9-1/2 | 10-1/2 | 13 | 15 | 16 | 24 | 30 |

C. Conduit bend radii for long radius bends shall be no less than as follows:

| TRADE SIZE (inches) | 3/4 | 1 | 1-1/4 | 1-1/2 | 2 | 2-1/2 | 3 | 3-1/2 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MIN. RADIUS (inches) | N/A | 12 | 18 | 24 | 30 | 30 | 36 | 36 | 48 | 48 | 60 |

2.08 MISCELLANEOUS

A. Conduit Periphery Sealing

1. The sealing of the exterior surface of conduits to prevent water and/or air from passing around the conduit periphery from one space to another (where required) shall be through the use of one of the following:

a. A conduit sleeve and pressure bushing sealing system. Acceptable products are FSK by OZ-GEDNEY, Link-Seal by Crouse-Hinds, or Engineer approved equal.

b. A conduit sleeve that is two trade sizes larger than the conduit being sealed, with 2-hour fire rated UL 1479 Listed caulk filling the entire void between the conduit and sleeve. This method is only suitable for penetrations in non-fire rated walls and floors between spaces within buildings. This method shall not be used for the sealing of conduits leaving a building and/or structure.

2. Conduit penetrations through fire-rated walls and floors shall be made with an approved UL 1479 Listed product specifically intended for the trade size of the conduit.

B. Primer and Cement

1. Nonmetallic conduit shall be cleaned with primer and connected to fittings with the manufacturer's recommended cement that is labeled Low VOC.

C. Galvanizing Compounds

1. Galvanizing compounds for field application shall be the cold-applied type, containing no less than 93% pure zinc.

D. Conduit Interior Sealing

1. The sealing of the inside of conduits against water ingress shall be achieved through the use of one of the following:

a. Two-part expanding polyurethane foam sealing compound, dispensed from a single tube which mixes the two parts as it is injected into the conduit. Expanding foam shall be compatible with the conduit material of construction as well as the outer jacket of the cables in the conduit. Acceptable products are Q-Pak 2000 by Chemque, FST by American Polywater Corporation, or Hydra-seal S-60 by Duraline.

b. Inflatable bag that provides seal around cables and around inside diameter of conduit. Provide appropriate quantity of additional fittings for applications with three or more cables in the conduit to be sealed. Acceptable products are Rayflate by Raychem, or Engineer approved equal. This sealing method is only applicable to conduits trade size 2 inch and larger.

c. Neoprene sealing ring provided with the required quantity and diameter of holes to accommodate the cables in each conduit. Sealing ring shall be compressed by two stainless steel pressure plates. Acceptable products are type CSB by OZ-GEDNEY, or Engineer approved equal. This sealing method is only applicable to metallic conduits containing 4 or less cables.

2. The use of aerosol-based expanding foam sealants or any other method of sealing against water ingress not listed above is not acceptable.

E. Pull Rope

1. Pull ropes for empty and/or spare conduits shall be woven polyester, 1/2 inch wide, with a minimum tensile strength of 1,250 lbs.

2. Pull ropes for the Contractors use in installing conductors shall be the size and strength required for the pull, and shall be made of a non-metallic material.

## PART 3 – EXECUTION

### 3.01 GENERAL

A. Minimum trade size for all rigid conduits shall be 3/4 inch in exposed applications and 1 inch in embedded applications. Conduits installed within ductbanks shall be allowed to be increased in size to trade size 2 inch, at the Contractor's option, to accommodate the saddle size of the ductbank spacers. However, no combining of circuits shall be allowed in the larger conduits.

B. Minimum trade size for flexible conduits (where specifically allowed herein) shall be 1/2 inch in all applications.

C. Conduit routing and/or homeruns within structures is not shown on the Drawings. Conduits shall be installed concealed wherever practical and within the limitations specified herein. All other conduits not capable of being installed concealed shall be installed exposed.

D. Empty and/or spare conduits shall be provided with pull ropes which have no less than 12 inches of slack at each end.

E. Nonmetallic conduits for installations requiring less than a factory length of conduit shall be field cut to the required length. The cut shall be made square, cleaned of debris, and primer shall be applied to ready each joint for fusing. Conduits shall then be fused together with the conduit manufacturer's approved cement compound.

F. Metallic conduits for installations requiring less than a factory length of conduit shall be field cut to the required length. The cut shall be made square, be cleaned of all debris and be de-burred, then threaded. Conduit threading performed in the field shall be ¾ inch per foot tapered threads in accordance with ANSI B1.20.1.

G. Conduits shall be protected from moisture, corrosion, and physical damage during construction. Install dust-tight and water-tight conduit fittings on the ends of all conduits immediately after installation and do not remove until conductors are installed.

H. Conduits shall be installed to provide no less than 12 inches clearance from pipes that have the potential to impart heat upon the conduit. Such pipes include, but are not limited to, hot water pipes, steam pipes, exhaust pipes, and blower air pipes. Clearance shall be maintained whether conduit is installed in parallel or in crossing of pipes.

I. Where non-metallic instrumentation conduits are installed exposed, the following clearances to other conduit types shall be maintained:

1. Instrumentation conduits installed parallel to conduits with conductors energized at 480V or above shall be 18 inches.

2. Instrumentation conduits installed parallel to conduits with conductors energized at 240V and below shall be 12 inches.

3. Instrumentation conduits installed at right angles to conductors energized at 480V and below shall be 6 inches.

4. Instrumentation conduits installed at right angles to conductors energized at voltages above 480V shall be 12 inches.

J. Where conduit fittings do not include an integral insulated bushing, an insulated bushing shall be installed at all conduit termination points.

K. Conduits which serve multi-section equipment shall be terminated in the section where wiring terminations will be made.

L. Conduits shall not penetrate the floors or walls inside liquid containment areas without specific written authorization from the Engineer. Liquid containment areas are indicated on the Drawings.

M. In no case shall conduit be supported or fastened to another pipe or be installed in a manner that would prevent the removal of other pipes for repairs. Spring steel fasteners are not permitted.

N. All field fabricated threads for rigid galvanized steel conduit shall be thoroughly coated with two coats of galvanizing compound, allowing at least two minutes to elapse between coats for proper drying.

O. The appropriate specialized tools shall be used for the installation of PVC coated conduit and conduit fittings. No damage to the PVC coating shall occur during installation. Conduit and conduit fittings with damaged PVC coating shall be replaced at the Contractor's cost. The use of PVC coating touch-up compounds is not permitted.

P. Aluminum conduits shall not be installed in direct contact with concrete surfaces. Where aluminum conduits are routed along concrete surfaces, they shall be installed with one-hole electro-galvanized malleable iron alloy straps with matching clamp-backs to space the conduit ¼ inch away from concrete surface. Where aluminum conduit passes through concrete, CMU or brick walls, the penetration shall be made such that the aluminum conduit does not come in contact with concrete, CMU, brick or mortar.

3.02 CONCEALED AND EMBEDDED CONDUITS

A. Conduits are permitted to be installed concealed and/or embedded with the following requirements:

1. Conduits shall not be installed horizontally when concealed within CMU walls, only vertical installation is acceptable.

2. Conduits installed embedded within concrete floors or walls shall be located so as not to affect the designed structural strength of the floor or wall. Embedded conduits shall be installed in accordance with Standard Detail 0331604 and ACI-318.

3. Where conduit bends emerge from concrete embedment, none of the curved portion of the bend shall be visible. Only the straight portion of the bend shall be visible.

4. Where multiple conduits emerge from concrete embedment or from concealment below a concrete floor, ample clear space shall be provided between conduits to allow for the appropriate and required conduit termination fittings to be installed.

5. Conduits installed embedded within concrete encasement of any kind shall be installed such that conduit couplings for parallel conduits are staggered so that they are not side by side.

B. Conduits are NOT permitted to be installed concealed and/or embedded for the following situations:

1. Conduits shall not be installed embedded within any water-bearing floors or walls. Conduits shall not be installed embedded within any liquid containment area floors or walls.

2. Conduits shall not be installed concealed within CMU walls or gypsum walls that are adjacent to Class I and II hazardous areas (Division I and Division II).

3. Conduits shall not be installed concealed within CMU walls or gypsum walls that are adjacent to indoor Type 1 or Type 2 chemical storage/transfer areas.

3.03 CONDUIT USES AND APPLICATIONS

A. Rigid Conduit

1. Rigid conduit for non-hazardous areas shall be furnished and installed in the materials of construction as follows:

| **RIGID CONDUIT FOR ALL AREAS** | | |
|---|---|---|
| **INSTALLATION AREA DESIGNATION/ SCENARIO** | **CONDUIT CATEGORY BY WIRING/CIRCUIT TYPE** | |
| | **Power and Control** | **Instrumentation** |
| Temporary Conduit | PVC Schedule 40 | Same as Power and Control |
| All Areas | Rigid aluminum conduit | Same as Power and Control |

2. The table for the materials of construction for rigid conduits are intended to exhaustively cover all possible scenarios and installation areas under this Contract. However, if a scenario or installation area is found that is not explicitly governed by this table, it shall be assumed for bid purposes that the conduit material of construction is to be rigid galvanized steel. This discrepancy shall be brought to the attention of the Engineer (in writing) immediately for resolution.

B. Conduit Bends

1. All conduit bends shall be the same material of construction as the rigid conduit listed in the tables above, with the following exceptions:

   a. All 90 degree bends or combinations of adjacent bends that form a 90 degree bend where concealed within concrete or below a concrete slab shall be pvc-coated rigid galvanized steel.

2. Field fabricated bends of metallic conduit shall be made with a bending machine and shall have no kinks. Field fabricated standard radius and long radius bends shall have minimum bending radii in accordance with the associated tables in Part 2 herein.

3. Field bending of non-metallic conduits is not acceptable, factory fabricated bends shall be used.

4. **Long radius bends** shall be furnished and installed for the following specific applications, all other bends shall be standard radius:

   a. Where specifically indicated on the Drawings.

C. Flexible Conduit

1. Flexible conduit shall only be installed for the limited applications specified herein. Flexible conduit shall not be installed in any other application without written authorization from the Engineer. Acceptable applications are as follows:

   a. Connections to motors and engine-generator sets (and similar vibrating equipment)

   b. Connections to solenoid valves and limit switches

   c. Connections to lighting fixtures installed in suspended ceilings

   d. Connections to lighting transformers

   e. Connections to pre-fabricated equipment skids

   f. Connections to HVAC equipment

   g. Connections to instrument transmitters and elements

   h. Where specifically indicated in the Standard Details

2. Flexible conduit length shall be limited to three (3) feet, maximum. Flexible conduit shall not be installed buried or embedded within any material.

3. Flexible conduit for non-hazardous areas shall be furnished and installed in the materials of construction as follows:

| FLEXIBLE CONDUIT FOR NON-HAZARDOUS AREAS | | |
|---|---|---|
| **INSTALLATION AREA DESIGNATION/SCENARIO** | **CONDUIT CATEGORY BY WIRING/CIRCUIT TYPE** | |
| | **Power and Control** | **Instrumentation** |
| Exposed in indoor dry non-process areas | Flexible metal conduit | Same as Power and Control |
| Exposed in outdoor areas | Liquid-tight flexible metal conduit | Same as Power and Control |

3.04 CONDUIT FITTING USES AND APPLICATIONS

A. General

1. Conduit fittings shall be furnished and installed in the materials of construction as indicated in Part 2, herein. Conduit fitting materials of construction are dependent on the material of construction used for the associated conduit.

2. Conduit fittings shall be provided in the trade size and configuration required to suit the application.

B. Conduit Bodies

1. Conduit bodies shall be installed where wire pulling points are desired or required, or where changes in conduit direction or breaking around beams is required.

2. Where conduit bodies larger than trade size 2 inches are intended to be used as a pull-through fitting during wire installation, oversized or elongated conduit bodies shall be used. Oversized or elongated conduit bodies shall not be required if the conduit body is intended to be used as a pull-out point during wire installation.

C. Conduit Nipples and Unions

1. Conduits with running threads shall not be used in place of 3-piece couplings (unions) or close nipples. After installation of a conduit fitting of any kind, there shall be no more than ¼ inch of exposed threads visible. Factory fabricated all-thread nipples may be used between adjacent enclosures, however, the same restriction applies regarding the length of exposed threads that are visible.

D. Conduit Expansion and Deflection Fittings

1. Conduit expansion fittings shall be installed where required by the NEC and where indicated on the Drawings. Expansion fittings shall also be installed for exposed straight metallic conduit runs of more than 75 feet, in both indoor and outdoor

locations. Expansion fittings for runs of non-metallic conduit shall be installed in accordance with the NEC.

2. Conduit deflection fittings shall be installed where required by the NEC and where conduits are installed (exposed and concealed) across structural expansion joints.

E. Conduit Seals

1. Conduit seals shall be installed for conduits installed within or associated with hazardous areas and other areas as required by the NEC. In addition, conduit seals shall also be furnished and installed as follows:

a. All conduits entering or leaving enclosed areas which store or distribute chlorine gas.

b. All conduits entering or leaving enclosed areas which store or distribute sulfur dioxide gas.

F. Conduit Termination Fittings

1. Where conduits terminate at enclosures with a NEMA 4, 4X, or 3R rating and the enclosure does not have integral conduit hubs, an appropriately sized watertight conduit hub shall be installed to maintain the integrity of the enclosure. The use of locknuts with integral gasket in lieu of watertight conduit hubs is not acceptable.

