

**PERFORMANCE BID SPECIFICATIONS
FOR THE EXISTING OIL FILLED TRANSFORMER T1
FOR:
NEW JERSEY
EXPOSITION AND
SPORTS AUTHORITY**

**LOCATED AT:
MEADOWLANDS, RUTHERFORD, NJ**



REV 1 DATED: JUNE 28, 2023

FAUST CONTRACT #FC-23-054

Prepared by:



PERFORMANCE
BID PACKAGE INDEX

PROJECT SCOPE OF WORK

CONTRACT DRAWING LIST

TRANSFORMER UPGRADE INSTALLATION SPECIFICATIONS

- PART I: GENERAL REQUIREMENTS**
- PART II: CONSTRUCTION & PURCHASE SPECIFICATIONS**
- PART III: CONTRACT DRAWINGS**

PROJECT SCOPE OF WORK

- A. New Jersey Sports and Exposition Authority located in Rutherford, NJ herein referred to either (NJSEA) or (OWNER) intends to replace one (1) of four (4) existing outdoor oil-filled substation transformer. The new transformer T1 shall be a direct replacement for the existing. The project also includes reconnecting existing auxiliary support wiring to the new transformer control terminal box for fan power and meter CT wiring.
- B. It is the intent of the OWNER that a qualified electrical contractor (EC) to take the responsibility as the General Contractor to furnish, rig, install, level, and connect the new transformer to existing overhead primary cables and secondary underground conduits as well as provide startup, testing, commissioning, and services necessary to deliver a complete operable and reliable electrical system for the site.
- C. The EC as the General Contractor shall control the project as well as all work performed by the subcontractors where required. The EC and the subcontractors shall be referred to herein as **CONTRACTOR**. The transformer vendor or supplier herein referred to as **VENDOR**. **NJSEA** herein shall be referred to as the **OWNER**. The **CONTRACTOR** shall install the new transformer system (and associated equipment) in accordance with applicable federal, state, and local laws and regulations as well as applicable standards and codes. The contract drawings are diagrammatic in nature to visualize the scope of work.
- D. The **CONTRACTOR** shall be responsible for coordinating his/her efforts with the township and/or state agencies for all inspections and site witness testing where required by authorities have local jurisdiction. The EC shall be responsible for installing all power and control connections from the transformer to the existing switchgear as well as remote ammeters in the 13.8kV switchgear house.
- E. The **CONTRACTOR** shall obtain the services of a NETA certified testing firm to assist with auxiliary interconnect wiring and testing of the new transformer. **VENDOR** shall assist with the installation of the new transformer.
- F. The **CONTRACTOR** shall be responsible for the removal of the existing transformer and accessories. Pre-work before demolition shall include tying or pulling back existing 35kV and 15kV shielded and cables in conduits from existing transformer as required to facilitate removal of the transformer.
- G. All work can be performed during normal hours. Testing shall be scheduled with **OWNER**.
- H. Install new #4/0 equipment grounds in area shown on plans to existing ground grid and steel support structure.
- I. Refer to the transformer purchase specifications and contract drawings for additional installation details and requirements.
- J. The contractor is responsible for the planning, approval process and execution of rigging and removing existing transformer T-1 from its current location and rigging the new transformer into the same location.
- K. The existing transformers have been retro filled with non-PCB dielectric fluid; however, the contractor shall be responsible for the removal and handling of this fluid that may contain residual PCB's.
- L. The contractor shall be responsible for developing a rigging plan for removal and installation of the transformers signed and sealed by a NJ PE that has five (5) years rigging experience.
- M. The contractor is responsible for transporting the new and existing transformers to and from the site (including rigger's yard).

- N. The contractor shall be responsible for the disposal of existing transformer and dielectric fluid in a responsible manner with documented proof of proper disposal to be submitted to the owner.
- O. The contractor shall be responsible for any necessary changes to the foundation and/or grade beams.
- P. **The Contractor shall provide proof of proper disposal of existing transformer and insulating oil (if transformer is not to be remanufactured per add/alternate below).**

ADD/ALTERNATE: *Contractor shall provide cost and lead time for a third-party transformer vendor to fully rebuild/remanufacture the existing T1 transformer after removal to be used as an onsite spare. Cost should include shipping to factory and delivery to NJSEA and rigging into designated storage location. The remanufactured transformer shall be prepared and delivered to the site prepared and weather sealed for long term storage outdoors. See part 1, Section 1 – General Scope for additional details.*

CONTRACT DRAWING LIST:

E-001 COVER SHEET

E-002 ELECTRICAL - GENERAL NOTES

E-003 ELECTRICAL - GENERAL NOTES

E-100 ELECTRICAL - DEMOLITION PART PLAN AND ELEVATIONS

E-101 ELECTRICAL - NEW WORK PART PLAN AND ELEVATIONS

E-200 ELECTRICAL - SINGLE LINE DIAGRAM – DEMOLITION

E-201 ELECTRICAL - SINGLE LINE DIAGRAM - NEW WORK

E-300 ELECTRICAL - BLOCK DIAGRAM & OUTDOOR BREAKER RELAY PANEL

E-400 ELECTRICAL - GROUNDING PART PLAN

E-500 ELECTRICAL - GROUNDING DETAILS

E-501 ELECTRICAL - GROUNDING DETAILS

TRANSFORMER REPLACEMENT SPECIFICATIONS

PART I - GENERAL REQUIREMENTS

INDEX

SECTION 1 - GENERAL SCOPE

SECTION 2 - CODES FOR PROJECT

SECTION 3 - GENERAL SERVICES TO BE PROVIDED BY CONTRACTOR

SECTION 4 - GENERAL SERVICES TO BE PROVIDED BY OWNER

SECTION 5 - UTILITIES

SECTION 6 - GENERAL CONDITIONS AND SERVICES PROVIDED BY CONTRACTOR

SECTION 7 - CORRESPONDENCE

SECTION 8 - INTERFERENCES AND COORDINATION WITH OTHERS

SECTION 9 - DRAWINGS, SPECIFICATIONS AND STANDARDS

SECTION 10 - PROJECT CONTROL

SECTION 11 - FIELD CHANGES

SECTION 12 - KEY EQUIPMENT SUMMARY

SECTION 13 - KEY EQUIPMENT SHUTDOWN SUMMARY

SECTION 1 - GENERAL SCOPE

- A. In general, the project scope includes the replacement of the existing transformer #1 with one 10/14MVA, 26.4/13.8KV unit in same location as existing transformer #1 (herein referred to as T1). The new transformer shall be re-connected to existing installed switchgear at 26,400V and 13,800V. Extend auxiliary wiring as required for fan power and meter CT's mounted on transformer.
- B. The BASE BID shall be in the form of installing the new transformer and accessories as described herein, on the contract drawings and in other parts of the specification including the PROJECT SCOPE OF WORK, PART 2 and applicable DIV specifications included herein.
- C. The CONTRACTOR shall purchase all equipment and provide submittals for approval to NJSEA and FAUST Engineers per enclosed purchase specification. Approved equipment manufacturers are as follows:
 - 1. The approved transformer manufacturers shall be as listed in the purchase specification.
 - 2. New 15kV and 35kV rated shielded cables should they be required shall be EPR. MV105 from Prysmian, Southwire, Okonite or approved equal.
 - 3. All other equipment and auxiliaries shall be as indicated on the drawings or approved equals.

- D. ***ADD/ALTERNATE: Contractor shall provide cost and lead time for a third party transformer vendor to fully rebuild/remanufacture the existing T1 transformer after removal to be used as an onsite spare. Cost should also include shipping to factory and delivery to NJSEA and rigging into designated storage location. The remanufactured transformer shall be prepared and delivered to the site prepared and weather sealed for long term storage outdoors.***

Transformer rebuild shall include but not limited to de-tanking and rebuilding core and windings, new primary/secondary bushings, primary bushing CT's, lighting arrestors, instruments/relays, control terminal box, control wiring drains and valves, etc. Transformer shall be fully tested as if it was factory new. Contractor shall provide submittal from final approved vendor as to rebuild procedures, replacement component list and final factory acceptance testing scope and procedures. Approved vendor shall have a minimum of 20 years' experience in remanufacturing transformers.

- E. The contract drawings included as part of this package were intended to show details required for bidding purposes, however it may not cover every item and detail for construction purposes. Details and components not explicitly shown on the contract drawings or listed in the project specification but necessary to complete the work, shall be the responsibility of the CONTRACTOR. Final installation details and items shall depend on the type, manufacturer, and exact location of the equipment to be installed. The CONTRACTOR shall be responsible for providing final as-built drawing markups and as-builts equipment submittal documentation upon completion of project.
- F. The CONTRACTOR shall be the primary contractor and point of contact for the project and shall be responsible for the following:
 - 1. Acquiring the services of a field service firm, NETA testing firm or vendor with 10-years' experience in testing 35kV and 15kV class equipment. The CONTRACTOR shall be responsible for all activities of the field service firm or vendor performing the testing and commissioning process. The CONTRACTOR shall provide commissioning procedures for

- OWNER review and modification as required.
2. Filing the project documents provided by the OWNER and paying for all required permits and inspections as required construction by local and state authorities having jurisdiction including the DCA.
 3. The CONTRACTOR shall coordinate and provide all inspections and necessary labor, materials, equipment, and support services.
 4. Shall provide a fast-track execution based on scope drawings and specifications provided by OWNER.
 5. All conduit, wireways and wiring for interconnections and remote equipment as required.
 6. Complete project control, coordination and administration for the installation and equipment as well as modification to as same shown on drawings or required to complete the work.
 7. Coordination of all required shutdowns and cutovers during installation and cutovers.
 8. Contract close-out procedures and final engineering documents including as-builts per bid specifications, punch-listing, etc. shall be provided by the CONTRACTOR.
 9. CONTRACTOR shall run bi-weekly construction meetings and shall be responsible for providing meeting minutes to be distributed among all attendees for review and comment.
 10. CONTRACTOR to provide instruction manuals and training for onsite personnel to be coordinated with OWNER.
 11. CONTRACTOR shall investigate all existing as-built drawings and on-site verification of existing and related equipment as well as control/power wiring prior to commencement of work (pre-demolition work).