2. Where conduits terminate at enclosures that do not require conduit hubs, a two-locknut system shall be used to secure the conduit to the enclosure. One locknut shall be installed on the outside of the enclosure, and the other inside, drawn tight against the enclosure wall. The locknut on the interior of the enclosure shall be the type with integral bonding lug, or a conduit bonding bushing may be used in place of the locknut.

3. Conduits shall not be installed such that conduit fittings penetrate the top of any enclosure located outdoors, except in cases where specifically required by the serving electric utility. Conduits which serve outdoor equipment or an enclosure from above shall instead be routed into the side of the enclosure at the bottom. The conduit termination fitting shall be provided with a conduit drain to divert moisture from the raceway away from the enclosure.

3.05 MISCELLANEOUS

A. Conduit Periphery Sealing

1. All conduit penetrations through exterior walls shall be sealed around the periphery using the appropriate products specified in Part 2 herein to prevent air and/or water entry into the structure.

2. All conduit penetrations through interior walls and floors shall be sealed through the use of with conduit sleeves and caulk as specified in Part 2 herein. Alternatively, mortar may be used to seal around the conduit periphery.

3. Conduit penetrations through fire-rated walls as floors shall be made with the appropriate fire rated penetration product.

B. Conduit Interior Sealing

1. All conduits (including spares) entering a structure below grade shall be sealed on the interior of the conduit against water ingress. Sealing shall be at an accessible location in the conduit system located within the building structure and shall be via one of the methods specified in Part 2 herein. If conduit sealing cannot be achieved at an accessible location within the building structure, sealing shall be placed in the conduits in the nearest manhole or handhole outside the structure.

3.06 CONDUIT IDENTIFICATION

A. Exposed conduits shall be identified at the source, load, and all intermediate components of the raceway system. Examples of intermediate components include but are not limited to junction boxes, pull boxes, and disconnect switches. Identification shall be by means of an adhesive label with the following requirements:

1. Labels shall consist of an orange background with black text. Text for the label shall be the conduit number as indicated in the conduit and wire schedules.

2. In addition, at the source end of the conduit, a second line of text shall be included to indicate the load equipment name. This second line shall consist of the word "TO:" and the text for the destination of the conduit (e.g. TO: PLC-600). At the load end of the conduit, a second line of text shall be included to indicate the source equipment name. This second line shall consist of the word "FROM:" and the text for the source of the conduit (e.g. FROM: SWBD-20). This requirement applies only to the source and load ends of the conduit, and not anywhere in between.

3. For conduits trade sizes 3/4 inch through 1-1/2 inch, the text shall be a minimum 18 point font. For conduits trade size 2 inch and larger, the text shall be a minimum 24 point font.

4. Label height shall be 3/4 inch minimum, and length shall be as required to fit required text. The label shall be installed such that the text is parallel with the axis of the conduit. The label shall be oriented such that the text can be read without the use of any special tools or removal of equipment.

5. Labels shall be installed after each conduit is installed and, if applicable, after painting. Labels shall be printed in the field via the use of a portable label printing system. Handwritten labels are not acceptable.

6. Labels shall be made of permanent vinyl with adhesive backing. Labels made of any other material are not acceptable.

B. Conduits that are not exposed but installed beneath free standing equipment enclosures shall be identified by means of a plastic tag with the following requirements:

1. The tag shall be made of white Tyvek material, and have an orange label with black text, as described above, adhered to it. Text for the label shall be the conduit number as indicated in the conduit and wire schedules.

2. The tag shall be affixed to the conduit by means of a nylon cable tie. The tag shall be of suitable dimensions to achieve a minimum text size of 18 points.

C. Conduits for lighting and receptacle circuits shall not require identification.

D. Any problems or conflicts with meeting the requirements above shall immediately be brought to the attention of the Engineer for a decision.

3.07 TESTING

A. The following tests are required:

1. All conduit installed below grade or concrete encased shall be tested to ensure continuity and the absence of obstructions by pulling through each conduit a swab followed by a mandrel 85% of the conduit inside diameter. After testing, all conduits shall be capped after installation of a suitable pulling rope.

- END OF SECTION -

# SECTION 16123

# LOW VOLTAGE WIRE AND CABLE

## PART 1 -- GENERAL

### 1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, connect, test, and place in satisfactory operating condition, all low voltage wire and cable indicated on the Drawings and as specified herein and/or required for proper operation. The work of connecting cables to equipment and devices shall be considered a part of this Section. All appurtenances required for the installation of cable and wire systems shall be furnished and installed by the Contractor.

B. The scope of this Section does not include internal wiring factory installed by electrical equipment manufacturers.

C. Reference Section 16000, Basic Electrical Requirements; Section 16111, Conduit; and Section 16130, Boxes.

### 1.02 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the wire and cable manufacturer and submit the following:

1. Shop Drawings

2. Reports of Field Tests

3. Wiring Identification Methods

B. Each submittal shall be identified by the applicable specification section.

### 1.03 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed material's compliance with the Contract Documents.

B. Partial, incomplete, or illegible Submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

2. Cable pulling calculations (if required).

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3. Wiring identification methods and materials.

1.04 IDENTIFICATION

A. Each cable shall be identified as specified in Part 3, Execution, of this Specification.

1.05 CABLE PULLING CALCULATIONS

A. The Contractor shall submit cable pulling calculations. These calculations, to be performed by a currently registered professional engineer in the State of Florida, shall define pulling tension and sidewall loading (sidewall bearing pressure values) for all installations of 600VAC, #1/0 conductors and larger greater than 200 feet in length. Calculations for straight horizontal installations of 600VAC, #1/0 conductors and larger greater than 200 feet are not required.

## PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The wire and cable to be furnished and installed for this project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten (10) years. Wire and cable shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and indicated on the Drawings. Only one (1) manufacturer for each wire and cable type shall be permitted.

B. The wire and cable manufacturer shall be ISO 9000 registered.

2.02 POWER WIRE AND CABLE

A. Power wire and cable shall be stranded copper conductor with insulation type XHHW/XHHW-2, rated 90°C and 600V.

B. Conductors shall be stranded copper per ASTM-B8 and B-3, and Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be No. 12 AWG.

C. Multi-conductor power cable assemblies shall be UL 1277 Listed, provided with a bonding conductor, and furnished with an overall PVC jacket.

D. Power wire and cable shall be as manufactured by the Okonite Company, the Southwire Company, or General Cable.

E. For temporary connections, power wire and cable shall be stranded copper conductor with insulation type RHW-2, rated 90°C and 600V.

B. Temporary conductors shall be stranded copper per ASTM-B8 and B-3, and Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be No. 12 AWG.

2.03 CONTROL CABLE

A. 600 volt control cable shall consist of stranded, copper conductor with insulation type THHN, 90°C for dry locations and THWN, 75°C for wet locations, and 600V.

B. Conductors shall be stranded copper per ASTM B-8 and B-3, and Class B or C stranding contingent on the size unless otherwise specified. Minimum wire size shall be No. 14 AWG.

C. Multi-conductor control cable assemblies shall be UL 1277 Listed, provided with a bonding conductor, and furnished with an overall PVC jacket.

D. Control cable shall be as manufactured by the Okonite Company, the Southwire Company, or General Cable.

2.04 LIGHTING AND RECEPTACLE WIRE

A. The lighting and receptacle branch circuit wire shall consist of solid, copper conductors with insulation type THHN, 90°C for dry locations and THWN, 75°C for wet locations.

B. Conductors shall be solid copper per ASTM- B-3. Minimum size wire shall be No. 12 AWG.

C. Lighting and receptacle wire shall be as manufactured by the Okonite Company, the Southwire Company, or General Cable.

2.05 INSTRUMENTATION CABLE

A. The instrumentation cable for analog signals shall be single, shielded, twisted pairs or triads with 600 volt insulation and shall have a 75°C (minimum) insulation rating.

B. Conductors shall be tin or alloy coated (if available), soft, annealed copper, stranded per ASTM-B8, Class B stranding unless otherwise specified. Minimum size wire shall be No. 16 AWG.

C. The instrumentation cable shall be Okoseal-N Type P-OS for single pair or triad applications and Okoseal-N Type SP-OS for multiple pair or triad applications as manufactured by the Okonite Company, Belden equivalent, or Southwire Company equivalent.

2.06 CONDUCTOR IDENTIFICATION

A. Conductors shall be identified using a color coding method. Color coding for individual power, control, lighting, and receptacle conductors shall be as follows:

1. 480/277V AC Power

Phase A - BROWN
Phase B - ORANGE
Phase C - YELLOW
Neutral – GREY

2. 120/208V or 120/240V AC Power

   Phase A - BLACK
   Phase B - RED
   Phase C - BLUE
   Neutral - WHITE

3. DC Power

   Positive Lead - RED
   Negative Lead - BLACK

4. DC Control

   All wiring - BLUE

5. 120VAC Control

   120 VAC control wire shall be RED except for a wire entering a motor control center compartment or control panel which is an interlock. This interlock conductor shall be color coded YELLOW.

6. 24VAC Control

   All wiring - ORANGE

7. Equipment Grounding Conductor

   All wiring - GREEN

B. Individual conductors No. 2 AWG and smaller shall have factory color coded insulation. It is acceptable for individual conductors larger than No.2 AWG to be provided with factory color coded insulation as well, but it is not required. Individual conductors larger than No.2 AWG that are not provided with factory color coded insulation shall be identified by the use of colored tape in accordance with the requirements listed in Part 3 herein. Insulation colors and tape colors shall be in accordance with the color coding requirements listed above.

C. Conductors that are a part of multi-conductor control cable assemblies shall have black insulation. The conductor number shall be printed on each conductor's insulation in accordance with ICEA S-58-679, Method 4. Each conductor within the cable assembly shall also be identified with a heat shrink tag with color coded background in accordance with the requirements listed in Part 3 herein. Background color shall be in accordance with the color coding requirements listed above.

D. Conductors that are a part of multi-conductor power cable assemblies shall have black insulation. The conductor number shall be printed on each conductor's insulation in accordance with ICEA S-58-679, Method 4. Each conductor No. 2 AWG and smaller within the cable assembly shall also be identified with a heat shrink tag with color coded background. Each conductor larger than No. 2 AWG within the cable assembly shall also

be identified by the use of colored tape. Heat shrink tags and colored tape shall be in accordance with the requirements listed in Part 3 herein. Tape color and heat shrink tag background color shall be in accordance with the color coding requirements listed above.

2.08 CABLE PULLING LUBRICANTS

A. Cable pulling lubricants shall be non-hardening type and approved for use on the type of cable installed. Lubricant shall be Yellow #77 Plus by Ideal, Cable Gel by Greenlee, Poly-Gel by Gardner Bender, or equal.

PART 3 -- EXECUTION

3.01 POWER, CONTROL, AND LIGHTING/RECEPTACLE WIRE AND CABLE INSTALLATION

A. The wire and cable shall be installed as specified herein and indicated on the Drawings.

B. The cables shall be terminated in accordance with the cable and/or termination product manufacturer's instructions for the particular type of cable.

C. To minimize oxidation and corrosion, wire and cable shall be terminated using an oxide-inhibiting joint compound recommended for "copper-to-copper" connections. The compound shall be Penetrox E as manufactured by Burndy Electrical, or equal.

D. Splices shall not be allowed in the underground manhole and handhole systems. If splices are required, the Contractor shall obtain approval in writing from the Engineer prior to splicing. Splicing materials shall be barrel type butt splice connectors and heat shrink tubing as manufactured by 3M, Ideal, or equal. No splicing of instrumentation cable is allowed. The use of screw-on wire connectors (wire nuts) shall only be permitted for lighting and receptacle circuits.

E. Wire and Cable Sizes

1. The sizes of wire and cable shall be as indicated on the Drawings, or if not shown, as approved by the Engineer. If required due to field routing, the size of conductors and respective conduit shall be increased so that the voltage drop measured from source to load does not exceed 2-1/2%.

F. Additional Conductor Identification

1. In addition to the color coding identification requirements specified in Part 2 herein, individual conductors shall be provided with heat shrinkable identification tags. Identification tags for individual conductors shall have a white background where the conductor insulation is colored. Identification tags for individual conductors shall have a colored background where the conductor insulation is black. Background color shall match that of the taping provided on the individual black conductors.

2. Multi-conductor cables shall be provided with heat shrinkable identification tags in accordance with Part 2 herein.

3. All wiring shall be identified at each point of termination. This includes but is not limited to identification at the source, load, and in any intermediate junction boxes where a termination is made. The Contractor shall meet with the Owner and Engineer to come to an agreement regarding a wire identification system prior to installation of any wiring. Wire numbers shall not be duplicated.

4. Wire identification shall be by means of a heat shrinkable sleeve with appropriately colored background and black text. Wire sizes #14 AWG through #10 AWG shall have a minimum text size of 7 points. Wire sizes #8 AWG and larger shall have a minimum text size of 10 points. Sleeves shall be of appropriate length to fit the required text. The use of handwritten text for wire identification shall not be permitted.

5. Sleeves shall be suitable for the size of wire on which they are installed. Sleeves shall not be heat-shrunk onto control cables. Tags shall remain loose on cable to promote easier identification. For all other applications, sleeves shall be tightly affixed to the wire and shall not move. Sleeves shall be heat shrunk onto wiring with a heat gun approved for the application. Sleeves shall not be heated by any means which employs the use of an open flame. The Contractor shall take special care to ensure that the wiring insulation is not damaged during the heating process.

6. Sleeves shall be installed prior to the completion of the wiring terminations and shall be oriented so that they can be easily read.

7. Sleeves shall be polyolefin as manufactured by Brady, Seton, Panduit, or equal.

8. Wire identification in manholes, handholes, pull boxes, and other accessible components in the raceway system where the wiring is continuous (no terminations are made) shall be accomplished by means of a tag installed around the bundled group of individual conductors or around the outer conductor jacket of a multi-conductor cable. Identification shall utilize a FROM-TO system. Each group of conductors shall consist of all of the individual conductors in a single conduit or duct. The tag shall have text that identifies the bundle in accordance with the 'FROM' and 'TO' column for that particular conduit number in the conduit and wire schedule. Minimum text size shall be 10 point. The tag shall be affixed to the wire bundle by the use of nylon wire ties, and shall be made of polyethylene as manufactured by Brady, Seton, Panduit, or equal.

9. Where colored tape is used to identify cables, it shall be wrapped around the cable with a 25% overlap and shall cover at least 2 inches of the cable.

H. Wiring Supplies

1. Only electrical wiring supplies manufactured under high standards of production and meeting the approval of the Engineer shall be used.

2. Rubber insulating tape shall be in accordance with ASTM Des. D119. Friction tape shall be in accordance with ASTM Des. D69.

I. Training of Cable

1. The Contractor shall furnish all labor and material required to train cables around cable vaults within buildings and in manholes and handholes in the outdoor underground duct system. Sufficient length of cable shall be provided in each handhole, manhole, and vault so that the cable can be trained and racked in an approved manner. In training or racking, the radius of bend of any cable shall be not less than the manufacturer's recommendation. The training shall be done in such a manner as to minimize chaffing. Reference Section 16118.

2. Instrumentation cable shall be racked separate from other AC and DC wiring to maintain the required separation as follows:

   a. 18 inches for 480/277VAC wiring

   b. 12 inches for 208/120VAC wiring

   c. 6 inches for 24VDC wiring

J. Conductor Terminations

1. Where wires are terminated at equipment which requires lugs, connections shall be made by solderless mechanical lug, crimp type ferrule, or irreversible compression type lugs. Reference individual equipment specification sections as applicable for additional termination requirements.

2. Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches, pressure switches, temperature switches, and other devices make terminations impractical due to the size of the field wiring, the Contractor shall terminate field wiring in an adjacent junction per the requirements of Section 16130, Boxes, complete with terminal strips. Contractor shall install the smaller wiring from the device to the junction box in a conduit, using the terminal strip as the means for joining the two different wire sizes. Splicing of wires in lieu of using terminal strips is not acceptable.

3. All spare conductors shall be terminated on terminal blocks mounted within equipment or junction boxes. Unless otherwise noted, coiling up of spare conductors within enclosure is not acceptable.

K. Pulling Temperature

1. Cable shall not be flexed or pulled when the temperature of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature of 40°F or less within a three (3) day period prior to pulling, the cable reels shall be stored three (3) days prior to pulling in a protected storage area with an ambient temperature of 55°F or more. Cable pulling shall be completed during the work day for which the cable is removed from the protected storage. Any remaining cable reels shall be returned to storage at the completion of the workday.

3.02 INSTRUMENTATION CABLE INSTALLATION

A. The Contractor shall install all cable or conductors used for instrumentation wiring (4-20 mA DC, etc.) in conduit as specified in Section 16111 - Conduit. Only instrumentation cable as specified herein shall exclusively occupy these conduits. No other wiring for AC or discrete DC circuits shall be installed in these conduits.

B. All shielding shall be continuous and shall be **grounded at one point only**.

C. Where instrumentation cables are installed in panels, manholes, handholes, and other locations, the Contractor shall arrange wiring to provide maximum clearance between these cables and other conductors. Instrumentation cables shall not be installed in same bundle with conductors of other circuits.

D. Special instrument cable shall be as specified or recommended by the manufacturer of the equipment or instruments requiring such wiring. Installation, storage, and terminations, shall be per manufacturer's recommendations.

3.03 TESTING

A. All testing shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Shop Test

a. Cable and wiring shall be tested in accordance with the applicable ICEA Standards. Wire and cable shall be physically and electrically tested in accordance with the manufacturer’s standards.

2. Field Tests

a. After installation, all wires and cables shall be tested for continuity. Testing for continuity shall be “test light” or “buzzer” style.

b. After installation, some wires and cables shall be tested for insulation levels. Insulation resistance between conductors of the same circuit and between conductor and ground shall be tested. Testing for insulation levels shall be as follows:

(1) For #8 AWG and larger 600V power and control cable, apply 1,000 VDC from a Megaohmeter for one (1) minute for all 600V wires and cables installed in lighting, control, power, indication, alarm and motor feeder circuits. Resistance shall be no less than 100 Megaohms. Insulation testing is not required for power and control cables smaller than #8 AWG.

(2) 600V instrumentation signal cable shall be tested from conductor to conductor, conductor to shield, and conductor to ground using a Simpson No. 260 volt-ohmmeter, or approved equal. The resistance value shall be 200 Megaohms or greater.

B. Wires and cables shall be tested before being connected to motors, devices or terminal blocks.

C. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.

D. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment. Test reports shall be submitted to the Engineer.

(EXHIBIT A)
TEST DATA - MEGOHMS
TEST NO. ____

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date: | | | Company: | | | | |
| Time: | | | Location: | | | | |
| Circuit: | Circuit Length: | Aerial: | Duct: | Buried: | No. of Conduc-tors | Size: | AMG<br>MCM<br>Shld: |
| Insulation Material: | | | Insulation Thickness: | | Voltage Rating: | | Age: |
| Type: _____Pothead _____Terminal | | | | | Location: Indoors_____<br>Outdoors_____ | | |
| Number and Type of Joints: | | | | | | | |
| Recent Operating History: | | | | | | | |
| Manufacturer: | | | | | | | |
| State if Potheads or Terminals were grounded during test: | | | | | | | |
| List associated equipment included in test: | | | | | | | |
| Miscellaneous Information: | | | | | | | |

(EXHIBIT A)
TEST DATA - MEGOHMS
TEST NO. ____

Part Tested:Test Made:_____
Hours/Days:_____
After Shutdown:_____

Grounding Time:Dry Bulb Temperature:_____
Wet Bulb Temperature:_____

Test Voltage:

Equipment Temperature: _____
How Obtained: _____
Relative Humidity: _____
Absolute Humidity: _____
Dew Point: _____

Megohmmeter: Serial Number: _____ Range: _____
Voltage: _____ Calibration Date_____

| Test Connections | To Line To Earth To Ground | To Line To Earth To Ground | To Line To Earth To Ground | Test Connections | To Line To Earth To Ground | To Line To Earth To Ground | To Line To Earth To Ground |
|---|---|---|---|---|---|---|---|
| □ Minute | | | | 5 Minutes | | | |
| □ Minute | | | | 6 Minutes | | | |
| 3/4 Minute | | | | 7 Minutes | | | |
| 1 Minute | | | | 8 Minutes | | | |
| 2 Minutes | | | | 9 Minutes | | | |
| 3 Minutes | | | | 10 Minutes | | | |
| 4 Minutes | | | | 10/1 Minutes | | | |
| | | | | Ratio | | | |

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SECTION 16130

BOXES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The scope of work under this Section includes furnishing and installing all pull boxes, junction boxes, and outlet boxes.

B. Requirements for other boxes and enclosures are not included in this Section. Reference each specific Division 16 equipment Section for requirements related to that equipment's respective enclosure.

C. Reference Section 16000, Basic Electrical Requirements, and Section 16111, Conduit.

1.02 CODES AND STANDARDS

A. Boxes shall be designed, manufactured, and/or listed to the following standards as applicable:

1. UL 514A - Metallic Outlet Boxes

2. UL 514C - Standard for Non-metallic Outlet Boxes, Flush Device Boxes, and Covers

3. UL 50 – Enclosures for Electrical Equipment, Non-environmental Considerations

4. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations

5. UL 1203 – Standard for Explosion-proof and Dust-ignition-proof Electrical Equipment for use in Hazardous (Classified) Locations.

6. NEMA 250 – Enclosures for Electrical Equipment

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer(s) and submit the following:

B. Shop Drawings

C. Each submittal shall be identified by the applicable specification section.

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1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible Submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets for boxes, terminal strips, and all accessories

2. Overall bill of material for all boxes included under this Contract to summarize exactly what is being submitted for review. Bill of material shall at a minimum show each box type (i.e. pull, junction, or outlet), quantity, material of construction, dimensions, and proposed installation location.

1.05 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions and Division 1.

B. As-built drawings showing dimensions, internal box layout, terminal strip information, and terminal strip identification information shall be provided for all junction boxes. As-built drawings are not required for pull boxes or outlet boxes.

1.06 IDENTIFICATION

A. Each pull and junction box shall be identified with the box name as indicated on the Contract Drawings (e.g. PPB-2, CPB-1) or as directed by the Engineer. A nameplate shall be securely affixed in a conspicuous place on each box. Nameplates shall be as specified in Section 16195, Electrical – Identification.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 PULL AND JUNCTION BOXES

A. General

1. All pull and junction boxes shall be UL listed and labeled.

2. Pull and junction boxes shall not be provided with eccentric or concentric knockouts.

3. Pull and junction boxes mounted embedded in concrete shall be UL listed for embedment.

4. Where metallic boxes are used they shall be of all welded construction. Tack welded boxes are not acceptable.

B. Pull Boxes

1. All pull boxes shall be provided with a matching gasketed cover. For covers with dimensions of 24 inches by 24 inches or less, the cover shall be held in place by machine screws. Other screw types are not acceptable. For covers with dimensions greater than 24 inches by 24 inches, the cover shall be hinged and held in place by screw-operated clamp mechanisms. Hinge pins shall be removable. Clamp mechanism material of construction shall match that of the associated box.

2. Pull boxes shall not have any wire terminations inside, other than those for grounding/bonding. A ground bar shall be provided with the necessary number of screw type terminals. Twenty (20) percent of the total amount of terminals otherwise required for the pull box (minimum of two) shall be provided as spare terminations. Boxes requiring any other wire terminations shall be furnished and installed in accordance with the requirements for junction boxes herein.

3. Pull boxes shall be 6 inches wide by 6 inches tall by 4 inches deep, minimum. For applications requiring larger boxes, the box shall be sized in accordance with the fill requirements and dimensional requirements of the NEC.

4. Barriers shall be provided in pull boxes to isolate conductors of different voltages, types, and functions. Barrier material of construction shall match that of the box. Isolation shall be provided between the following groups:

   a. Power wiring

   b. AC control wiring

   c. DC control wiring

   d. Instrumentation wiring

C. Junction Boxes

1. Junction boxes used for lighting and receptacle circuits only shall be provided with a matching gasketed cover held in place by machine screws. Other screw types are not acceptable.

2. Junction boxes for all uses other than lighting and receptacle circuits shall be provided with a hinged, gasketed cover. Hinge pins shall be removable. Cover shall be held in place by screw-operated clamp mechanisms. Clamp mechanism material of construction shall match that of the associated box.

3. Barriers shall be provided in junction boxes to isolate conductors and terminal blocks of different voltages, types, and functions. Barrier material of construction shall match that of the box. Isolation shall be provided between the following groups:

   a. Power wiring

   b. AC control wiring

   c. DC control wiring

   d. Instrumentation wiring

4. Junction boxes used for lighting and receptacle circuits only shall be allowed to have screw-on (wire nut) type connectors for wire terminations/junctions.

5. Junction boxes for all uses other than lighting and receptacle circuits shall be provided with terminal strips, consisting the necessary number of screw type terminals. Current carrying parts of the terminal blocks shall be of ample capacity to carry the full load current of the circuits connected, with a 10A minimum capacity. Terminal strips shall be rated for the voltage of the circuits connected. A separate ground bar shall be provided with the necessary number of screw type terminals. Twenty (20) percent of the total amount of terminals otherwise required for the junction box (minimum of two) shall be provided as spare terminations. When barriers are provided within the box, separate terminal strips shall be provided in each barrier area. Terminals shall be lettered and/or numbered to conform to the wiring labeling scheme in place on the project.

6. Junction boxes shall be 6 inches wide by 6 inches tall by 4 inches deep, minimum. For applications requiring larger boxes, the box shall be sized in accordance with the fill requirements and dimensional requirements of the NEC. Terminal blocks (including spare terminals) shall be considered when sizing the junction box.

D. Enclosure Types and Materials

1. In non-hazardous locations, pull and junction boxes shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

| **AREA DESIGNATION** | **ENCLOSURE TYPE AND MATERIAL** |
|---|---|
| Indoor Wet Process Area | NEMA 4X, Type 316 Stainless Steel |
| Indoor Dry Process Area | NEMA 12, Painted Steel |
| Indoor Dry Non-process Area | NEMA 1, Painted Steel |
| All Outdoor Areas | NEMA 4X, Type 316 Stainless Steel |

2.03 OUTLET BOXES

A. General

1. Outlet boxes shall be provided with a trim appropriate for the wiring device installed inside. Reference Section 16141, Wiring Devices, for outlet box trim requirements. An appropriate outlet box trim is required to achieve the NEMA rating of the outlet boxes as specified herein.

B. Surface Mount Outlet Boxes

1. Outlet boxes shall be the deep type, no less than 2.5 inches deep.

2. Outlet boxes shall be provided in single or multi-gang configuration as required, sized in accordance with the requirements of the NEC.