SECTION 2 - CODES FOR PROJECT

- A. In addition to that specified in Parts 1 & 2 of this specification all designs, construction work, equipment and/or material shall be in accordance with all latest local, state, and national codes, laws, rules, and regulations applicable thereto. Any conflict between OWNER'S drawings, specifications, standards, etc., and applicable codes, etc., shall immediately be brought to the attention of the OWNER prior to bidding.
- B. The CONTRACTOR shall obtain all necessary temporary and/or permanent permits, certificates, etc., required to execute and complete the work, adhering to all state and local codes.

SECTION 3 - GENERAL SERVICES TO BE PROVIDED BY CONTRACTOR

- A. The work to be performed by CONTRACTOR shall include furnishing all labor, materials, consumables, equipment, tools, and support services for the work described herein.
- B. The CONTRACTOR shall provide a full-time project coordinator/manager to oversee and coordinate all work on site between the OWNER, CONTRACTOR and vendor providing the equipment as well as all work that is critical for the completion of this project.
- C. CONTRACTOR shall coordinate each shutdown with OWNER.
- D. CONTRACTOR shall furnish and install all labor, materials, equipment, and tools as necessary to return the site, fence, sidewalks, retaining walls, bollards, curbs, storm drainage, parking lots, roadways, lawn areas, etc. back to its original condition unless otherwise instructed by OWNER.
- E. CONTRACTOR shall perform an inspection of the existing facility to determine the actual conditions prior to submitting their bid.
- F. The location and sizes of equipment shown on the drawings are approximate and are not

intended to be complete and accurate in every detail. The CONTRACTOR shall review drawings and specifications and field verify all dimensions prior to beginning work. If any conflict exists with drawings, specification and field conditions, CONTRACTOR shall notify OWNER Project Manager in writing of such conflict prior to start of work.

- G. All existing facilities will continue to operate during the period that work is in progress. All existing system shutdowns shall be arranged to minimize disruption to the existing services. Coordinate all shutdowns with the project manager to meet OWNER shutdown windows. CONTRACTOR shall submit with his bid a proposed work schedule which highlights all activities that may affect normal business activities to ensure that these activities are minimized.
- H. CONTRACTOR shall supply, install, maintain, and remove all necessary protective devices for personnel protection as covered by OSHA safety and health regulations, EPA, OWNER Safety Requirements, and the protection of existing structures, equipment, and temporary setups. All lockout/tagout procedures shall be coordinated with OWNER.
- I. CONTRACTOR shall supply all necessary sanitary facilities for personnel performing work under this contract. Temporary lighting and power, if required, shall be provided by the CONTRACTOR.
- J. CONTRACTOR shall be responsible for providing all testing of organics/flammables as required by code and OWNER Standards. Testing shall be performed prior to entry into any manhole or confined space and continuous if findings dictate. Provide testing and perimeter monitoring during all excavations. CONTRACTOR shall use OWNER approved vendor.
- K. These specifications and contract drawings listed herein are complementary. Any discrepancies between contract drawings, specifications, OWNER Guides, and existing conditions shall be referred to the OWNER Project Manager for clarification before proceeding with the work.
- L. CONTRACTOR shall obtain all required permits, licenses and inspections including all fees associated with filing and submission for same unless otherwise noted. The CONTRACTOR shall turn over to the OWNER all file copies, certificates of completion, and proof of inspection as required by the authorities having jurisdiction at the completion of the work. All required permit applications are to be submitted to OWNER for review prior to submitting to the local authorities. All cost information on these permits to be provided to the OWNER.
- M. CONTRACTOR shall turn over to Owner a complete set of “as-built” mark-up contract drawings. Mark-ups shall be neat and legible and shall include all changes made.

SECTION 4 - GENERAL SERVICES TO BE PROVIDED BY OWNER

- A. The OWNER will assign a project representative for the project and shall be the CONTRACTOR's contact at the jobsite. The CONTRACTOR shall not contact OWNER'S operations personnel and shall not receive instructions from OWNER'S operations personnel without prior written approval from OWNER. Exceptions to this requirement are instances of personnel emergency.
- B. The CONTRACTOR shall secure direction by OWNER about personnel access to facility rest rooms and cafeteria must be approved by the OWNER. Use is contingent upon CONTRACTOR'S personnel complying with all requirements. If approved, the OWNER reserves the right to terminate the CONTRACTOR'S use of these facilities at any time.

SECTION 5 - UTILITIES

- A. On-site electrical power - 120/240V and 480/277 Volt 60 Hz., 3 phase power will be coordinated with the OWNER. The CONTRACTOR will be responsible for any additional power supply including transformer and required transformation for temp light and power to satisfy his needs.
- B. Telephone service will not be provided by the OWNER. All other required utilities shall be provided by CONTRACTOR.
- C. Level ground space within the jobsite area for the CONTRACTOR's general use will be provided. Any additional preparation required shall be the CONTRACTOR 's responsibility.
- D. Limited jobsite parking will be provided and as directed by the OWNER.

SECTION 6 - GENERAL CONDITIONS PROVIDED BY CONTRACTOR

- A. Provide all utilities required for his work not provided by the OWNER. The CONTRACTOR shall confine the storage of his material and equipment to his designated area, and provide for his own field office, gang boxes and storage area. The CONTRACTOR shall always be prepared to receive, unload, and handle items and any other materials, as may be required by this specification without interference from other ECs or OWNER. CONTRACTOR will be responsible for receiving, unloading, transiting, unpacking, and installing all equipment as well as equipment or material provided by the OWNER.
- B. The CONTRACTOR shall advise the OWNER'S Project Representative immediately of any labor dispute being experienced or anticipated. CONTRACTOR shall also be responsible for the conduct of his employees and those of CONTRACTOR's vendors/subcontractors while such employees are on OWNER'S property.
- C. CONTRACTOR's personnel shall maintain the schedule of starting, quitting, breaks and lunch as directed by the OWNER and in areas as designated by the OWNER and work in harmony with other ECs, and/or OWNER'S own union forces.
- D. CONTRACTOR shall be responsible for layout and alignment of all work, including all required interferences, stub-up of conduits, and equipment.
- E. CONTRACTOR shall have a full-time competent superintendent on the site who shall be fully authorized to act for the CONTRACTOR and to receive such orders as may be given by the OWNER for the proper continuance of the work. CONTRACTOR shall submit with his proposal the name and resume of his superintendent.
- F. The CONTRACTOR shall not disrupt OWNER'S traffic or parking facilities without prior approval. CONTRACTOR shall always maintain access for emergency and fire control vehicles.
- G. OWNER or OWNER'S representatives shall always have access to the WORK at the site or at CONTRACTOR's offices or other's shops. If WORK is unsatisfactory, immediate steps shall be taken to revise the WORK to conform to the specifications.
- H. CONTRACTOR shall be responsible for maintaining a clean jobsite as required by OWNER, OSHA and any other governing legislation. The prompt collection and disposal of all wastes and/or scrap (not including old cable) shall be the responsibility of the CONTRACTOR.

OWNER may desire to designate a scrap area for waste resulting from OWNER supplied materials. The CONTRACTOR shall turn equipment systems over to the OWNER free of trash and construction debris.

- I. CONTRACTOR shall assume responsibility for protecting from damage, all existing facilities. He shall repair and restore, at his cost, to the satisfaction of the OWNER, any damage to the OWNER'S property caused because of his work.
- J. CONTRACTOR shall supply all tools (capital and small) and consumable materials and shall be responsible for the security of same.
- K. Smoking shall be permitted only in areas indicated by the OWNER and may be terminated at any time.
- L. Materials furnished by CONTRACTOR shall be new and of first quality. Substitution shall not be made in either materials or manufacturer from those specified unless prior written approval has been obtained from the OWNER.
- M. Under no circumstances will drugs, alcoholic beverages, firearms or weapons of any type be permitted on the jobsite. Possession of the above items on jobsite are considered grounds for immediate expulsion and discharge.
- N. CONTRACTOR shall furnish with his proposal the estimated size of office and storage area required and electrical power requirements for CONTRACTOR's use.
- O. CONTRACTOR shall provide all material required for his work not specifically identified as being furnished by others.
- P. CONTRACTOR shall:
 - 1. Request from the OWNER the assistance of the Power Plant Facility personnel when necessary to perform any necessary switching operations.
 - 2. Remove all rust preventatives and oils used to protect the equipment during shipment and/or the construction period whenever these protective materials will be detrimental to operation.
 - 3. Remove all temporary supports, bracing or other foreign objects that were installed in switchgear or other equipment to prevent damage during shipping, storage and/or erection. Provide all materials not furnished by OWNER required for the complete installation such as concrete, bolts, nuts, nails, lumber, anchor bolts, markers, warning signs, and miscellaneous hardware.

SECTION 7 - CORRESPONDENCE

- A. Prior to award of contract, correspondence concerning technical matters (drawings, data, etc.) shall be directed to the OWNER.
- B. All correspondence shall be in duplicate.
- C. In case of conflicting or incomplete technical information, it shall be the responsibility of the CONTRACTOR to bring these conflicts or deficiencies to the OWNER'S attention prior to the submission of the proposal or the commencement of the work.