3. In non-hazardous locations, outlet boxes shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

| **AREA DESIGNATION** | **ENCLOSURE TYPE AND MATERIAL** |
|---|---|
| Indoor Wet Process Area | NEMA 4X, Cast Aluminum |
| Indoor Dry Process Area | NEMA 1, Cast Aluminum |
| Indoor Dry Non-process Area | NEMA 1, Cast Aluminum |
| All Outdoor Areas | NEMA 4X, Cast Aluminum |

C. Flush Mount Outlet Boxes

1. Outlet boxes shall be no less than 2-1/8 inches deep, and 4-11/16 inches square. Boxes shall be UL listed and labeled. Pre-punched single diameter conduit knockouts are acceptable, however, concentric and eccentric knockouts are not acceptable.

2. Outlet boxes mounted flush in CMU walls shall be made of galvanized, tack welded steel, and suitable for installation in masonry walls. Sectional type boxes are not acceptable for this application.

3. Outlet boxes mounted flush in gypsum walls shall be made of galvanized pressed steel. Tack welded boxes are not acceptable for this application. Sectional type boxes are not acceptable for this application.

4. Outlet boxes mounted cast into concrete shall be concrete tight, and shall be made of galvanized steel or PVC.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Pull and Junction Boxes

1. Pull boxes and junction boxes shall be solidly attached to structural members prior to installation of conduit and set true and plumb. Boxes shall not be supported by their associated conduits.

2. Wooden plugs are not permitted for securing boxes to concrete. Appropriately rated anchors specifically suited for use in concrete shall be used.

3. Box penetrations for conduits shall be made with a punch tool, and penetrations shall be of the size required for the conduit entry and/or hub. Oversized penetrations in boxes are not acceptable.

4. Watertight conduit hubs shall be provided for boxes where a NEMA 4X enclosure rating is specified. Reference Section 16111, Conduit, for conduit hub requirements.

5. Pull and junction boxes may be installed flush mounted in gypsum, concrete or CMU walls where appropriate provided that covers are easily removed or opened.

6. Pull and junction boxes shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

B. Outlet Boxes

1. Outlet boxes shall be solidly attached to structural members prior to installation of conduit and set true and plumb. Boxes shall not be supported by their associated conduits.

2. Wooden plugs are not permitted for securing boxes to concrete. Appropriately rated anchors specifically suited for use in concrete shall be used.

3. Flush mounted outlet boxes shall be arranged and located so that tile and grout lines fit closely around the boxes, and so placed that the cover or device plate shall fit flush to the finished wall surface.

4. Outlet boxes shall be flush mounted in finished areas and other areas where practical. Flush mounted outlet boxes shall not be installed in hazardous areas and type 1 or 2 chemical storage/transfer areas.

5. For the below-named items, mounting heights from finished floor, or finished grade to top is applicable, depending on the type of wiring device to be installed in the outlet box. Mounting heights for outlet boxes shall be as follows, unless otherwise specified herein, indicated on the Drawings, or required by the Americans with Disability Act (ADA):

a. Light switches and wall mounted occupancy sensors, 48 inches

b. Receptacles in indoor dry process/non-process areas, 16 inches

c. Receptacles in indoor wet process areas and all indoor chemical storage/transfer areas, 48 inches

d. Receptacles in outdoor locations, 24 inches

6. Outlet boxes shall be provided in the material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

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# SECTION 16170

# GROUNDING AND BONDING

## PART 1 -- GENERAL

### 1.01 THE REQUIREMENT

A. The Contractor shall furnish and install grounding systems complete in accordance with the minimum requirements established by Article 250 of the NEC. Article 250 of the NEC shall be considered a minimum requirement for compliance with this Specification.

B. Grounding of all instrumentation and control systems shall be furnished and installed in accordance with the manufacturer/system requirements and IEEE 1100-92, Powering and Grounding of Sensitive Electronic Equipment. Conflicts shall be promptly brought to the attention of the Engineer.

C. In addition to the NEC requirements, building structural steel columns shall be permanently and effectively grounded:

D. Reference Section 16000, Basic Electrical Requirements

### 1.02 CODES AND STANDARDS

A. Equipment and materials covered under this Section shall be designed, manufactured, and/or listed to the following standards as applicable:

1. UL 467 – Grounding and Bonding Equipment

2. IEEE 81 – Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

### 1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Reports of certified field tests.

B. Each submittal shall be identified by the applicable specification section.

### 1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

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B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

2. Drawings and written description of how the Contractor intends to furnish and install the grounding system.

## PART 2 -- PRODUCTS

### 2.01 MANUFACTURERS

A. The equipment covered by these specifications shall be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

### 2.02 GROUND RODS AND GRID

A. Ground rods shall be rolled to a commercially round shape from a welded copper-clad steel manufactured by the molten-welding process or by the electro-formed process (molecularly bonded). They shall have an ultimate tensile strength of 75,000 pounds per square inch (psi) and an elastic limit of 49,000 psi. The rods shall be not less than 3/4 inch in diameter by 10 feet in length; and the proportion of copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of 0.010 inch at any point on the rod. Ground rods shall be UL 467 listed. The ground rods shall be manufactured by Erico Products, Blackburn, or equal.

B. Except where specifically indicated otherwise, all exposed non current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductors in nonmetallic raceways and neutral conductors of wiring systems shall be grounded.

C. The ground connection shall be made at the main service equipment and shall be extended to the ground grid surrounding the structure. The ground grid shall also be connected to the point of entrance of the metallic water service. Connection to the water pipe shall be made by a suitable ground clamp or lug connection to a plugged tee. If flanged pipes are encountered, connection shall be made with the lug bolted to the street side of the flanged connection.

D. Where ground fault protection is employed, care shall be taken so that the connection of the ground and neutral does not interfere with the correct operation of the ground fault protection system.

2.03 FITTINGS

A. Grounding connections to equipment shall be bolted. Cable end connections shall be made by hydraulic crimp or exothermically welded. Split bolt type connectors are not acceptable. Fittings shall be UL 467 listed.

2.04 EQUIPMENT GROUNDING CONDUCTORS

A. An insulated equipment grounding conductor, which shall be separate from the electrical system neutral conductor, shall be furnished and installed for all circuits. Insulation shall be of the same type as the underground conductors in the raceway and shall be green in color. Equipment grounding conductors shall be furnished and installed in all conduits. Use of conduits as the NEC required equipment grounding conductor is not acceptable.

2.05 EQUIPMENT GROUNDS

A. Equipment grounds shall be solid and continuous from a connection at earth to all distribution panelboards. Ground connections at panelboards, outlets, equipment, and apparatus shall be made in an approved and permanent manner.

2.06 EXOTHERMIC WELDS

A. All exothermic welding shall be completed per welding kit manufacturer's instructions. Exothermic welds shall be CadWeld by Erico or ThermoWeld.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. Metal surfaces where grounding connections are to be made shall be clean and dry. Steel surfaces shall be ground or filed to remove all scale, rust, grease, and dirt. Copper and galvanized steel shall be cleaned with emery cloth to remove oxide before making connections.

B. Ground Grid

1. A main ground grid shall be provided for each structure and interconnecting structure grids consisting of driven ground rods as shown on the Drawings. The ground rods shall be interconnected by the use of copper cable exothermically welded to the rods. The grounding cables shall be installed after the excavations for the building have been completed and prior to the pouring of concrete for the footings, mats, etc. Copper "pigtails" shall be connected to the ground grid and shall enter the buildings and structure from the outside and shall be connected to steel structures, and equipment as described in this Section and as required to provide a complete grounding system. The copper pigtails shall be exothermically welded to the ground grid, and connected to building reinforcement steel by hydraulic crimp.

2. Grounding conductors shall be continuous between points of connection; splices shall not be permitted.

3. Where conductors are exposed and subject to damage from personnel, traffic, etc., conductors shall be installed in metal raceway. The raceway shall be bonded to the grounding system.

4. Where subsurface conditions do not permit use of driven ground rods to obtain proper ground resistance, rods shall be installed in a trench or plate electrodes shall be provided, as applicable and necessary to obtain proper values of resistance.

5. Buried exothermic welds and ground ring shall not be backfilled until inspected by Engineer.

C. Raceways

1. Conduit which enters equipment such as switchgear, motor control centers, transformers, panelboards, variable frequency drives, instrument and control panels, and similar equipment shall be bonded to the ground bus or ground lug, where provided, and as otherwise required by the NEC.

3.02 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests

a. None required.

2. Field Tests

a. Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition.

b. Fall of potential tests shall be performed on the ground grid per IEEE81 recommendations by a third party, independent testing firm. A fall of potential plot shall be submitted at the conclusion of testing for Engineer review. Documentation indicating the location of the rod and grounding system as well as the resistance and soil conditions at the time the measurements were made shall be submitted. Testing shall show that the ground grid has 5 ohms resistance or less. Due to soil conditions and/or unforeseen field conditions, ground resistances greater than 5 ohms may be acceptable if specifically approved in writing by the Engineer. Ground resistance measurements shall be made in normally dry weather not less than 48 hours after rainfall and with the ground grid under test isolated from other grounds.

c. Continuity tests for the grounding electrode conductor shall also be performed. Test will be accepted when a resistance of less than 1 ohm is shown for this conductor.

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SECTION 16190

SUPPORTING DEVICES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install structural supports for mounting and installing all conduit, electrical equipment, lighting, alarm systems, instrumentation, and communications equipment furnished under this Contract.

B. Equipment shall be installed strictly in accordance with recommendations of the manufacturer and best practices of the trade resulting in a complete, operable, and safe installation. The Contractor shall obtain written installation manuals from the equipment manufacturer prior to installation.

C. Reference Section 16000, Basic Electrical Requirements.

1.02 CODES AND STANDARDS

A. Equipment and materials covered under this Section shall be designed, manufactured, and/or listed to the following standards as applicable:

1. ASTM A123 – Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

2. ASTM A153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

3. ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

4. ASTM A276 – Standard Specification for Steel Bars and Shapes

5. ASTM B783 – Standard Specification for Materials for Ferrous Powder Metallurgy Structural Parts

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop drawings

2. Structural support calculations (if required)

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B. Each submittal shall be identified by the applicable Specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

2. Complete assembly, layout, installation, and foundation drawings with clearly marked dimensions.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 MATERIALS

A. Support channel shall be 1-5/8” by 1-5/8” minimum, with 12 gage material thickness.

B. Support channel, support channel fittings, and threaded rod shall be furnished with the following material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

| **AREA DESIGNATION** | **MATERIAL OF CONSTRUCTION** |
|---|---|
| Indoor Wet Process Area | Type 316 Stainless Steel |
| Indoor Dry Process Area | Hot Dipped Galvanized Steel |
| Indoor Dry Non-process Area | Hot Dipped Galvanized Steel |
| All Outdoor Areas | Type 316 Stainless Steel |
| All Hazardous Areas | Type 316 Stainless Steel |

C. Fastening hardware (bolts, nuts, washers, and screws) shall be furnished with the following material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

| AREA DESIGNATION | MATERIAL OF CONSTRUCTION |
|---|---|
| Indoor Wet Process Area | Type 316 Stainless Steel |
| Indoor Dry Process Area | Type 316 Stainless Steel |
| Indoor Dry Non-process Area | Type 316 Stainless Steel |
| All Outdoor Areas | Type 316 Stainless Steel |

## PART 3 -- EXECUTION

### 3.01 INSTALLATION

A. Concrete or Masonry Inserts

1. The Contractor shall be responsible for the furnishing and installation of all anchor bolts, masonry inserts, and similar devices required for installation of equipment furnished under this Contract.

2. If a time delay for the arrival of any special inserts or equipment drawings, etc. occurs, the Contractor may, if permitted by the Engineer, make arrangements for providing approved recesses and openings in the concrete or masonry and, upon subsequent installation, the Contractor shall be responsible for filling in such recesses and openings. Any additional costs that may be incurred by this procedure shall be borne by the Contractor.

3. The Contractor shall furnish leveling channels for all switchgear, switchboards, motor control centers, and similar floor mounted equipment. The leveling channels shall be provided for embedment in the equipment housekeeping pads. Coordination of the installation of these channels with the concrete pad is essential and required. Pad height shall be as required to maintain concrete coverage of the reinforcement bars while not causing associated equipment to exceed the maximum mounting height requirements of the NEC.

B. Support Fastening and Locations

1. All equipment fastenings to columns, steel beams, and trusses shall be by beam clamps or welded. No holes shall be drilled in the steel.

2. All holes made in reflected ceilings for support rods, conduits, and other equipment shall be made adjacent to ceiling grid bars where possible, to facilitate removal of ceiling panels.

3. Support channel shall be provided wherever required for the support of starters, switches, panels, and miscellaneous equipment.

4. All equipment, devices, and raceways that are installed on the dry side of a water bearing wall shall not be installed directly onto the wall. Support channel shall be used to allow ventilation air to pass behind the equipment, devices, or raceway.

5. All supports shall be rigidly bolted together and braced to make a substantial supporting framework. Where possible, control equipment shall be grouped together and mounted on a single framework.

6. Aluminum support members shall not be installed in direct contact with concrete. Stainless steel or non-metallic "spacers" shall be used to prevent contact of aluminum with concrete.

7. Actual designs for supporting framework should take the nature of a picture frame of support channels and bracket with a plate for mounting the components. The Contractor is responsible for the design of supporting structure; he shall submit design details to the Engineer for acceptance before proceeding with the fabrication.

8. Wherever dissimilar metals come into contact, the Contractor shall isolate these metals as required with neoprene washers, nine (9) mil polyethylene tape, or gaskets.

9. For all installations where fiberglass supporting materials are required, the Contractor shall submit structural calculations and the details of the proposed system of support. Structural calculations shall be signed and sealed by a registered professional engineer in the State of Florida.

10. For the following installations where conduits are provided with a support system suspended from the above or attached to a vertical structure, the Contractor shall submit structural calculations and details of the proposed system of support. Structural calculations shall be signed and sealed by a registered professional engineer in the State of Florida.

    a. A quantity of twelve (12) or more conduits trade size 1” and smaller are proposed for a conduit support rack.

    b. A quantity of eight (8) or more conduits trade sizes 1 ½” to 2 1/2” are proposed for a conduit support rack.

    c. A quantity of four (4) or more conduits trade sizes 3” and larger are proposed for a conduit support rack.

11. Single conduits installed exposed along walls and ceilings shall be secured to the wall or ceiling with a one-hole conduit clamp and clamp-back. Where multiple conduits are installed exposed together, support channel and conduit clamps shall be used.

- END OF SECTION -

SECTION 16195

ELECTRICAL - IDENTIFICATION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. All electrical equipment shall be properly identified in accordance with these Specifications and the Contract Drawings. All switchgear, switchboards, motor control centers, variable frequency drives, lighting and distribution panelboards, combination starters, control panels, pull and junction boxes, enclosures, disconnect switches, control stations, and similar equipment shall be identified in the manner described, or in an equally approved manner.

B. The types of electrical identification specified in this section include, but are not limited to, the following:

1. Operational instructions and warnings.

2. Danger signs.

3. Equipment/system identification signs.

4. Nameplates.

1.02 SIGNS

A. "DANGER-HIGH-VOLTAGE" signs shall be securely mounted on the entry doors of all electrical rooms.

1.03 LETTERING AND GRAPHICS

A. The Contractor shall coordinate names, abbreviations, and other designations used in the electrical identification work with the corresponding designations shown, specified or scheduled. Provide numbers, lettering, and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the electrical systems and equipment.

1.04 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable specification section.

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1.05 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Product data sheets.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The material covered by these Specifications is intended to be standard material of proven performance as manufactured by reputable concerns. Material shall be fabricated, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and shown on the Drawings.

2.02 NAMEPLATES

A. Nameplates shall be engraved, high pressure plastic laminate, white with black lettering.

B. Nameplates shall be attached to NEMA 4X enclosures utilizing UL-recognized mounting kits designed to maintain the overall UL Type rating of the enclosure. Mounting kit fasteners shall be stainless steel Type AHK10324X as manufactured by Hoffman, or equal.

2.03 HIGH VOLTAGE SIGNS

A. Standard "DANGER" signs shall be of baked enamel finish on 20 gage steel; of standard red, black and white graphics; 14 inches by 10 inches size except where 10 inches by 7 inches is the largest size which can be applied where needed, and except where a larger size is needed for adequate identification.

2.04 CONDUIT IDENTIFICATION

A. Conduit identification shall be as specified in Section 16111, Conduit.

2.05 WIRE AND CABLE IDENTIFICATION

A. Field installed wire and cable identification shall be as specified in Section 16123, Low Voltage Wire and Cable.

B. A plastic laminate nameplate shall be provided at each panelboard, motor control center, switchgear assembly, and switchboard assembly. This nameplate shall be used to clearly convey the conductor identification means used at that piece of equipment (i.e. Phase A=Brown, Phase B=Orange, C = Yellow).

C. Wiring identification for factory installed wiring in equipment enclosures shall be as specified in the respective section.

2.06 BOX IDENTIFICATION

A. Pull, junction and device box identification shall be as specified in Section 16130 – Boxes.

PART 3 -- EXECUTION

3.01 NAMEPLATES

A. Nameplates shall be attached to the equipment enclosures with (2) two stainless steel sheet metal screws for nameplates up to 2-inches wide. For nameplates over 2-inches wide, four (4) stainless steel sheet metal screws shall be used, one (1) in each corner of the nameplate. The utilization of adhesives is not permitted.

3.02 OPERATIONAL IDENTIFICATION AND WARNINGS

A. Wherever reasonably required to ensure safe and efficient operation and maintenance of the electrical systems and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install plastic signs or similar equivalent identification, instruction, or warnings on switches, outlets, and other controls, devices, and covers or electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for the intended purposes. Signs shall be attached as specified above for nameplates.

3.03 POWER SOURCE IDENTIFICATION

A. After installation of all field equipment (i.e. valves, motors, fans, unit heaters, instruments, etc) install nameplates at each power termination for the field equipment. Nameplate data shall include equipment designation (tag number), power source (MCC number, panelboard, etc), circuit number, conduit number from schedule and voltage/phase.

B. Contractor to coordinate with the Engineer and the Owner regarding exact nameplate placement during construction.

C. Nameplates shall be as specified herein.

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SECTION 16426

LOW VOLTAGE SWITCHBOARDS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, test, and place in satisfactory operation, the low voltage switchboards as specified herein and indicated on the Drawings. The switchboard provided as part of this project shall be relocated to Arlington East WTF at the completion of this project.

B. The main circuit breaker assembly shall serve as the service entrance equipment and connection to the service shall be coordinated with the serving electric utility. See Section 16000 for serving electric utility contact information.

C. The line-up shall contain main breaker, generator breaker, generator quick connections, manual transfer between main and generator breaker, feeder breakers, metering equipment, control devices, and all accessories as specified herein, indicated on the Drawings, and as required to result in a complete and operable power distribution equipment assembly.

D. The Contractor shall obtain the switchboard from one manufacturer who shall also manufacture the structure and major equipment components, which includes, but is not limited to, circuit breakers, instrument transformers, meters, relays, and controls. Sub-contracting of wiring is not acceptable.

E. The switchboard shall be assembled using NEMA rated components. Components designed and built to International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured and labeled in compliance with IEC standards is not acceptable.

F. Circuit breaker control and relaying/metering circuits shall be wired in accordance with the requirements specified herein or indicated on the Drawings.

1.02 CODES AND STANDARDS

A. All equipment shall be listed by and shall bear the label of Underwriter's Laboratories, Incorporated (U.L.).

B. The equipment shall comply with the following codes and standards:

1. National Electrical Code (NEC)

2. Institute of Electrical and Electronic Engineers (IEEE)

3. American National Standards Institute (ANSI):

a. C12.1 - Code for Electricity Metering

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b. C57.13 - Instrument Transformers

4. National Electrical Manufacturer's Association (NEMA):

a. AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

b. PB 2 - Deadfront Distribution Switchboards.

5. Underwriters Laboratories, Inc. (U.L.):

a. U.L. 98 - Enclosed and Dead Front Switches.

b. U.L. 489 - Molded Case Circuit Breakers.

c. U.L. 891 - Dead-Front Switchboards.

1.03 SUBMITTALS

A. The Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Operation and Maintenance Manuals

3. Spare Parts List

4. Reports of Certified Shop and Field Tests

5. Manufacturer’s Representatives Installation Certification

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submissions will be returned to the Contractor without review for resubmittal.

C. Shop drawings for <u>each switchboard assembly</u> shall include but not be limited to:

1. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall

be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

2. Product data sheets identifying all electrical ratings.

3. Complete assembly, layout, anchoring, and installation drawings with clearly marked dimensions.

4. Approximate total shipping weight of each equipment assembly.

5. Example equipment nameplate data sheet.

6. Plan, front and side view drawings, including overall dimensions of each switchboard assembly. Identify shipping splits and show conduit stub-up area locations on the Drawings.

7. Internal wiring diagram of each low voltage switchboard assembly. Each wiring diagram shall include wire identification and terminal numbers.

8. Internal interconnection wiring diagrams including wiring identification and terminal numbers.

9. Complete single line diagram for each switchboard line-up. The drawing shall indicate devices comprising the switchboard assembly including, but not limited to, circuit breakers, control power and instrument transformers, meters, relays, and control devices. Clearly indicate electrical ratings of all devices.

10. Bill of material list for each switchboard assembly.

11. Nameplate schedule.

12. Manufacturer's installation instructions.

13. Manufacturer's warranty statement.

14. Key interlock scheme drawing and sequence of operations.

The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items the Contractor intends to provide are acceptable and shall be submitted.

1.05 OPERATIONS AND MAINTENANCE MANUALS

A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions and Division 1. The manuals shall include:

1. Instruction books and/or leaflets.

2. Recommended spare parts list.

3. Final as-built construction drawings included in the shop drawings incorporating all changes made in the manufacturing process and field installation.

1.06 SPARE PARTS

A. The switchboard shall be furnished with all spare parts as recommended by the equipment manufacturer. All spaces in switchboards shall be furnished with a spare circuit breaker where indicated on the Drawings.

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the Work, at which time they shall be delivered to the Owner.

D. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.07 IDENTIFICATION

A. Each switchboard assembly shall be identified with the identification name and/or number indicated on the Drawings (e.g., SWBD-TEMP). A nameplate shall be securely affixed in a conspicuous place on each switchboard assembly. Nameplates shall be as specified in Section 16195, Electrical - Identification.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. It is the intent of these specifications that the switchboard be produced by a single manufacturer who shall be responsible for matching all components and providing equipment which functions together as a system.

C. The temporary switchboard basis of design is the QED-2 switchboard as manufactured by Square D Company. **No substitutions shall be permitted.**

2.02 CIRCUIT BREAKER SWITCHBOARD

A. General

1. Furnish and install dead-front type, completely metal enclosed, self-supporting electrical equipment including main circuit breaker(s) and molded case branch circuit breaker assemblies of the number, rating and type noted on the Drawings. The equipment shall meet Underwriters' Laboratories requirements and shall be a furnished with a U.L. service entrance label where indicated on the Drawings.

2. The main breaker section and distribution section shall be NEMA Type 3R industrial use enclosures. The main circuit breaker section shall be totally accessible from the front and the sides. The distribution switchboard shall be totally accessible from the front and the sides. Equipment assemblies requiring rear access are not acceptable. The framework shall be of U.L. gauge steel. Ventilation shall be provided as required.

3. All wire troughs shall have hinged doors.

4. The equipment assemblies shall be suitable for operation at the available fault current, 65 kA (minimum). The equipment assemblies shall be labeled to indicate the maximum available fault current rating, taking into account the structure, bussing, main circuit breaker and switchboard branch circuit devices. The short circuit current rating shall not be less than that specified herein or indicated on the Drawings. The distribution switchboard branch circuit devices short circuit current rating shall be fully rated.

5. All bus shall be tin-plated copper. The bussing shall be of sufficient cross sectional area to meet U.L. standard 891 for temperature rise. The fully rated main bus shall have a maximum ampacity as indicated on the Drawings and extend the full length of the equipment. The main bus shall be 100 percent rated. The ground bus shall be sized per U.L. standard 891, installed in the entire length of the equipment assemblies. The distribution switchboard bus shall be rated as required by the rating of the mounted branch devices, including spares or spaces. Full height vertical bus shall be provided to accommodate future circuit breakers. Less than full height vertical bus which will only accommodate the circuit breakers included for this project is unacceptable.

6. Provide engraved plastic nameplates to identify the main circuit breaker and each branch circuit breaker. The circuit number and circuit name shall appear on the nameplate in accordance with the single line diagram(s) indicated on the Drawings. Nameplates shall be as specified in Section 16195, Electrical - Identification.

B. Utility Pull and Metering Section

1. The Contractor shall furnish and install a pull and metering section, as required, in accordance with all applicable utility requirements. This section shall be suitable for outdoor use.

2. During the design period, some information was gained from the utility regarding service requirements and is specified herein or shown on the Drawings.

3. The Contractor shall be responsible for all final coordination with the electric utility to furnish and install the necessary equipment to meet the latest utility requirements. This includes pull and metering section dimensions, materials of construction, location, bus/cable restrictions, and requirements for concrete pad, utility vault, bumper posts, and similar equipment.

C. Main Circuit Breaker Section

1. The main circuit breaker section shall be furnished and installed for front and side accessibility and manufactured to accept a bus duct connection.

2. The main circuit breaker shall be a fixed type, insulated case manually operated, on-off breaker, 100 percent rated with full-function trip system, sensors, and rating plug.

3. The main circuit breaker shall be Square-D Company Powerpact R or Cutler Hammer/Westinghouse SPB type. The breaker shall be rated for 65,000 A RMS symmetrical at 480V. The full function trip system shall be MICROLOGIC 6.0A Ammeter Trip with Modified Differential Ground Fault (MDGF) by Square D Company or Cutler Hammer/Westinghouse Digitrip RMS 810 with adjustable instantaneous, long-time pick-up and delay, short-time pick-up and delay, ground fault pick-up and delay, and trip indicator, minimum. The main breaker shall be capable of being tripped from a remote control circuit (e.g. command from computer control system or hard-wired trip circuit).

4. Provide control power and current transformers as required. Provide a minimum of two (2) auxiliary contacts for remote indication of breaker position. Provide other accessories as specified herein or indicated on the Drawings.

5. The generator main breaker section shall be provided with a generator quick-connect assembly in the lower portion of the section for ease of access to connect a portable generator to the lineup.

D. Distribution Switchboard

1. The distribution switchboard shall be furnished complete with auxiliary section to accept an incoming bus duct connection. This auxiliary section shall be completely front accessible.

2. The auxiliary section shall also contain a PM 5563 with dual Ethernet Ports as manufactured by Square D Company or an IQ Analyzer as manufactured by Eaton.

All voltage and current transformers, fuses, wiring, and other devices shall be furnished and installed to produce a complete monitoring system.