- D. Upon contract award, all project correspondence, drawings, and submittals shall be directed to the OWNER.

SECTION 8 - INTERFERENCES AND COORDINATION WITH OTHERS

- E. The CONTRACTOR shall obtain clearance from the OWNER'S Project Representative prior to installing equipment or material at any location where interferences might develop. Should the CONTRACTOR proceed without obtaining such clearances and interferences to develop, the CONTRACTOR must relocate his equipment, etc., and such relocation shall be completed at the CONTRACTOR's expense.
- F. The plans are generally diagrammatic such that the CONTRACTORS shall coordinate work so that interferences between conduit, equipment and structural work shall be avoided.
- G. In no case shall the CONTRACTOR weld, cut, burn, or drill any structural member or mount electrical equipment or facilitate conduit installation without having previously received approval in writing from the OWNER'S Project Representative. CONTRACTOR to provide touch-up paint and perform all required touch-up painting of equipment and/or materials.
- H. In the event of discrepancies between drawings and/or specifications, the price quoted by CONTRACTOR shall be based on the most complete drawings and/or specification requirements.

SECTION 9 - DRAWINGS, SPECIFICATIONS AND STANDARDS

- A. A series of drawings covering single line diagrams, equipment locations, mechanical systems, cable & conduit schedule are provided to detail sizing as well as a guide to CONTRACTOR in the interconnecting of the facilities. These shall be the basis for CONTRACTOR's development of any necessary construction sketches for use to develop as-built drawings.
- B. During the project CONTRACTOR shall maintain an up to date set of "as built" information on job. Upon completion CONTRACTOR shall turn over his as-built drawings including conduit, equipment arrangement and cable runs. Work shall be neat draftsmen like mark ups on a clear set of blue lines.
- C. All equipment supplied shall be UL listed and shall be installed in complete compliance with NEC or local inspection authority. Any work rejected due to non-code compliance whether specified or not by the OWNER or his representative shall be the responsibility of the CONTRACTOR to correct without additional cost to the OWNER.

SECTION 10 - PROJECT CONTROL

- A. The CONTRACTOR is responsible for complying with the following Project Control reporting requirements. These requirements will be reviewed with CONTRACTOR prior to award.
- B. Scope of Work: Work Breakdown Structure-Code of Accounts After award of contract, CONTRACTOR shall divide the scope of work into the established Work Breakdown Structure (WBS) for the project. This may be based on the CONTRACTOR's standard Code of Accounts. Accordingly, the Work Breakdown Structure (WBS) shall be used by the CONTRACTOR as a basis for developing Detailed Construction Schedules and Construction Progress Curves, and Price Breakdown, Cost Reporting, and Forecasting.
- C. Schedules

1. Work Schedule - Direct Labor Activities: CONTRACTOR shall be responsible for developing and submitting a Work Schedule which reflects the scope of work consistent with the WBS. This schedule will be prepared in accordance with the following criteria: Be a simplified time/logic diagram with the critical path identified. OWNER reserves the option to revise work priorities to meet project requirements. Reflect planned start, completion, and milestone dates. - Be manpower loaded by craft for each activity and summarized on a manpower summary chart. Update status to show progress and submit on a weekly basis, or as specified by the OWNER.
4. Weekly Look-Ahead Schedule: CONTRACTOR shall provide OWNER Weekly Look-Ahead Schedules which specify in detail the activities to be worked on during the upcoming weeks and the shutdown period. Emphasis should be placed on the identification of priority work items which impact project completion.
3. Manpower Schedule - Field In-directs: CONTRACTOR shall provide an organization chart which reflects the planned field organization in the areas of supervision, craftsmen, and office staff. CONTRACTOR shall prepare a bar chart which reflects anticipated duration of each person on-site and should be updated as required. This is a fast-track job - CONTRACTOR's schedule should reflect premium time activities.
4. Construction Equipment Schedule: This schedule will identify the common name and size parameter of major equipment and activities planned for use in CONTRACTOR's work. This schedule shall be time phased in bar chart format.

D. Reporting Requirements

1. Shutdown Scheduling/Progress Meetings: On a weekly basis, the CONTRACTOR shall meet with the OWNER and review the status of the work. Among the documents to be reviewed at these meetings are Manpower Plans, the Work Schedule, and the Weekly Look Ahead Schedule.
2. Daily Time Sheets for T & M or cost-plus basis outside the Contract parameters and beyond the base specification: CONTRACTOR shall supply OWNER with Daily Time Sheets within two (2) hours after the end of each shift. These time sheets are to be prepared for each shift separately. These reports must contain descriptions of work activities as specified by the OWNER. Specify hours worked on a straight time basis, on shift work, and on overtime, specifying time and a half hour separately from double time hours.
3. Shift Force Report: CONTRACTOR shall supply OWNER with a Shift Force Report within one (1) hour after the start of each shift for each workday. Reports for evening or night shift work are to be provided separately.
4. Manpower Plans-CONTRACTOR shall submit weekly a Manpower Loading Chart which depicts manpower required to complete the project. These charts shall identify manpower associated with each shift as well as proposed overtime plans.

SECTION 11 - FIELD CHANGES

- A. All changes made by the OWNER shall be in writing. This authorization may take three forms:
1. Drawing revision with a transmittal letter authorizing the CONTRACTOR to proceed pending submission of a Request for Change.
 2. Field Order for Minor Work.
 3. Request for Change. Request for Change by OWNER to CONTRACTOR with authorization to proceed upon approval of costs.
- B. Should the CONTRACTOR believe that a situation has developed that may be construed as a Change, he shall notify OWNER by issuance of a properly executed Request for Change form with complete labor and material back-up. The CONTRACTOR shall maintain a list of scope changes. The items on the list will be discussed at the weekly progress meeting or at the end of shift meeting with the OWNER.
- C. Basis of Change: Changes may be approved in one of the following forms:
1. Negotiated Lump Sum
 2. Unit Price
- D. OWNER reserves the right to select the form.
- E. Procedure for Change Order Request: The requests for change shall be submitted to OWNER'S Project Manager and processed in accordance with one of the following categories:
1. Lump Sum: The CONTRACTOR shall submit a Lump Sum Estimate of the cost and time required to perform the WORK as specified on the enclosed forms. Markups shall be as stated in the Purchase Order. The CONTRACTOR shall number the Estimate letters for reference in numerical sequence.
 2. Time and Material: The CONTRACTOR's original copy of each Time and Material (T&M) Sheet shall accompany the Change Order Request and shall legibly include:
 - The CONTRACTOR's OWNER name preprinted
 - Date of Work
 - OWNER'S Purchase Order Number
 - Signature of OWNER'S Representative
 - Signature of CONTRACTOR's Representative
 - OWNER'S cost code
 - OWNER'S authorized signature (if required).
 - Name of CONTRACTOR's personnel involved, including badge payroll number and classification
 - Work item (s) performed by CONTRACTOR's personnel
 - List of materials or other services provided

Each T&M Sheet shall have all manhours extended per entry by the approved Contract Manhour Selling Rate. Each T&M Sheet shall have all materials and service priced in detail and extended per the approved Contract Markups. Substantiating invoices shall be attached. The value of each T&M Sheet shall be individually listed by T&M Sheet number and totaled on a summary sheet. T&M Sheets shall be submitted for signature

by 9:00am on the first working day following the day the work was performed. Priced T&M Sheets shall be returned within one week. Failure to comply with this requirement will delay payment for T&M work.

3. Unit Price: The CONTRACTOR shall submit lists of work units which shall comply with the following requirements:

Work Units and unit Prices shall be limited to those listed on the Schedule of Work Units for Pricing or added or revised by formal change order to the original purchase order.

Quantity of Work Units - Takeoffs and measurements shall be made by OWNER and CONTRACTOR separately and individually and differences, if any, resolved.

Signature of OWNER'S authorized representative confirming validity of quantities and Work Units shall be obtained. Each Work Unit is to be extended by the approved unit price.

Each list of Work Units shall be priced in total and entered individually by page reference number on a summary sheet.

New Work Units and/or New Unit Price Change Orders: After discussions with OWNER'S Superintendent, CONTRACTOR shall submit a fully detailed breakdown of all costs comprising the new unit price and referenced to the Work Unit. If this Unit Price is to replace a previously used Unit Price, CONTRACTOR shall include an explanation for this change. CONTRACTOR shall not invoice for changes until CONTRACTOR has received a change order from the OWNER.

PART II - TECHNICAL SPECIFICATIONS

DIVISION 1
DIVISION 2
DIVISION 26

PURCHASE SPECIFICATIONS (in addition to drawings specs)

GENERATOR UPGRADE SPECIFICATIONS

PART II – TECHNICAL SPECIFICATIONS

SUPPLEMENTARY GENERAL CONDITIONS

The Instructions to Bidders, including General Conditions, etc., applying to the contract for general construction shall apply to all trades. The supplementary conditions enumerated in this division shall apply specifically to the work of the trades which shall include the following divisions:

SPECIFICATION INDEX

TAB 1 - Division 1 – General

011000.00	Project Summary
013000.00	Submittals
017310.00	Cutting and Patching
017600.00	Warranties
017750.00	Commissioning & Turnover
017760.00	Operating and Maintenance Data

TAB 2 - Division 2 - Site Work

020500.00	Common Work Results for Existing Conditions
024000.00	Demolition

TAB 3 - Division 26 – Electrical

260500.10	Electrical General Provisions
260500.20	Specific Provisions
260526.00	Grounding & Bonding Electrical Systems
260533.00	Raceways, Fittings and Boxes
260553.00	Equipment Identification
260800.10	Commissioning Electrical
260800.20	Equipment Testing

TAB 4 – Purchase Specification

TAB 1 – DIV 1

SECTION 011000.00
PROJECT SUMMARY

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

Project Location: This project is located within the NJSEA complex east of the track between the maintenance and the engineering building in the Meadowlands of Rutherford, NJ. The new transformer shall be located in the existing pump house transformer room on an existing concrete pad. The existing switchgear equipment is located in the main pump room.