3. The distribution switchboard shall include individually mounted branch circuit breakers which are to be totally front accessible and front connectable. The circuit breaker connections to the distribution panel bussing shall be of bolt-on design such that the connections grip the bus bars firmly under high-fault conditions.

4. The switchboard manufacturer shall provide all the proper lugs for all cable connections as required to avoid field modifications.

5. Branch circuit breakers shall be molded case type with ratings as indicated on the Drawings. For the temporary switchboard, all breakers shall have digital, adjustable trip units so that the switchboard can be used at both Southwest and Arlington East. **The Contractor is responsible for providing breakers within the switchboard to accommodate both projects.** Some branch circuit breakers shall have shunt trips as indicated on the Drawings. Branch circuit breakers shall be rated for 65,000 A RMS symmetrical at 480V.

2.03 SURGE PROTECTIVE DEVICES

A. The switchboard shall be furnished with integrated Type II surge protective devices (SPD). SPDs shall be provided in the location and quantity as shown on the Drawings.

B. The SPD shall be rated, designed, tested, listed, and labeled in accordance with UL-1449, latest edition.

C. The SPD shall be factory installed by the switchboard manufacturer using a direct bus connection. There shall be no cable connection between the bus bar and the SPD device.

D. The SPD shall have a fault current rating equal to or greater than that of the fault current rating of the switchboard. The SPD shall employ metal-oxide varistor (MOV) technology. If integral fusing is used, the fuses shall allow the maximum rated surge current to pass without fuse operation.

E. The SPD shall have a maximum continuous operating voltage (MCOV) of at least 115% of the nominal voltage of the switchboard. The Voltage Protection Rating (VPR) of each SPD shall not exceed the following:

| SYSTEM VOLTAGE | L-N | L-G | L-L | N-G |
|---|---|---|---|---|
| 208Y/120 | 700V | 700V | 1200V | 700V |
| 480Y/277 | 1200V | 1200V | 1800V | 1200V |
| 480 DELTA | N/A | 1200V | 2000V | N/A |
| 240 DELTA | N/A | 1200V | 1200V | N/A |
| 120/240 | 700V | 700V | 1200V | 700V |

F. The Nominal Discharge Current ($I_n$) of the SPD shall be 20kA. Peak surge current ratings shall not be used as a basis for applying the SPD to the system.

The surge current rating for each SPD shall be as indicated on the Drawings. Surge current ratings are indicated on single line diagrams. Surge current rating indicated is on a per phase basis.

G. Each SPD system shall provide surge protection in all possible modes. Surge protection shall be as follows:

| SYSTEM CONFIGURATION | MODES OF PROTECTION | NUMBER OF MODES |
|---|---|---|
| 3-Phase Wye | L-N, L-G, N-G | 7 |
| 3-Phase Delta | L-L, L-G | 6 |
| 3-Phase Impedence Grounded | L-L, L-G | 6 |
| Single-Phase | L-N, L-G, N-G | 3 |

H. The SPD shall be furnished with an audible alarm and silence pushbutton, integral SPD status LEDs (one per phase), and a Form C dry contact for remote indication of alarm. A surge counter shall also be provided.

I. The SPD equipment shall be SPD Series by Eaton or SurgeLogic by the Square D Company.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. The switchboard shall be furnished and installed as shown on the Drawings and in accordance with the manufacturer's installation instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment. The equipment shall be suitably protected until accepted by the Owner.

B. The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to:

1. Checking to ensure that the pad location is level to within .125 inches.

2. Checking to ensure that all bus bars are torqued to the manufacturer's recommendations.

3. Assemble all shipping sections, remove all shipping braces and connect all shipping split mechanical and electrical connections.

4. Secure assemblies to foundation or floor channels.

5. Inspect and install all circuit breakers in their proper places.

3.02 PAINTING

A. Prior to final completion of the work, all metal surfaces of the equipment shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same lacquer as used for shop finishing coats.

3.03 TESTING

A. The following tests are required:

1. Witness Shop Tests

a. Not required.

2. Certified Shop Tests and Reports

a. Submit description of proposed testing methods, procedures, and apparatus. Submit notarized and certified copies of all test reports.

b. As a minimum, the entire switchboard assembly shall go through a quality inspection before shipment. This inspection shall include, but is not limited to, the following:

i. Physical inspection of the structure and the electrical conductors including bussing, general wiring, and units.

ii. General electrical tests including power circuit phasing, control circuit wiring, instrument transformers, meters, ground fault system, and device electrical operation.

iii. AC dielectric tests of the power circuits and control circuits.

iv. Markings/labels, including instructional type, Underwriters Laboratory (U.L.), and inspector's stamps.

The manufacturer shall use integral quality control checks throughout the manufacturing process to maintain the correctness of the switchboard.

3. Field Tests

a. Field tests shall be performed in accordance with requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition

3.04 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide the services of a qualified, factory-trained manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment furnished under this Contract. The manufacturer's representative shall certify in writing that the equipment has been installed in accordance with the manufacturer's recommendations. No further testing or equipment startup may take place until this certification is accepted by the Owner.

B. The manufacturer's technical representative shall perform startup and functional testing of the switchboard and controls as specified herein.

C. The Contractor shall provide training for Owner personnel. Training shall be conducted by the manufacturer's factory-trained representative who shall instruct Owner personnel in operation and maintenance of all equipment provided under this Section. Training shall be provided for two (2) sessions of four (4) hours each. Training shall not take place until after all switchboard units have been installed and energized. Training shall be at times coordinated with the Owner.

D. The services of the manufacturer's representative shall be provided for a period of not less than as follows:

1. One (1) trip of two (2) working days during the installation of the switchboard.

2. One (1) trip of two (2) working days for the testing and startup of the switchboard.

3. One (1) trip of one (1) working day to perform training as specified herein.

4. One (1) trip of one (1) working day two (2) months before the warranty expiration to identify any issues to be corrected under warranty.

E. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor.

3.05 FIELD ADJUSTMENTS

A. The circuit breaker trip units shall be set in the field by a qualified representative of the manufacturer, or an outside testing company retained by the Contractor, in accordance with the settings designated in the coordination study. See Section 16000 – Basic Electrical Requirements.

- END OF SECTION -

SECTION 16428

LOW VOLTAGE SWITCHGEAR

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, test, and place in satisfactory operation, dead-front type, low voltage, draw-out, metal enclosed power circuit breakers to replace existing circuit breakers as specified herein and indicated on the Drawings.

B. The circuit breakers shall be air break power circuit breaker type with drawout circuit breaker elements.

C. The Contractor shall furnish and install two main breakers, a generator main breaker, tie breaker, metering equipment, transfer control devices, and all accessories as specified herein, indicated on the Drawings, and as required to result in a complete and operable power distribution equipment assembly.

D. The Contractor shall obtain the switchgear from one manufacturer who shall also manufacture the structure and major equipment components, which includes, but is not limited to, assemblies of circuit breakers and auxiliary housings, drawout type air circuit breakers, instrument transformers, meters, relays, and controls. Sub-contracting of wiring is not acceptable.

E. The switchgear shall be assembled using NEMA rated components. Components designed and built to International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured and labeled in compliance with IEC standards is not acceptable.

F. Circuit breaker control and relaying/metering circuits shall be wired in accordance with the requirements specified herein or indicated on the Drawings.

1.02 CODES AND STANDARDS

A. The switchgear assemblies and power circuit breakers shall comply with the following codes and standards:

1. American National Standards Institute (ANSI):

a. C37.13 - Low Voltage AC Power Circuit Breakers Used in Enclosures.

b. C37.16 - Preferred Ratings, Related Requirements and Application Recommendations for Low Voltage Power Circuit Breakers and AC Power Circuit Protectors.

c. C37.20.1 - Standard for Metal - Enclosed Low Voltage Power Circuit Breaker Switchgear.

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d. C37.51 - Standard Conformance Test Procedures for Metal-Enclosed Low Voltage AC Power Circuit Breaker Switchgear Assemblies.

2. Institute of Electrical and Electronic Engineers (IEEE).

3. National Electrical Manufacturers' Association (NEMA):

a. SG3 - Low-Voltage Power Circuit Breakers.

b. SG5 - Power Switchgear Assemblies.

4. Underwriters Laboratories, Inc. (UL):

a. UL 1558 - Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear.

b. UL 1066 –Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01300, Submittals, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Operation and Maintenance Manuals

3. Spare Parts List

4. Proposed Testing Methods and Reports of Certified Shop Tests

5. Manufacturer’s Field Start-up Report

6. Manufacturer’s Representative’s Installation Certification

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submissions will be returned to the Contractor without review for resubmittal.

C. Shop drawings for each switchgear assembly shall include but not be limited to:

1. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

2. Equipment specifications and product data sheets identifying all electrical ratings.

3. Complete assembly, layout, installation, and foundation drawings with clearly marked dimensions.

4. Assembled weight of units and approximate total shipping weight.

5. Example equipment nameplate data sheet.

6. Plan, front and side view drawings, including overall dimensions of each switchgear assembly. Identify shipping splits and show conduit stub-up area locations on the drawings. Provide details for busway connections.

7. Internal wiring diagram of each low voltage switchgear compartment. Each wiring diagram shall include wire identification and terminal numbers.

8. Internal compartment-to-compartment interconnection wiring diagrams including wiring identification and terminal numbers.

9. Complete one-line diagram of each switchgear line-up and complete three-line diagram for each switchgear line-up. These drawings shall indicate devices comprising the switchgear assembly including, but not limited to, circuit breakers, control power and instrument transformers, meters, relays, and control devices. Clearly indicate electrical ratings of all devices.

10. Bill of material list for each switchgear assembly including each switchgear compartment.

11. Nameplate schedule for each compartment.

12. Manufacturer's installation instructions.

13. Manufacturer's written warranty statement.

14. Written sequence of operation for automatic transfer controls.

15. UPS system sizing characteristics.

The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items the Contractor intends to provide are acceptable and shall be submitted.

1.05 OPERATIONS AND MAINTENANCE MANUALS

A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions and Division 1. The manuals shall include:

1. Instruction books and/or leaflets.

2. Recommended spare parts list.

3. Final as-built construction drawings included in the shop drawings incorporating all changes made in the manufacturing process.

1.06 SPARE PARTS

A. The switchgear shall be furnished with all spare parts as recommended by the equipment manufacturer.

In addition to the spare parts recommended by the manufacturer, the Contractor shall furnish the following minimum spare parts for each switchgear assembly:

| No. Required | Description |
|---|---|
| 1 set | Fuses of each size provided. |
| 1 | Control power transformer of each size used. |
| 1 | Lamps and lenses for indicating lights, each color. |
| 1 | Indicating lamp sockets for each type used. |
| 2 | Pilot devices (e.g. pushbutton, selector switch, etc.) complete with contact blocks and legend plates for each type, color, size and rating used. |

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the Work, at which time they shall be delivered to the Owner.

D. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.07 IDENTIFICATION

A. Each switchgear assembly shall be identified with the identification number indicated on the Drawings (e.g., Switchgear SWGR-20). A nameplate shall be securely affixed in a conspicuous place on each switchgear assembly. Nameplates shall be as specified in Section 16195, Electrical - Identification.

1.08 WARRANTY TERMS

A. The manufacturer's and Contractor's warranty shall in no event be for a period of less than two (2) years from date of delivery of equipment to the project site and shall include repair labor, travel expense necessary for repairs at the jobsite, and expendables used during the course of repair. Submittals received without written warranties as specified shall be rejected in their entirety.

B. The Contractor shall provide a complete warranty covering all equipment included in the scope of supply. This warranty shall include, but is not limited to, the following:

- All paralleling and transfer controls
- Complete switchgear lineup, including all components and accessories
- UPS system

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. It is the intent of these specifications that the switchgear be produced by a single manufacturer who shall be responsible for matching all components and providing equipment which functions together as a system. Manufacturers that provide complete switchgear assemblies using power circuit breakers produced by another major manufacturer shall only be allowed if specifically accepted by the Engineer

C. The switchgear shall be Power Zone 4 as manufactured by the Square D Company. **No substitutions are permitted.**

2.02 LOW VOLTAGE METAL ENCLOSED SWITCHGEAR

A. General

1. Switchgear shall be suitable for use as service entrance equipment in accordance with Underwriters Laboratories requirements. Each complete assembly shall bear a U.L. label.

B. Ratings

1. Voltage rating shall be as indicated on the Drawings. The entire assembly shall be suitable for 600 volts maximum AC service.

2. Rate complete switchgear assembly to withstand mechanical forces exerted during short circuit conditions when connected directly to a power source having available fault current of 65,000 amperes symmetrical at rated voltage. Test switchgear for conformance according to ANSI C37.51.

3. The bus system shall have a minimum ANSI 30-cycle short circuit withstand rating of 100,000 amperes symmetrical without upstream current limiting fuses.

4. All ratings shall be tested to the requirements of ANSI C37.20.1, C37.50 and C37.51 and U.L. witnessed and approved.

5. The switchgear assembly enclosure rating shall be NEMA 1 suitable for indoor use. Enclosure shall be painted ANSI-61 light grey, using the manufacturer's standard painting process.

C. Stationary Structure

1. The switchgear structure shall be constructed of formed sections of specially smooth and leveled steel, welded together and reinforced where necessary with formed steel members. The sides shall be covered with removable bolt on covers. The resulting structure shall be rigid and self-supporting.

2. The rear of structure shall be covered with concealed hinged, padlockable steel doors for access to buses, connections, and other equipment mounted within. The ends of the structure shall be closed with removable steel panels held in place with slotted head bolts or concealed screws. The hinged access doors shall be provided with 2-point latches, door stops, structural reinforcing to prevent sagging and provisions for padlocking. Knurled screwhead type fasteners are not acceptable.

3. Secondary control devices and associated wiring shall be isolated from all high voltage primary devices by grounded metal barriers. Primary circuits such as circuit breakers, transformers, and buses shall also be isolated from each other and from personnel by grounded metal barriers.

4. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position. Provisions shall be made for jacking of shipping groups for removal of skids or insertion of equipment rollers. Base of assembly shall be suitable for rolling directly on pipes without skids.

5. Each vertical steel unit forming part of the switchgear line-up shall be a self-contained housing having one or more individual breaker or instrument compartments, a centralized main bus compartment, and a rear cabling compartment. Each individual circuit breaker compartment shall be segregated from adjacent compartments and sections, including the bus compartment, by means of grounded steel barriers. It shall be equipped with drawout rails and primary and secondary disconnecting contacts. Current transformers for feeder instrumentation, where indicated on the Drawings, shall be located within the appropriate breaker cells.

6. The stationary part of the primary disconnecting devices for each power circuit breaker shall consist of a set of contacts extending to the rear through a glass polyester insulating support barrier; corresponding moving finger contacts suitably spaced shall be furnished on the power circuit breaker studs which engage in only the CONNECTED position. The assembly shall provide multiple silver-to-silver full floating high pressure point contacts with uniform pressure on each finger maintained by springs. Each circuit shall include the necessary three-phase bus connections between the section bus and the breaker line side studs. Load studs shall be equipped with insulated copper load extension busses. Bus extensions shall be tin-plated where outgoing terminals are attached.

7. The secondary disconnecting devices shall consist of floating fingers mounted on the removable unit and engaging flat contact segments at the rear of the compartment. The secondary disconnecting devices shall be silver-plated and sliding contact engagement shall be maintained in the CONNECTED and TEST positions.

8. The removable power circuit breaker element shall be equipped with disconnecting contacts, and interlocks for drawout application. It shall have four positions, CONNECTED, TEST, DISCONNECTED and REMOVE all of which permit closing the compartment door. Breakers shall be dead-front, through door construction, allowing racking with the door closed. The breaker drawout element shall contain a worm gear levering "in" and "out" mechanism with removable lever crank. Mechanical interlocking shall be provided so that the breaker is in the tripped position before levering "in" and "out" of the cell. The breaker shall include a provision for padlocking open to prevent manual or electric closing. The padlocking shall also secure the breaker in the CONNECTED, TEST, or DISCONNECTED position by preventing levering.

9. An insulating flash shield shall be mounted above each circuit breaker to prevent flashover from the arc chutes to ground.

10. **New** hinged doors shall be provided for the fronts of the drawout circuit breaker compartments and any power monitor and/or transfer controls section where new equipment cannot fully occupy empty space left from old equipement which is removed from service.

11. Hinged panels shall be provided for mounting of meters, protective relays, and other devices. Doors and panels shall be equipped with concealed hinges and suitable latches. Doors and panels shall have one-inch (1") deep formed edges with double returns where necessary to assure stiffness.

12. A glass polyester safety shutter shall be furnished to automatically cover the bus stabs in the circuit breaker compartment when the circuit breaker unit is moved to the TEST, DISCONNECTED, or REMOVE position.

13. Provide a rear compartment steel barrier between the cable compartment and main bus to protect against inadvertent contact with the main or vertical bus bars. Provide full height and depth metal barriers between adjacent vertical structures in the cable compartment. Provide a full height and depth glass polyester barrier with appropriate slots for the main bus between adjacent vertical structures in the bus compartment.

14. Equip each cable compartment with cable lug adapters complete with hydraulic compression lugs which can be mounted up or down at a 45 degree angle to facilitate cable termination with a minimum bending radius. Provide lugs including grounding lugs, suitable for copper cable, of quantity and size required for the cables indicated on the Drawings. Mechanical type lugs utilizing a set screw are not acceptable.

15. Except as otherwise described herein, all "space" compartments specified herein or indicated on the Drawings shall be furnished as "prepared spaces" or "futures" complete with buses, supports, insulators, primary and secondary disconnects, lugs for future outgoing cables, and rails ready to receive a future circuit breaker of appropriate size. Insulating barriers shall be installed in the cubicles to cover all live terminals to prevent accidental contact.

16. The withdrawal type units and the stationary sections for these units shall be assembled in jigs which accurately locate the contacts, holding devices, and interlocks. One removable unit of each type and rating shall be tried in each stationary compartment of same type and rating. Each stationary compartment shall be checked with its own removable unit to insure interchangeability.

17. Switchgear shall be furnished complete with fused, thermostatically controlled spare heaters. One space heater shall be installed in each vertical structure. Utilize tubular type operated at half voltage for long life; 250 volt rated heaters at 120 volt. Provide power supplies to the space heaters as specified herein and indicated on the Drawings. The Contractor shall wire heaters to provide temporary heating during storage.

D. Bus

1. Buses and main connections shall consist of tin plated flat copper bars or copper channels of suitable size carried on supports fabricated from an approved insulating material. The buses shall be mounted in a compartment at the rear or above the circuit breakers. Bus sizes shall be based upon a maximum current density of 1000 amperes per square inch. All bus connections, including shipping

breaks and for future bus extensions, shall be silver-plated and tightly clamped with through bolts. Provide all bus joints with Bellville type spring washers. Buses shall have a continuous current-carrying capacity of not less than that specified herein or indicated on the Drawings.

2. Insulate/isolate buses to protect against spread of arcing faults and accidental contact by people or foreign objects.

3. Provide the 3 phase bus of each unit with insulation to completely encase each bar, including where provisions have been made by splicing adjacent units together, or making connections to disconnecting devices.

4. Fabricate bus bar molded insulation, molded insulation covers for bus joints, and bus insulated supports from insulation possessing flame-retardant and self-extinguishing, dielectric and anti-hydroscopic properties.

5. Provide a neutral landing lug in the incoming cable area to allow landing of all neutral conductors as indicated on the Drawings. Provide a bonding jumper from the neutral lugs to the ground bus for service entrance rated assemblies.

6. A tin plated ground bus of adequate capacity (1/4-inch by 2-inch minimum) shall be furnished and installed throughout the switchgear structure. Each stationary unit shall be effectively connected to this ground bus. A substantial ground contact shall be provided between each breaker and removable element and the ground bus, which shall automatically be made before the primary contacts touch. Contact engagement to the ground bus shall be maintained in the CONNECTED and TEST positions. Ground relay panels with a No. 6 AWG insulated copper wire to the ground bus.

7. Main and ground buses shall be extended through all units, including spares and prepared spaces.

8. A full neutral bus shall be provided as specified herein and where indicated on the Drawings.

E. Removable Element

1. Removable element of each circuit breaker unit shall consist of a 3-pole power circuit breaker with trip-free stored-energy mechanism, positive mechanical interlock, primary and secondary disconnecting devices, auxiliary switches, position indicator, and control wiring. The removable element shall have four positions: CONNECTED, TEST, DISCONNECTED, and REMOVE, all of which permit closing of the compartment door.

2. Provide for mechanical locking of the removable element in the TEST and DISCONNECTED position. Lock shall not interfere with operation of the breaker and its mechanism.

3. Provide an interlock on each circuit breaker unit to prevent the circuit breaker from being removed while breaker is closed and to prevent breaker from being placed in CONNECTED position unless the breaker is open. If the circuit breaker is closed, the interlock shall trip the breaker before it can be placed in CONNECTED position.

F. Circuit Breakers

1. Each circuit breaker shall be drawout type and enclosed in a separate metal compartment.

2. Circuit breakers shall be rated in accordance with Underwriters Laboratories Standards, with the following minimum ratings:

   a. Nominal voltage: 480 volts.

   b. Maximum design voltage: 600 volts

   c. Low frequency withstand: 2.2 kV

   d. Frame continuous current rating: as indicated on the Drawings.

   e. Sensor rating: Same as frame rating.

   f. Rated interrupting time: 5 cycles.

   g. Interrupting capability at rated voltage: 65,000 amperes (symmetrical). To assure a fully selective system, all circuit breakers shall have 30 cycle short time withstand ratings equal to their symmetrical interrupting ratings, regardless of whether equipped with instantaneous trip protection or not.

   h. Where circuit breakers are equipped with current limiters, the combination shall have short time ratings in accordance with the characteristics of the limiter selected.

3. Circuit breakers shall be UL listed for application in their enclosures for 100 percent of their continuous current rating.

4. Circuit breakers of equal rating shall be completely interchangeable.

5. Equip each circuit breaker with secondary disconnecting contacts to automatically engage in the CONNECTED and TEST position to complete circuits as required.

6. Provide a means for racking in and out of the compartment and between positions. Provide a means for holding the circuit breaker in the compartment in all positions. Include a provision for padlocking open to prevent manual or electric closure of the circuit breaker.

7. Provide interlocking to prevent a closed circuit breaker from racking to or from any position. Provide an additional interlock to assure automatic discharging of the closing springs upon insertion or removal of the breaker into or out of the compartment.

8. Circuit breakers shall be equipped with arc suppressors and individual poles shall be separated by insulating barriers. Main contacts shall be silver faced. Arcing contacts shall have non-welding and high conductivity features.

9. Each low voltage power circuit breaker shall be equipped with current sensors and a self-powered microprocessor-based trip device to sense overload and short circuit conditions. Trip devices shall be interchangeable so that any trip device can be used with any frame size circuit breaker. The device shall measure true RMS currents. Peak sensing devices will not be accepted. All adjustment setting switches shall be digitally encoded type with gold contacts. Trip units shall be removable.

   Equip each circuit breaker with a Micrologic by Square D Company microprocessor based trip unit complete with rating plug size as indicated on the Drawings. The trip units shall be furnished complete with all additional modules required to facilitate all trip unit functions. Trip units shall have adjustable long, short, instantaneous and ground fault functions. The main circuit breaker trip units shall be provided with a reduced energy let-thru mode to reduce arc-flash energy. The trip unit manufacturer shall match the manufacturer of the circuit breakers and other components of the switchgear assembly.

11. A programmable alarm relay output shall be provided to activate based on threshold and time delay values associated with any of the measured parameters. Alarm output operation shall be recorded in an event log.

12. The trip unit shall include an integral test pushbutton. A keypad shall be provided to enable the user to select the values of test currents within a range of available settings. The protection functions shall not be affected during test operations. The breaker may be tested in the TRIP or NO TRIP test mode.

13. Circuit breakers shall be equipped with a self-coupling primary and secondary disconnect contacts and arranged with a disconnect mechanism for moving it physically between the CONNECTED and DISCONNECTED positions.

14. A TEST position for each circuit breaker shall be provided and so interlocked to insure proper sequence and safe operation.

15. Each circuit breaker faceplate shall include a drawout position indicator, spring charge indictor, push-to-trip button, push-to-close mechanism release button, and open-close indicator.

16. Each circuit breaker shall be provided with "a" and "b" auxiliary contacts which will open or close when the breaker is open or closed. Each breaker shall also be provided with an alarm switch or contact to indicate that the breaker has tripped. All of these contacts shall be wired to terminals in each compartment for use in indicating breaker status. Each circuit breaker shall be furnished with enough auxiliary contacts to indicate breaker position.

G. Operation and Interlocks for the 480V Switchgear

1. The switchgear main breakers and generator breaker shall be electrically and mechanically interlocked with each other, and also operate together as part of the automatic transfer system. The mechanical interlocks shall function as follows:

   a. Permit closing the switchgear main breakers when the generator breaker is OPEN.

   b. Permit closing the generator breaker when the switchgear main breakers are OPEN.

   c. Prevent closing the generator breaker when either of the switchgear main breakers is CLOSED.

   d. Prevent closing the switchgear main breaker when the generator breaker is CLOSED.

   e. Prevent closing any combination of two (2) main breakers or generator breaker when the tie breaker is CLOSED.

   These mechanical interlocks shall be in addition to electrical interlocks specified herein or indicated on the Drawings.

H. Current Transformers

1. Ring type current transformers shall be dry type, for indoor service, insulated for 600 volts, 10 kV BIL. Design shall have a mechanical and thermal rating to withstand short-circuit current, stresses, and heating effects equal to the rating of the circuit breaker of the application.

2. Current ratio shall be as indicated on the Drawings.

3. Transformers shall be rated in accordance with ANSI Standard C37.20.1, with accuracy of the current transformers suitable for BO.5 metering accuracy at rated burden. The transformers shall be sized for the necessary burden for the required devices, minimum.

4. Identify the current transformers for polarity with standard marking or symbols. The transformers shall be capable of carrying rated primary current continuously without damage.

5. Run secondary wiring from current transformers in suitable wiring trough, or conduit, to proper short-circuiting type terminal blocks for connection to relays, instruments, and other devices.

6. Door mounted test blocks for all current transformers in the switchgear shall be provided.

I. Potential Transformers

1. Potential transformers shall be indoor dry type, single-phase, 60 hertz.

2. Potential transformers shall have an accuracy classification determined according to ANSI Standards. The potential transformers shall be suitable for metering accuracy, the burden to be served for the required devices plus 20 percent, and shall meet the following minimum requirements:

a. BIL: 10kV

b. Primary Voltage: 480 volts

c. Secondary Voltage: 120 volts

d. Winding Ratio: 4:1

e. Metering Accuracy Class: 0.3 at rated burden

3. Identify polarity with standard markings or symbols. Connect secondaries to potential buses as required. Protect potential transformers with primary and secondary fuses. Protect primary side with current-limiting fuses.