Project Identification: This Project consists of replacing the existing two (2) transformers with one 2000kW unit and accessories as described in detail herein and on the contract drawings.

The phasing required for this work will include construction periods required to install the new electrical equipment in separate area(s) from the existing equipment and structures while maintaining maximum reliability and uptime of electrical service to the facility.

The major milestones for this project are as follows:

- 1. Removal and rigging of existing transformer T1 and associated equipment and accessories.**
- 2. Rigging and installation of new transformer and accessory/associated equipment.**
- 3. Wiring of new transformer and accessory/associated equipment.**
- 4. Install and terminate existing 15kV and 35kV feeders.**
- 5. Install and terminate required control wiring and auxiliary power.**
- 6. Energizing/testing/commissioning of new transformer and systems and turnover to OWNER.**

Contractor shall be responsible for all scheduling of his work and coordination with OWNER personnel and representatives as well as coordinate with utility for shutdowns, all inspections, cut-in cards, final tie –in work as required. Contractor shall perform all power transfers and provide all temporary high-voltage feeds, as required to maintain continuity.

1.02 WORK UNDER OTHER CONTRACTS

- A. Separate Contract: Owner may award a separate contract for performance of certain construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins. See Data Sheet for separate contracts.
- B. Separate Contract Owner may award a separate contract for performance of certain construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
- C. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.03 PRODUCTS ORDERED IN ADVANCE

- A. Owner has negotiated preferred pricing with suppliers of material and equipment to be incorporated into the Work. Owner has assigned the purchase of said materials and equipment to Contractor. Costs for receiving, handling, storage if required, and installation of material and equipment are included in the Contract Sum.
 1. Contractor's responsibilities are the same as if Contractor had negotiated Purchase Orders, including responsibility to renegotiate purchase and to execute final Purchase-Order agreements.

2. The Schedule of Products Ordered in Advance is included at the end of this Section.

1.04 OWNER-FURNISHED PRODUCTS

- A. If applicable, the Work includes providing support systems to receive Owner's equipment and plumbing, mechanical, and electrical connections as may be required.
 1. Owner will provide information to allow the contractor to arrange for and deliver Shop Drawings, Product Data, and Samples.
 2. Owner will pay for delivery of Owner-furnished items.
 3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
 4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
 5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
 6. Contractor will arrange directly with vendor for the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
 7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to vendor or Construction Manager (as appropriate) noting discrepancies or anticipated problems in use of product.
 8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
 9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
 10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.

1.05 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using a modified version of the "Master Format" numbering system.
 1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL SCOPE

- A. It is the intent of this project to have the CONTRACTOR provide construction services for electrical, mechanical, civil, and architectural disciplines related to the modifications of the existing main electrical substation at the New Brunswick facility as based on scope drawings and specifications provided by OWNER.
- B. Work Included in Project
 1. The index for specifications and drawings in the data sheet of this section generally indicates the extent of construction Work included in this project.
 2. The demolition, excavation, cutting, patching, salvaging, restoration, etc. of existing work as required to complete the Work of the Contract.
 3. The restoration of areas damaged by the Contract construction operations
- C. Work Schedule
 1. Preliminary Progress Schedule: Within 10 days after notice of award, the CONTRACTOR shall present to the OWNER'S representative a Preliminary Progress Schedule based on the items indicated in the Bidding Documents, except as otherwise agreed to, for starting and completing the Work. This schedule will be used for coordinating the Work of all Subcontractors, material suppliers, etc., providing the Work for the project. The CONTRACTOR shall coordinate the Work with the OWNER and adjust the Preliminary Progress Schedule and issue a Final Progress Schedule satisfactory to the Owner and all concerned.
- D. Detailed Work Phasing
 1. Refer to specification 260500.20 for a suggested general Work Phasing plan that has been developed to coordinate the construction of the new substation while maintaining continuity of service and reliability to OWNER's facility as well as the utility system.

3.01 SCHEDULE OF PRODUCTS ORDERED IN ADVANCE

A. Products ordered in advance include all items purchased by owner. Contractor will arrange directly with vendor for the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.

END OF SECTION 011000.00

SECTION 013000-00 SUBMITTALS

PART 1 - GENERAL

1.01 RELATED SECTIONS

DIVISION 1

1.02 SUBMISSION REQUIREMENTS

- A. Submittals requested for A-E's review are listed in individual specification sections or are subsequently required by the Owner.
- B. Shop Drawings:
 - 1. Submit eight (8) copies of shop drawings for use by Owner, Contractor, and A-E, plus any additional sets required by submitter.
 - 2. Include information for total assembly as outlined in specifications or shown on drawings.
- C. Samples:
 - 1. Submit two (2) sets of samples.
 - 2. Where color variation occurs, submit a minimum of three (3) representative samples per set.
 - 3. Submit color samples in a single package for color and material finish coordination.
- D. Product Data:
 - 1. Submit eight (8) copies of product data for use by Owner, Contractor and A-E, plus any additional sets required by submitter.
 - 2. Maintain at job site as project record documents.
- E. Miscellaneous Submittals: Individual specification sections include submittal requirements for miscellaneous submittal items.
- F. Accompany each submittal with transmittal letter.

1.03 PROCEDURES

- A. Provide a submittal schedule, by specification section number, within fifteen (15) days after Notice to Commence Work and comply with construction schedule for submittals related to work progress. Coordinate submittals of related items.
- B. After A-E review of submittal, revise and resubmit as required, identifying changes made since previous submittal.
- C. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.
- D. Refer to the contract documents.

1.04 DURING CONSTRUCTION

- A. During progress of construction, make following submittals in a timely manner to prevent any delay in work schedule:
 - 1. Construction schedule.
 - 2. Updates to Construction Schedule: Provide semi-monthly assessment of work progress in relation to construction schedules.
 - 3. Shop Drawings, Product Data and Samples: Submit shop drawings, product data and samples, certificates, test reports and similar information applicable to work and as required in various sections of the Product Specifications.
- B. Submittals shall be marked in accordance with attached legend.
 - 1. Submittals (including Operation and Maintenance Data) shall be listed by specification section numbers.
 - 2. Omission of an item from list of "submittals" will not relieve Contractor from responsibility for submitting item required.

1.05 PROJECT CLOSE OUT

- A. With a written notice of completion, submit project record documents, guarantees, warranties and bonds, and operating and maintenance data items in proper form as a condition of final acceptance of work in accordance with Section 01700.00, Project Close Out.

END OF SECTION

SECTION 017310.00 CUTTING & PATCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Divisions 2 through 26 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
- C. Any cutting, repair and replacing of pavements, sidewalks, streets, curbs, and other top surfaces as required due to execution of the Contract shall be paid for by party requiring that the work be done. Make all necessary arrangements to have this work done. Secure necessary approvals before proceeding.
- D. Existing Construction: Each trade shall be responsible for cutting and patching to admit their own work, except where chases and openings are specifically indicated, on the contract drawings as provided by the General Contractor.
- E. New Construction: The General contractor shall be responsible for leaving openings in all new work to admit the work of all other trades, except where such work was not indicated, on the contract drawings.
- F. Each trade shall compensate the General Contractor for any cutting and patching necessitated by damage, unplanned or out-of-sequence work.

1.03 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.04 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.

4. Dates: Indicate when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Obtain Owner's approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.05 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Exterior curtain-wall construction.
 4. Equipment supports.
 5. Other Miscellaneous elements.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.03 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.

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

END OF SECTION

017310.00

SECTION 017600.00 WARRANTIES

PART 1 – GENERAL

1.01 CONTRACTOR'S ONE (1) YEAR GUARANTEE

- A. Refer to the Agreement.
- B. The Contractor shall furnish the Owner with a written guarantee on all workmanship and materials provided by him for the project. The written guarantee shall be made out to the Owner, guaranteeing all the work under this Contract to be free from faulty material and free from improper workmanship; and against unusual damage from proper and usual wear; and agreeing to replace or to re-execute without cost to the Owner such work as may be found to be improper or imperfect, and to make good all damages caused to other work or material, due to such defective work or due to its required replacement or re-execution. This guarantee shall be made to cover a period of one (1) year from the date of acceptance of work under the Contract, as evidenced by the Owner's Certificate of Acceptance, or the work. Neither the Certificate of Acceptance, final payment, nor any provisions in the Contract Documents shall relieve the Contractor of the responsibility for neglect or faulty material or workmanship during the period covered by the guarantee. The one (1) year period of any guarantee clauses will not limit the Owner's other rights under common law to have defects remedied when discovered after one (1) year.

1.02 SUBCONTRACTORS' AND MANUFACTURERS' WARRANTIES

- A. A separate warranty shall be required from each subcontractor and manufacturer of equipment supplied to the project. Unless required otherwise by a specific technical section of the Specifications, warranty period and requirements shall be in accordance with Paragraph 1.01 above.
- B. Number of original signed copies required: Two (2) each.
- C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.
 - 1. Product or work item.
 - 2. Firm, with name of principal, address, and telephone number.
 - 3. Scope.
 - 4. Date of beginning of warranty.
 - 5. Duration of warranty.
 - 6. Provide information for Owner's personnel: Proper procedure in case of failure and instances which might affect the validity of warranty.
 - 7. Contractor, name of responsible principal, address, and telephone number.

1.03 PRODUCT WARRANTIES

- A. Warranties specified in order Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly

executed.

2. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for special warranties.
- C. All products and materials shall be warranted for a period not less than one year from the date of substantial completion of the project.
- D. Submittal Time: Comply with requirements in Section 01700.00 – Closeout Procedures.

1.04 **FORM OF SUBMITTAL**

- A. Prepare in packets for inclusion in turnover binders per Specification Section 01775.00.
- B. Format:
1. Size eight and one-half inches by eleven inches (8-1/2" x 11"), punch sheets for three (3) ring binders.
 2. Identify each packet with the typed or printed title "WARRANTIES", title of project; and name of Contractor.

1.05 **TIME OF SUBMITTALS**

- A. For equipment or components parts of equipment put into service during progress of construction: Submit documents within ten (10) days after inspection and acceptance, otherwise make submittals within ten (10) days after acceptance of facilities.
- B. For items of work, where acceptance is delayed materially beyond the completion of facilities, provide updated submittal within ten (10) days after acceptance, listing the date of acceptance as the start of the warranty period.

END OF SECTION

017600.00

SECTION 017750.00 COMMISSIONING & TURNOVER

PART 1 – GENERAL

1.01 RELATED SECTIONS

- A. Section 260500.10 – Electrical General Provisions
- B. Section 260500.20 – Electrical Specific Provisions
- C. Section 017760.00 – Operating and Maintenance Manuals

1.02 STARTING SYSTEMS – GENERAL REQUIREMENTS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect / Engineer and Owner seven days prior to start-up of each item.
- C. Submit a written report that equipment or system has been properly installed and is functioning correctly.
- D. The contractor shall request and execute the checklists from DG-4 for each piece of equipment with the Owner as witness.

1.03 DEMONSTRATION AND INSTRUCTIONS – GENERAL REQUIREMENTS

- A. Demonstrate operation and maintenance of equipment to Owner's personnel.
- B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- C. Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instruction.
- D. The amount of time required for instruction on each item of equipment and / or system is specified in individual sections.

PART 2 – PRODUCTS

2.01 TURNOVER PACKAGE

- A. Binder one (1) of the turnover package shall consist of:
 - 1. A summary of all warranties.
 - 2. A summary of all contractors and vendors - with contact names and numbers.
 - 3. An index of the purchase orders.
 - 4. An index of the testing documents.
 - 5. An index of the O & M manuals provided.
 - 6. An index of the samples provided.
 - 7. An index of the design documents and as-builts.
- B. Binder two (2) of the turnover package shall consist of:

1. All mechanical check lists.
 2. All electrical check lists.
 3. All testing documents.
 4. All certificates.
 5. All balancing documentation.
 6. All leak test reports (hydrostatic and duct).
 7. All manufacturer's start-up / test reports.
- C. Binder three (3) of the turnover package shall consist of:
1. The as-built specifications.
 2. 11"x17" copies of the as-built drawings.
 3. Valve schedules, tag lists, schematics.
- D. Binder four (4) of the turnover package shall consist of:
1. Copies of all purchase orders.
- E. Binder five (5) and up shall contain:
1. Copies of O & M recommendations / information for all systems.
 2. Copies of the manufacturer's O & M manuals for all equipment.
- F. Five (5) of all turnover binders shall be provided as follows:
1. One (1) copy to the Project Manager (for archive).
 2. One (1) copy to Maintenance.
 3. One (1) copy to Facilities Engineering.
 4. One (1) copy to the Building Manager / Utilities
 5. One (1) copy to be placed in a file cabinet within the mechanical equipment room.

PART 3 – EXECUTION

3.01 GENERAL

- A. Prior to final turnover, the following items shall be complete:
1. Basic exterior / interior construction must be completed with only minor Owner authorized punch list items remaining.
 2. All temporary construction items (not required for completion of the punch list) such as temporary walls, scaffolding, rigging, supports, strainers, blanks, etc., removed.
 3. Doors and airlocks are complete and functional.
 4. The Contractor shall demonstrate that all systems and equipment are in compliance with

manufacturer recommendations, code requirements, specifications and design parameters. Specialized and trained manufacturer representatives shall start-up and demonstrate performance of systems and equipment.

- B. The following lists of equipment, systems and responsibilities is a summary only. Comply with the design document requirements, manufacturer's recommendations, and detailed specifications wherever they are more stringent.

1. Electrical

- a. The following equipment shall be tested per manufacturer's recommendation and systems shall be demonstrated to verify compliance with contract documents.

- 1) MV switchgear and LV Switchboards shall be tested under direct supervision of the manufacturer's electrical service engineer.
- 2) Transformers:
 - a) Shall be tested under the direct supervision of manufacturer's electrical service engineer.
 - b) Winding resistance tests shall be performed for each winding.
 - c) Insulation resistance and absorption test shall be per manufacturer's recommendations.
- 3) All circuits shall be tested for proper phasing.
- 4) Proper size fuses and overload heaters installed.
- 5) Metering and instrumentation devices shall have calibration verified.
- 6) All labeling is complete.

5. Instrumentation

- a. All field instruments installed, calibrated, documented, and functionally tested.
- b. All safety relief devices (valves / rupture discs) installed and operational.
- c. All gags or blanks removed.
- d. Any required documentation for transformer and insulating oil disposal is completed and returned to owner.
- e. All control wiring dressed and secured.
- f. Control panels installed, tested, cleaned up and dressed out.
- g. I / O panels installed, tested, cleaned up and dressed out.

END OF SECTION

017750.00

SECTION 017760.00 OPERATING & MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for operation and maintenance manuals, including the following:
 - 1. Preparing and submitting operation and maintenance manuals for building operating systems and equipment.
 - 2. Preparing and submitting instruction manuals covering the care, preservation, and maintenance of architectural products and finishes.
 - 3. Instruction of the Owner's operating personnel in the operation and maintenance of building systems and equipment.
- B. Related Sections: The following Sections where provided contain requirements that relate to this Section:
 - 1. Section 01300.00 - Submittals specify preparation of Shop Drawings and Product Data.
 - 2. Section 01775.00 - Building Commissioning specifies general requirements for submitting project record documents.
 - 3. Appropriate Sections of Divisions 2 through 16 specify special operation and maintenance data requirements for specific pieces of equipment or building operating systems.
- C. Preparation of operation and maintenance manuals includes collecting material, collating and binding material, and submitting data. Each prime contractor shall prepare operation and maintenance data for its own installations.

1.02 OPERATING AND MAINTENANCE MANUALS

- A. Accumulate during progress of work, five (5), service manuals, parts lists and operating instructions pertaining to equipment and materials covered by contractual agreement.
- B. Bind and organize with index tabs according to specification section, in numerical sequence.

1.03 QUALITY ASSURANCE

- A. Maintenance Manual Preparation: In preparation of maintenance manuals, use personnel thoroughly trained and experienced in operation and maintenance of equipment or system involved.
 - 1. Where maintenance manuals require written instructions, use personnel skilled in technical writing where necessary for communication of essential data.
 - 2. Where maintenance manuals require drawings or diagrams, use draftsmen capable of preparing drawings clearly in an understandable format.

1.04 SCHEDULE

- A. Submittal Schedule: Comply with the following schedule for submitting operation and maintenance manuals:

1. Before Substantial Completion, when each installation that requires operation and maintenance manuals is nominally complete, submit 2 draft copies of each manual to the Owner for review. Include a complete index or table of contents of each manual.
 - a. The Owner will return 1 copy of the draft with comments within 15 days of receipt.
2. After final inspection, make corrections or modifications to comply with the Owner's and Architect's comments. Submit the specified number of copies of each approved manual to the Owner within 15 working days after substantial completion.
- A. Form of Submittal: Prepare operation and maintenance manuals in the form of an instructional manual for use by the Owner's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.
1. Binders: For each manual, provide heavy-duty, commercial-quality, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to receive 8-1/2-by-11- inch paper. Provide a clear plastic sleeve on the spine to hold labels describing contents. Provide pockets in the covers to receive folded sheets.
 - a. Where 2 or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.
 - b. Identify each binder on front and spine, with the printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter covered. Indicate volume number for multiple volume sets of manuals.
2. Dividers: Provide heavy paper dividers with celluloid-covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the Section on each divider.
3. Protective Plastic Jackets: Provide protective, transparent, plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
4. Text Material: Where maintenance manuals require written material, use the manufacturer's standard printed material. If manufacturer's standard printed material is not available, provide specially prepared data, neatly typewritten, on 8-1/2-by-11-inch white bond paper.
5. Drawings: Where maintenance manuals require drawings or diagrams, provide reinforced, punched binder tabs on drawings, and bind in with text.
 - c. Where oversize drawings are necessary, fold drawings to the same size as text pages and use as a foldout.
 - d. If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in front or rear pocket of binder. Insert a typewritten page indicating drawing title, description of contents, and drawing location at the appropriate location in the manual.

1.06 MANUAL CONTENT

- A. In each manual include information specified in the individual Specification Section and the following information for each major component of building equipment and its controls:

1. General system or equipment description.
 2. Design factors and assumptions.
 3. Copies of applicable Shop Drawings and Product Data.
 4. System or equipment identification, including:
 - a. Name of manufacturer.
 - b. Model number.
 - c. Serial number of each component.
 5. Operating instructions.
 6. Emergency instructions.
 7. Wiring diagrams.
 8. Inspection and test procedures.
 9. Maintenance procedures and schedules.
 10. Precautions against improper use and maintenance.
 11. Copies of warranties.
 12. Repair instructions including spare parts listing.
 13. Sources of required maintenance materials and related services.
 14. Manual index (including manufacturer's name and model number).
 15. Control diagrams.
 16. Lubrication / maintenance schedule.
 17. Predicted life of major components.
 18. Test data and performance curves.
 19. Troubleshooting recommendations.
- B. Organize each manual into separate Sections for each piece of related equipment. As a minimum, each manual shall contain a title page; a table of contents; copies of Product Data, supplemented by Drawings and written text; and copies of each warranty, bond, and service contract issued.
1. Title Page: Provide a title page in a transparent, plastic envelope as the first sheet of each manual. Provide the following information:
 - a. Subject matter covered by the manual.
 - b. Name and address of the Project.
 - c. Date of submittal.