4. Door mounted test switches located at the switchgear. Test switch wiring shall be plainly marked to indicate the respective circuits to each pole of the switch. Test switches shall be ABB Flexitest Type FT-1 with clear cover, GE/Multilin equivalent, or equal.

J. Control Power Transformers

1. Provide 480 to 120 VAC control power transformers as required. Verify that control power transformers have adequate capacity for the load to be served.

2. Protect control power transformers with both primary and secondary fuses. Protect primary side with current limiting fuses. Provide a manual disconnect ahead of the primary fuses.

3. Control power transformers for space heaters, lighting, receptacles and other ancillary loads shall be separate from those used for control circuits.

K. Control Wiring and Control Terminal Blocks

1. Wire and factory test switchgear to satisfy the requirements of the operation described or necessary.

2. Switchgear secondary wiring shall be NEC Type SIS, single-conductor, stranded copper, rated 600 volts, 90°C bundled and secured with nylon ties. Provide flexible stranding for swinging doors and panels. Minimum wire size shall be No. 14 AWG for voltage transformer wiring, interlock wiring, and control circuit wiring. For current transformer circuits, minimum wire size shall be No. 12 AWG. Number 10 AWG or larger wire shall be used to decrease resistance as required.

3. Route outgoing control wires for outgoing or "cell-to-cell" interconnecting wiring to the master terminal blocks with suitable numbering strips numbered in agreement with the manufacturer's detailed wiring diagrams. Provide a minimum of 10 percent (10%) spare terminal blocks for each circuit breaker and auxiliary compartment.

4. Terminal blocks for control wiring shall be provided in accordance with Section 16902, Electric Controls and Relays.

5. Number wiring with shrink-type tag devices at both ends consistent with the manufacturer's detailed wiring diagrams. Duplication of wire numbers and terminal block numbers is not acceptable.

6. One control power circuit cut-out device shall be furnished in each circuit breaker housing. If cut-out device has exposed conductors (i.e., knife switch), the exposed conductors shall be suitably protected against inadvertent contact.

L. Analog Indicating Instruments

1. Provide analog indicating instruments where shown on the Drawings. Instruments shall be door-mounted, and shall be in accordance with ANSI C39.1, 1 percent accuracy class, 4-1/2 inch nominal square, with 250 degrees scale unless otherwise noted.

2. Analog indicating instrument switches shall be door-mounted, rotary operated type with means for maintaining contact position. Contacts shall be silver-to-silver, enclosed in easily removable protective covers.

M. Control Devices

1. Furnish and install control devices as required and/or shown on the Drawings. The following control devices shall be provided as specified in Section 16902, Electric Controls and Relays:

   a. Pilot devices (switches, indicating lights, etc)

   b. Relays and timers

2. For each electrically operated circuit breaker, provide door-mounted circuit breaker pistol grip control switch with red (closed) and green (open) indicating lights to indicate breaker contact position. Provide amber indicating lights to indicate breaker lockout status and tripped status, and blue indicating lights for trip coil status monitor.

N. Nameplates

1. Provide engraved plastic nameplates to identify switchgear units, door mounted devices, and internal components.

2. Nameplates shall be as specified in Section 16195, Electrical - Identification engraved with the circuit number and circuit name as indicated on the Drawings.

3. Label the switchgear per the requirements of NEC, Articles 110-21 and 110-22.

O. Power Metering

1. Provide a SENTRON PAC4200 as manufactured by Siemens to match existing power monitoring throughout JEA facilities. No substitutes shall be permitted. Provide the quantity indicated on the Drawings.

2. Power meter shall be provided with 1GB of memory, minimum, and network communications port. A hardware gateway shall be provided (if required) to convert the network communications from the respective meter to the Profinet Ethernet protocol for communication of metering parameters to the plant control system. The following parameters shall be communicated as a minimum:

- Current (all phases)
- Voltage (all phases)
- KW, KVAR, KVA
- Power Factor

P. Warning Signs

1. Provide a minimum of 2 warning signs on the front of the switchgear lineup and 2 on the back.

a. Red laminated plastic engraved with white letters approximately 1/2 inch high.

b. Signs shall read "DANGER HIGH VOLTAGE"

Q. Source Quality Control

1. Completely assemble, wire, and test switchgear at the factory. Detailed inspections before and after assembly shall assure correctness of design and workmanship. Provide groups of wires leaving the shipping-assembled equipment with terminal blocks with suitable numbering strips.

2. After assembly, provide the switchgear with lifting channels having eyebolts for attachment of crane slings to facilitate lifting and handling each shipping-assembly unit. These lifting channels shall be removable after equipment is placed on permanent foundations.

R. Accessories

1. Switchgear accessories shall be provided as follows:

a. Manual handles for operating circuit breakers.

b. One complete integral lifting device consisting of rails, hoist and dolly shall be furnished for each switchgear assembly for installing or removing breakers. The elevating table type lifting device is not acceptable.

c. Secondary couplers for operating a power circuit breaker in the DISCONNECTED position.

d. Auxiliary power module to provide power for testing the trip unit when the breaker is in the DISCONNECTED or REMOVED position.

e. Test plugs for draw-out relays and meters.

f. Auxiliary switches with at least two (2) unused normally open and two (2) unused normally closed contacts on each circuit breaker.

S. Uninterruptable Power Supply System for Switchgear Control

1. Furnish and install an independent UPS system as indicated on the Drawings and specified herein, to operate breaker mechanisms and protective relays. One UPS system shall be provided for the entire switchgear assembly.

2. The system shall be capable of operating 100% of the circuit breakers simultaneously. One-minute discharge rate down to final 1.75 volt/cell shall be equal to trip current drawn by 100% of breakers tripping simultaneously.

3. Minimum UPS system ratings shall be as required by the switchgear manufacturer plus 25% spare capacity. Submit UPS system sizing calculations in the Shop Drawings for Engineer review/approval.

T. Control Sequence

1. It is the intent of this specification that the switchgear control system will control both of the main breakers, the generator breaker, the tie breaker, and the generator. Alternatives to this proposed approach will only be acceptable if approved by the Engineer and the Owner.

a. <u>Initial Conditions</u>

i. Utility #1 present. Main breaker #1 closed. Tie closed.

ii. Generator breaker open.

iii. Generator off.

iv. Feeder breakers closed.

b. Utility #1 Power Failure

i. Initiate sequence when utility power source fails and the system control switch is in the auto mode.

ii. Open main breaker #1.

iii. Close main breaker #2.

iv. Supply plant load as required.

c. Utility #1 and Utility #2 Power Failure

i. Initiate sequence after both utility power sources fail and the system control switch is in the auto mode.

ii. Open both main breakers.

iii. Start generator.

iv. When generator voltage $\geq$ 460V and frequency is $59.5 \leq f \leq 60.5$, close generator breaker.

v. Supply plant load as required.

d. Return to Utility from Generator (open transition)

i. Initiate sequence automatically when utility bus voltage and frequency are 460V-510V, $59.5 \leq f \leq 60.5$ for an adjustable time delay, and the system control switch is in the Auto mode.

ii. Open the generator breaker. The generator shall then run in an unloaded cooldown mode for an adjustable time delay.

iii. Close the main breaker to supply plant load.

2.03 SURGE PROTECTIVE DEVICES

A. The switchgear shall be furnished with integrated Type II surge protective devices (SPD). SPDs shall be provided in the location and quantity as shown on the Drawings.

B. The SPD shall be rated, designed, tested, listed, and labeled in accordance with UL-1449, edition.

C. The SPD shall be factory installed by the switchgear manufacturer using a direct bus connection. There shall be no cable connection between the bus bar and the SPD device.

D. The SPD shall have a fault current rating equal to or greater than that of the fault current rating of the switchgear. The SPD shall employ metal-oxide varistor (MOV) technology. If integral fusing is used, the fuses shall allow the maximum rated surge current to pass without fuse operation.

E. The SPD shall have a maximum continuous operating voltage (MCOV) of at least 115% of the nominal voltage of the switchgear. The Voltage Protection Rating (VPR) of each SPD shall not exceed the following:

| SYSTEM VOLTAGE | L-N | L-G | L-L | N-G |
|---|---|---|---|---|
| 208Y/120 | 700V | 700V | 1200V | 700V |
| 480Y/277 | 1200V | 1200V | 1800V | 1200V |
| 480 DELTA | N/A | 1200V | 2000V | N/A |
| 240 DELTA | N/A | 1200V | 1200V | N/A |
| 120/240 | 700V | 700V | 1200V | 700V |

F. The Nominal Discharge Current ($I_n$) of the SPD shall be 20kA. Peak surge current ratings shall not be used as a basis for applying the SPD to the system.

The surge current rating for each SPD shall be as indicated on the Drawings. Surge current ratings are indicated on single line diagrams. Surge current rating indicated is on a per phase basis.

G. Each SPD system shall provide surge protection in all possible modes. Surge protection shall be as follows:

| SYSTEM CONFIGURATION | MODES OF PROTECTION | NUMBER OF MODES |
|---|---|---|
| 3-Phase Wye | L-N, L-G, N-G | 7 |
| 3-Phase Delta | L-L, L-G | 6 |
| 3-Phase Impedence Grounded | L-L, L-G | 6 |
| Single-Phase | L-N, L-G, N-G | 3 |

H. The SPD shall be furnished with an audible alarm and silence pushbutton, integral SPD status LEDs (one per phase), and a Form C dry contact for remote indication of alarm. A surge counter shall also be provided.

I. The SPD equipment shall be SurgeLogic by the Square D Company.

## PART 3 -- EXECUTION

### 3.01 INSTALLATION

A. The switchgear shall be furnished and installed as shown on the Drawings and in accordance with the manufacturer's installation instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment. The equipment shall be suitably protected and space heaters connected until accepted by the Owner.

B. The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to:

1. Checking to ensure that the pad location is level to within .125 inches.

2. Checking to ensure that all bus bars are torque to the manufacturer's recommendations.

3. Assemble all shipping sections, remove all shipping braces and connect all shipping split mechanical and electrical connections.

4. Secure assemblies to foundation or floor channels.

5. Inspect and install all circuit breakers in their proper compartments.

C. Install the switchgear to allow complete unit door swing required for unit removal. This is specifically required where a vertical section of switchgear is set next to a wall to the left of a switchgear section.

3.02 PAINTING

A. Prior to final completion of the work, all metal surfaces of the equipment shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same coating as used for factory finishing coats.

3.03 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests

a. None required.

2. Certified Shop Tests and Reports

a. Submit description of proposed testing methods, procedures, and apparatus.

b. Submit notarized and certified copies of all test reports.

c. As a minimum, the entire switchgear assembly shall go through a quality inspection before shipment. This inspection shall include, but is not limited to, the following:

i. Physical inspection of the structure and the electrical conductors including bussing, general wiring, and units.

ii. General electrical tests including power circuit phasing, control circuit wiring, instrument transformers, meters, ground fault system, and device electrical operation.

iii. AC dielectric tests of the power circuits and control circuits.

iv. Markings/labels, including instructional type, Underwriters Laboratory (U.L.), and inspector's stamps.

d. The manufacturer shall use integral quality control checks throughout the manufacturing process to maintain the correctness of the switchgear.

3. Field Tests

a. Field tests shall be performed in accordance with requirements specified in the General Conditions, Division 1, and NETA Acceptance Testing Specifications, latest edition.

b. The manufacturer’s technical representative shall perform startup and functional testing of the switchgear controls. Functional testing shall include field verification of each and every part of the sequence of operations listed herein. Representatives from the Owner and the Engineer shall be present to witness the functional testing.

c. Prior to commencement of the functional testing, a test plan shall be submitted for Owner and Engineer approval. Test plan shall demonstrate how each part of the sequence of operations will be tested, and shall detail any required outages, switchovers, or the like that must be performed during the testing.

3.04 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide the services of a qualified, factory-trained manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment furnished under this Contract. The manufacturer's representative shall certify in writing that the equipment has been installed in accordance with the manufacturer's recommendations. No further testing or equipment startup may take place until this certification is accepted by the Owner.

B. The manufacturer’s technical representative shall perform startup and functional testing of the switchgear and controls as specified herein.

C. The Contractor shall provide training for Owner personnel. Training shall be conducted by the manufacturer's factory-trained representative who shall instruct Owner personnel in operation and maintenance of all equipment provided under this Section. Training shall be provided for two (2) sessions of eight (8) hours each. Training shall not take place until after all switchgear units have been installed and energized. Training shall be at times coordinated with the Owner.

D. The services of the manufacturer's representative shall be provided for a period of not less than as follows:

1. One (1) trip of two (2) working days during the installation of the switchgear.

2. One (1) trip of two (2) working days for the testing and startup of the switchgear.

3. One (1) trip of five (5) working days to perform the functional testing of the entire switchgear assembly and controls.

4. One (1) trip of two (2) working days to perform training as specified herein.

5. One (1) trip of one (1) working day two (2) months before the warranty expiration to identify issues to be corrected under warranty.

E. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor.

3.05 FIELD ADJUSTMENTS

A. The protective relays and/or trip units shall be set in the field by a qualified representative of the manufacturer, or an outside testing company retained by the Contractor, in accordance with the settings designated in the coordination study. See Section 16000 – Basic Electrical Requirements.

- END OF SECTION -

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