- d. Name, address, and telephone number of the Contractor.
 - e. Name and address of the Architect.
 - f. Cross-reference to related systems in other operation and maintenance manuals.
2. Table of Contents: After title page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.
 - a. Where a system requires more than one volume to accommodate data, provide a comprehensive table of contents for all volumes in each volume of the set.
3. General Information: Provide a general information Section immediately following table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the subcontractor or Installer and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. Include a local source for replacement parts and equipment.
4. Product Data: Where the manuals include the manufacturer's standard printed data, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where the Project includes more than one item in a tabular format, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information that is not applicable.
5. Written Text: Prepare written text to provide necessary information where manufacturer's standard printed data is not available, and the information is necessary for proper operation and maintenance of equipment or systems. Prepare written text where it is necessary to provide additional information or to supplement data included in the manual. Organize text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operation or maintenance procedure.
6. Drawings: Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems or to provide control or flow diagrams. Coordinate these drawings with information contained in project record drawings to assure correct illustration of the completed installation.
7. Warranties, Bonds, and Service Contracts: Provide a copy of each warranty, bond, or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to follow in the event of product failure. List circumstances and conditions that would affect validity of warranty or bond.

1.07 MATERIAL AND FINISHES MAINTENANCE MANUAL

- A. Submit 3 copies of each manual, in final form, on material and finishes to the Architect for distribution. Provide one section for architectural products, including applied materials and finishes. Provide a second section for products designed for moisture protection and products exposed to the weather.
 1. Refer to individual Specification Sections for additional requirements on care and maintenance of materials and finishes.

1.08 EQUIPMENT AND SYSTEMS MAINTENANCE MANUAL

- A. Submit 6 copies of each manual, in final form, on equipment and systems to the Architect for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.
 - 1. Refer to individual Specification Sections for additional requirements on operation and maintenance of the various pieces of equipment and operating systems.
- B. Equipment and Systems: Provide the following information for each piece of equipment.
 - 1. Description: Provide a complete description of each unit and related component parts, including the following:
 - g. Equipment or system function.
 - h. Operating characteristics.
 - i. Limiting conditions.
 - j. Performance curves.
 - k. Engineering data and tests.
 - l. Complete nomenclature and number of replacement parts.
 - 2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment, provide the following:
 - a. Printed operation and maintenance instructions.
 - b. Assembly drawings and diagrams required for maintenance.
 - c. List of items recommended to be stocked as spare parts.
 - 3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:
 - a. Routine operations.
 - b. Troubleshooting guide.
 - c. Disassembly, repair, and re-assembly.
 - d. Alignment, adjusting, and checking.
 - 4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:
 - a. Startup procedures.
 - b. Equipment or system break-in.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Instructions on stopping.

- f. Shutdown and emergency instructions.
 - g. Summer and winter operating instructions.
 - h. Required sequences for electric or electronic systems.
 - i. Special operating instructions.
- 5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
- 6. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.
- 7. Coordination Drawings: Provide each Contractor's Coordination Drawings.
 - a. Provide as installed, color-coded, piping diagrams, where required for identification.
- 8. Valve Tags: Provide charts of valve-tag numbers, with the location and function of each valve.

END OF SECTION

017760.00

TAB 2 – DIV 2

SECTION 020500.00 - COMMON WORK RESULTS FOR EXISTING CONDITIONS

PART 1 - GENERAL

1.0 SCOPE

This section provides information common to two or more technical site work specification sections or items that are of a general nature, and not included in other sections. This section applies to ALL sitework, as applicable. Included are the following topics:

REFERENCED ORGANIZATIONS

Applicable provisions of Division 1 shall govern all work under this section.

Abbreviations of organizations referenced in these specifications are as follows:

AASHTO	American Association of State Highway and Transportation Officials
ACPA	American Concrete Pipe Association
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
FHA	Federal Highway Administration
EPA	Environmental Protection Agency
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
STI	Steel Tank Institute
UL	Underwriters Laboratories Inc.

2.0 QUALITY ASSURANCE

Provide materials and products as required by individual specification sections. Refer to General Conditions of the Contract regarding substitutions.

Provide quality assurance testing and reporting as required by individual specification sections.

3.0 SAFETY

The contractor is solely responsible for worksite safety.

Perform all work in accordance with applicable OSHA, state and local safety standards.

Contact Diggers Hotline at 1-800-242-8511 in accordance with statutory requirements. Request that non-member utilities and private utilities be located by the appropriate parties.

4.0 PERMITS

Unless otherwise noted in the Contract Documents, the Contractor shall be responsible for obtaining and paying for all permits necessary to complete the work.

5.0 CONSTRUCTION LIMITS

Construction Limits are indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by UCC. In no case shall construction activities extend beyond state property lines or construction easements.

The Contractor shall restore all disturbed areas in accordance with the drawings and specifications. If plans and specifications do not address restoration of specific areas, these areas will be restored to pre-construction conditions as approved by UCC.

6.0 WORK BY OTHERS

Coordinate work under this project with work by Owner and other contractors on the site.

7.0 SUBMITTALS

Refer also to Section GC - General Conditions of the Contract and Division 1.

Submit manufacturer's shop drawings, product data, samples, substitutions and operation and maintenance (O&M) data for approval as required by individual specification sections.

Unless otherwise noted, provide 6 copies of each submittal. Submit to project architect/engineer (A/E) unless otherwise directed by DFD Construction Representative at the Pre-Construction Meeting.

8.0 OFF SITE STORAGE

Refer to Division 1.

In general, the payments for materials stored off site will only be considered in instances where there is limited space available for storage on the site. Prior approval by UCC, together with the execution of a Storage Agreement will be required.

9.0 CODES

Comply with the requirements of all applicable, local, state and federal codes.

10.0 CERTIFICATIONS AND INSPECTIONS

Refer to - General Conditions.

Obtain and pay for all required sampling, testing, inspections, and certifications except those expressly listed as provided by the A/E or other third party in the Contract Documents. Deliver originals of certificates and documents to UCC w/I 3 days; provide copies to the A/E. Include copies of the certifications and documents in the O&M Manual.

PART 2 - MATERIALS

1.0 BARRICADES, SIGNS, AND WARNING DEVICES

Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA standards and the FHA Manual of Uniform Traffic Control Devices (MUTCD).

2.0 TEMPORARY PLASTIC BARRIER FENCING

UV stabilized high-density polyethylene barrier fence free of holes tears and other defects. Provide 4' tall fence in diamond or rectangular pattern. Fencing shall be "safety orange" color, unless otherwise noted.

Posts for temporary plastic barrier fencing shall be 5' tall, minimum 12-gauge, painted metal posts.

PART 3 - EXECUTION

1.0 MAINTENANCE OF SITE AND BUILDING ACCESS/EGRESS

Unless otherwise shown or directed, maintain existing access and egress to the facility throughout construction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency vehicle access, and emergency egress. Do not interrupt access and egress without prior written approval from UCC.

2.0 CONTINUITY OF EXISTING TRAFFIC/PARKING and traffic control

Refer also to Section GR - General Requirements.

Do not interrupt or change existing traffic, delivery, or parking without prior written approval from UCC. When interruption is required, coordinate schedule with the Owner agency to minimize disruptions. When working in public right-of-way, obtain all necessary approvals and permits from applicable municipalities and UCC.

When Contractor's activities impede or obstruct traffic flow, Contractor shall provide traffic control devices, signs, and flaggers in accordance with other Contract Documents and the current version of the MUTCD, or as shown on the Drawings.

3.0 PROTECTION AND CONTINUITY OF EXISTING UTILITIES

Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, telephone/communication, fuel, steam lines or other utilities and site features which may be encountered in any excavations or other sitework. All lines shall be properly underpinned and supported to avoid disruption of service.

Do not interrupt or change existing utilities without prior written approval from UCC, affected utilities and users. Notify all users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be provided in writing and describe the nature and duration of outages and provide the name and number of Contractor's foreman or other contact.

Any service connections encountered which are to be removed shall be cut off at the limits of the excavation and capped in accordance with the requirements of applicable codes and any specifications governing such removals.

4.0 PROTECTION OF EXISTING WORK AND FACILITIES

Verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, streetlights, utilities, and all other such facilities that may be encountered or interfered with during the progress of the work. Take measures necessary to safeguard all existing work and facilities that are outside the limits of the work or items that are within the construction limits but are intended to remain. Report any damage to existing facilities to UCC immediately. Correct and pay for all damages.

5.0 STORMWATER/EXCAVATION WATER MANAGEMENT

Control grading around structures, pitch ground to prevent water running into excavated areas.

Pits, trenches within building lines and other excavations shall be maintained free of water.

Provide trenching, pumping, and other facilities required.

Notify Architect/Engineer if springs or running water are encountered in excavation; provide discharge by trenches, drains, pumping to point outside of excavation. Provide information to Architect/Engineer of points and areas that water will be discharged. At the Engineer's option, the Contractor shall drain the spring to the storm sewer system by the use of field tile.

Be responsible for control measures to prevent damage from flooding, erosion, and sedimentation to on-site and off-site areas.

**END OF SECTION
020500.00**

SECTION 024000.00 DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Contract Document conditions and requirements will govern this work.
- B. The General Contractor shall provide labor, materials, and equipment necessary to complete the Demolition Work as indicated, specified, and required including but not limited to the following principal items:
 - 1. Protection of work to remain in place.
 - 2. Salvage and removal of existing work as indicated and delivered to the Owner to locations on the premises as directed.
 - 3. Relocation and removal of existing work as indicated, and reinstallation as required.
 - 4. Demolition of existing work except for items indicated to remain, to be salvaged or to be relocated. Such work shall become the Contractor's property and shall be removed from the site and disposed of in a legal manner.
 - 5. Disconnection and termination of existing HVAC, plumbing and electric work shall be performed by the Contractor's appropriate subcontractors in compliance with local governing codes.
 - 6. Permits: The Contractor shall obtain and pay for all necessary demolition permits and pay for all fees and licenses required to perform and complete the Work.

1.02 JOB CONDITIONS

- A. Inspect project work area and check conditions under which work will be done.
- B. Conditions of Work to be Demolished: The Owner assumes no responsibility for the actual condition of the work to be demolished. Conditions at the time of inspection, for bidding purposes, will be maintained by the Owner, however, variations may occur due to the Owner's removal and storage operations prior to the commencement of the demolition work.
- C. Structural and Other Conditions shall be verified with the Project Engineer before proceeding with the work. Notify the Project Engineer in writing of any conditions detrimental to the execution and timing of the work.
- D. Security and Access: The contractor shall ensure coordination of his work with the Owner and all concerned so that all entrances and exits to adjacent areas of the building remain accessible at all times.
- E. Cleaning: Daily cleaning of the demolition areas shall be the responsibility of the Contractor. There shall be no accumulation of excessive quantities of materials, rubbish, dirt, debris, waste, etc., at any time. The Owner reserves the right to clean up any condition that, in the Project Engineer's judgement, is detrimental to the Owner. All cleanup expense charges are to be paid by the Contractor.
- F. Acceptance: Proceeding with the work shall be evidence of the acceptance by the Contractor of job conditions.

PART 2 - PRODUCTS

2.01 **MATERIALS**

- A. Where materials required to complete the work are not specifically indicated on the Drawings or in the Specifications, they shall be similar to existing materials and their installation in areas of cutting, patching and relocating the work. Supplement relocated materials as required to complete the removal, relocation and reinstallation of work.

PART 3 - EXECUTION

3.01 **EXECUTION OF WORK**

- A. Timing: Coordinate Work to facilitate scheduling of abandonment and to allow for the installation of temporary and permanent services as required. All Work shall be scheduled in advance at a meeting with the Owner and Contractor to provide as little interference as possible with the operation of the existing facilities.
- B. Manner: The Work shall be executed when, directed by the Project Engineer, in an orderly and careful manner with due consideration for inhabitants and the public.
- C. Contractor shall protect and maintain all conduits, drains, piping, heating systems, wiring, etc. that will remain, where encountered.
- D. The Contractor shall legally dispose of, off the Project Site, all materials removed that will not be reused in the project or indicated to be returned to Owner.
- E. Demolished Materials: Except as specified or shown otherwise, all work demolished shall become the property of the General Construction Contractor and shall be removed from the Project Site at frequent intervals. Piles of demolished material will not be allowed to accumulate.
- F. Protect and safeguard from damage all existing structural systems, equipment and finishes that will remain. General Contractor shall be responsible for any damage caused by his forces or his subcontractors.
- G. All alteration work areas shall be finished so that there will be no visible signs of patching. Patching of existing construction shall match existing adjacent work in structure and finish.
- H. Where unanticipated mechanical, electrical, or structural elements which conflict with the work are encountered, Contractor shall investigate and measure the nature and extent of the conflict. Report this to the Project Engineer in written, accurate detail, and pending receipt of his decision, rearrange demolition scheduled as necessary to continue overall job progress without delay.

3.02 **COMPLETION**

- A. The Contractor shall leave demolition areas free of debris caused by Work of this project. The Demolition areas shall be left in good order and clean, to the entire satisfaction of the Owner.
- B. **The Contractor shall provide proof of proper disposal of existing transformer and insulating oil (if transformers is not to be remanufactured).**

END OF SECTION

024000.00

TAB 3 – DIV 26

SECTION 260500.10 ELECTRICAL GENERAL PROVISIONS

1. **GENERAL REQUIREMENTS**

All work under this Division shall be performed by an Electrical Contractor, approved by the Owner, and shall be subject to the applicable parts of the General Requirements of the Contract and the Special Conditions of the Contract Documents.

2. **SCOPE**

- a. The work includes but is not limited to furnishing of all labor, material, equipment (except the equipment noted herein as "Furnished by Owner" or "Pre-purchased") and services necessary for and reasonably incidental to the proper and complete installation of all electrical work as shown on the Drawings and herein specified. The Electrical Contractor is obliged to be familiar with the requirements and details of all other trades insofar as his work is affected thereby.
- b. Contractor shall install new transformer, accessories and auxiliary equipment as detailed in the drawings and specifications. It is the intent of this project to maintain maximum availability and reliability of service and utility feeders during all phases of construction. All shutdowns shall be scheduled 1 month in advance. Contractor shall submit a schedule within 2 weeks of commencement of project with a schedule.
- c. ***Electrical items that are not shown or included but are necessary to satisfy the intent and scope of these specifications such as good general practice, manufacturer's recommendations, codes, etc. shall be considered a part of these specifications.***
- d. Point to point control wiring for controls, alarms, etc. shall be included
- e. The site shall be visited for familiarizing with the "Scope of Work" in connection therewith, and details of conditions under which electrical work will have to be executed. Particular attention should be made concerning conditions bearing on transportation, disposal, handling and storage of materials, availability of labor, labor conditions, water, electrical power, roads or similar physical conditions at the site, the character of equipment and facilities needed preliminary to and during the execution of the work and all other matters upon which information is reasonably obtainable and which in any case can affect the work or the cost thereof under these specifications. Lack of such knowledge will not be accepted as valid excuse for granting extra compensation or for failure to neglect or refusal to perform any or all work under these specifications.
- f. All existing facilities will continue to operate during the period that work is in progress. All existing system shutdowns shall be arranged to minimize disruption of the existing services. Coordinate all shutdowns with project manager with one (1) month advance notice. Contractor shall submit with his bid a proposed work schedule which highlights all activities that may affect normal business activities to ensure that these activities are minimized. Refer to SCOPE OF WORK of these specifications.
- g. Contractor shall supply, install, and remove all necessary protective devices for personnel protection as covered by OSHA safety and health regulations, EPA, Owner's Safety Requirements, and the protection of existing structures, equipment, and temporary setups.
- h. Contractor shall supply all necessary sanitary facilities for personnel performing work under this contract. Temporary lighting and power, if required, shall be provided by the Contractor.
- i. The work to be performed by Contractor includes maintaining full electrical services to all existing loads.
- j. In general, all work shall be completed during normal work hours. Requirements for shutdowns to transfer feeders during off hours and weekends and shall be coordinated with OWNER, project manager and/or Owner's Engineer to coordinate facility notification and critical load backup and/or refeed.
- k. The contractor shall submit with bid a projected schedule of work for all major phases of work. The contractor shall highlight all time periods of interference to normal business operations including all road closings, work area restrictions, egress closings, etc. and minimize such activities during normal business hours. The contractor shall be sure to include all necessary shutdowns for feeder swap-overs to and from temporary service and that such shutdowns are scheduled after normal business hours.
- l. Immediately after the Contractor is authorized to proceed with the work, the Contractor shall meet with the Owner and review the preliminary project schedule submitted with the bid. Within five days of this

meeting, the Contractor shall submit to the Owner a final detailed schedule showing the dates on which the Contractor intends to complete various parts of work. This schedule shall be subject to Owner's approval.

3. PERMITS AND FEES

Before commencing work, all certificates and permits required for the performance of the work shall be obtained by the Electrical Contractor and paid by the OWNER. After completion of the work, the Owner shall be furnished certificates of final inspection and approval from the inspection authority having jurisdiction when required by the Owner.

4. CODES AND REGULATIONS

- a. All workmanship and material shall conform in all respects to the latest rules and regulations of the National Fire Protection Association (NFPA), the National Electrical Code (NEC), OSHA and the Owner's insurance company except where same conflicts with or is forbidden in the Electrical Code of the State or Commonwealth or local regulations.
- b. Should these Specifications conflict with the rules of the National Board of Fire Underwriters of latest issue, State or Commonwealth or local regulations or utility company regulations, then the Electrical Contractor shall notify the Owner of such before proceeding with the work.
- c. All materials shall be new and only such materials as are herein specified, which have the approval and stamp or label of the Underwriters' Laboratories and are constructed in accordance with the latest standards of I.E.E.E., U.S.A.S.I. and N.E.M.A. where applicable shall be used.
- d. The Electrical Contractor shall give notice to the Owner in ample time so that the work can be inspected and approved as it progresses, and no work shall be concealed until approved by the Owner.
- e. Code Adequacy:
 - (1) All wiring, conduit, and materials shown and specified shall be in accordance with NEC requirements as to size and applicability.
 - (2) Wiring, conduit and materials shall be provided in sizes and numbers sufficient to function as specified and in accordance with Manufacturer's recommendations.
 - (3) Any discrepancies shall be called to the Owner's attention before bids are submitted, and bids shall be based on Code and functional adequacy. Failure of the Electrical Contractor in this respect shall not relieve him of responsibility for a fully adequate installation at no additional cost to the Owner.
- f. The installation of all electrical components shall meet the seismic provisions for the area where the installation is located.

5. STANDARDS

The following standards govern all work performed and equipment installed by the Electrical Contractor:

- a. Underwriters' Laboratories (UL).
- b. National Electric Manufacturer's Association (NEMA).
- c. United States of America Standards Institute (USASI).
- d. Institute of Electrical and Electronic Engineers (IEEE).
- e. Illuminating Engineering Society (IES).
- f. American National Standard Institute (ANSI)
- g. Occupational Safety and Health Administration (OSHA, Part 1910 S Electrical).
- h. National Electric Code (NEC)

6. DRAWINGS

a. Contract Drawings:

- (1) The work, in general, is shown on the Contract Drawings. These drawings are diagrammatic and do not intend to bear indicate the exact locations of conduit, outlets, switches and other devices and equipment located on the plans and shall be installed unless the Owner directs otherwise. The Owner reserves the right to relocate any outlets, switches, and other equipment not more than

ten feet (10'-0") from the location indicated on the Drawings without additional cost to the Owner, provided the work has not been installed prior to the giving of notice to the Electrical Contractor of the desired location.

- (2) Any discrepancies noted by the Electrical Contractor shall be referred to the Owner before proceeding with the work. Failure to observe this requirement shall cause the correction to be made at the expense of the Electrical Contractor.
- (3) All changes to the Contract Drawings, unless approved by the Owner in writing, necessary to facilitate the installation or to conform to the codes shall be made by the Electrical Contractor at his own expense.
- (4) Each part of the work shall be complete as related to the other, and there shall be no omission in the work even though each item may not be specified.
- (5) All outlets, switches and receptacles shall be centered regarding paneling, trim, equipment, etc., failure to observe this requirement will cause the correction to be made at the expense of the Electrical Contractor.
- (6) Work shall be installed in such manner as to avoid all interferences.

b. Shop Drawings

- (1) The Electrical Contractor shall submit electronic (PDF) copies of Shop Drawings and data with such promptness as to cause no delay in his own work or in that of any other Contractor. Submittals shall bear the stamp of approval of the Electrical Contractor as evidence that the Drawings have been checked by him. The correct dimensions, locations of various items, or variations from the requirements of the Contract Documents shall be ascertained by the Electrical Contractor and shall be his responsibility.
- (2) Submit brochures containing descriptive information for each lighting fixture type, arranged by type designation. Provide index indicating manufacturer, catalog number, voltage, and lamps for each lighting fixture type.
- (3) The Owner's approval of shop drawings and Specifications shall extend only to determining the conformity with the general features of the Contract Drawings and Specifications.
- (4) Release for fabrication, assembly or production shall not be issued unless the submission has been completely processed and approved, unless conditional permission is given in writing or by means of markings on the submissions material.
- (5) Partial submissions will be rejected. Each system, equipment or material shall be a complete submission, requiring no other supporting information to be submitted later. This requirement may only be waived by the Owner to facilitate ordering of specific long lead materials.
- (6) Shop drawings shall contain all pertinent performance data and dimensional information to facilitate field fabrication, installation, and connections and to demonstrate that equipment, materials, devices and systems meet all Contract requirements.

c. As-Built Drawings:

- (1) An accurate record shall be kept of all deviations from the approved design and shop drawings and Specifications which may occur in the work as actually constructed.
- (2) Two (2) complete sets of drawing prints shall be maintained exclusively for record purposes for the Owner and all field changes, actual interconnection wiring between electrical equipment and electrical and mechanical equipment, modifications and additions shall be shown and noted thereon including supplemental drawings or sketches. Circuit identification and all significant information required for a complete record shall be noted thereon. At the completion of the work all changes shall be incorporated on a set of drawings and given to the project engineer for review and approval. After approval a final set of as-built drawings and a CAD disk are to be submitted to the Owner.

7. **LAYOUT WORK**

- a. The Electrical Contractor shall take all measurements and layout all his work in accordance with the approved shop and work drawings. The Electrical Contractor shall be responsible for the accuracy of all measurements and the location of all outlets and equipment installed by him.
- b. In laying out and installing the work under this Division, the Electrical Contractor shall cooperate with all of the other Contractors and the Owner's representative so as to avoid interferences that might arise if this was not done. Where this is not done, the Owner reserves the right to have the necessary changes made to avoid interference, such changes to be made at the expense of the Electrical Contractor.
- c. The Electrical Contractor shall provide the necessary size of sleeves. This is to be coordinated with the Architectural Contractor in advance regarding the location and size of sleeves, recesses and chases required for the work under this Division.
- d. The Electrical Contractor shall have a responsible workman present during the pouring of concrete or the erection of masonry containing electrical work, to ensure that the electrical work is undisturbed and properly installed.

8. **EQUIPMENT AND MATERIALS**

- a. Equipment and Materials Purchased and Furnished by the Owner:
 - (1) Promptly upon delivery of equipment and materials listed on Bill of Material, an inspection shall be made by the Owner and the Electrical Contractor, after which time the electrical equipment and materials furnished by the Owner will become the responsibility of the Electrical Contractor. Equipment furnished by the Owner will be stored in a warehouse located on or off site. Electrical Contractor shall arrange and pay for loading equipment at such warehouse and delivery to site, setting in place, aligning, and securing to structure, installation and wiring.
 - (2) All instruction books, drawings, etc., as furnished with the equipment are the property of the Owner and shall be returned to the Owner upon completion of this Contract.
 - (3) Provide the Owner a signed receipt with an itemized listing of all equipment and materials received.
- b. Equipment and Materials Purchased by the Electrical Contractor:
 - (1) All electrical equipment and materials not Owner purchased, as indicated elsewhere, shall be purchased by the Electrical Contractor.
 - (2) All electrical equipment and materials shall be new, except where existing equipment is designated for reuse.
 - (3) All electrical material shall carry the label of Underwriter's Laboratories, Inc. where applicable.
 - (4) All electrical equipment and materials shall conform to the Standards as specified herein, or on the Drawings.
- c. Existing Equipment and Materials
 - (1) The Electrical Contractor shall assume full responsibility for any damage to existing equipment and materials that may occur during or as a result of performance of the work under this contract.
 - (2) Any existing equipment that is found damaged and/or defective must be reported to the Owner prior to moving and/or handling of such equipment.
 - (3) Make the necessary alterations and additions to the electrical and communication systems required by changes as shown on the Drawings in the existing building and/or equipment.
 - (4) Where the removal of walls, floor or ceilings as shown on the Drawings, exposes or interferes with the existing electrical wiring or equipment, the Electrical Contractor, at his expense, shall make the necessary changes and leave the system in a satisfactory operating condition.
 - (5) The Electrical Contractor, at his expense, shall disconnect and leave all existing wiring not forming a part of the ultimate system in a nonhazardous condition. Remove all conduits and equipment projecting into finished areas and remove all conductors back to the panels, motor control centers, etc.
 - (6) Where existing conduit and outlet boxes are shown on the Drawings to be reused and additional conductors installed in the conduit, all existing conductors shall be removed, and new conductors

- installed.
- (7) Existing lighting fixtures shall be removed and/or relocated as indicated on the Drawings. Relocated lighting fixtures shall be rehabilitated, re-lamped, cleaned, washed thoroughly with detergent and rinsed.
- (8) Existing wiring devices that are removed shall be replaced with new wiring devices as herein specified.
- (9) Any and all interruptions of electrical service for the installation or modification of equipment shall be done at a time approved by the Owner. Electrical Contractor will be held responsible for loss or damage incurred because of interruption of power to production, heating or other critical systems because of his work.
- (10) All vibration, careless handling or tracking of dirt, etc. which is detrimental to the existing and new equipment shall be avoided.
- (11) All existing electrical equipment which has been removed such as motor starters, lighting fixtures, etc. shall be delivered to the Owner unless directed by the Owner for disposal.
- d. **Protection of Equipment and Materials:**
The Electrical Contractor shall always provide adequate protection for all material, apparatus and equipment furnished by him and by the Owner on the site and after erection of same. All damaged or rejected material must be removed from the premises without delay. Material stolen shall be replaced by the Electrical Contractor at no extra cost to the Owner. Electrical equipment, switches, receptacles, conduits, panelboards, etc. shall be protected from moisture, dust, and debris at all times.

9. **PAINTING**

- a. All non-galvanized electrical equipment, conduit, materials, brackets, angles, supports, and hangers installed and fabricated by the Electrical Contractor shall be primed and painted by the Electrical Contractor as directed by the Owner to match existing painted surfaces (inside and outside of building).
- b. All electrical equipment shall be retouched where the finish has been slightly damaged in transit or installation to match the manufacturer's finished surface.

11. **CUTTING AND PATCHING**

Cutting and patching necessary for the installation of the work under this Contract shall be done at the expense of the Electrical Contractor and shall be executed by workers skilled in the respective division of the work affected. Patching shall be done using like materials and shall not show in the finished work. All openings around pipes and recessed equipment shall be closed. The cutting of walls, floors and structural members will be permitted only when necessary and then only when approved by the Owner.

12. **SLEEVES**

A. **Conduit Penetrations**

- (1) Provide sleeves at all conduit penetrations of building walls, floors, ceilings, and roof, except as specifically noted below. Sleeves in non-process areas shall be schedule 40 carbon steel pipe, except where the steel is exposed to the weather, where it shall be schedule 40 galvanized steel. Sleeves exposed inside of process rooms shall be 304 stainless steel.
- (2) Conduit penetrations through non-fire interior floors, ceilings, and walls: Provide a sleeve at least 1" larger in diameter than the outside diameter of the conduit. Sleeves for walls and vertical partitions shall be flush with the wall on both sides. Sleeves for ceiling and floor penetrations shall be flush on the bottom side and extend a minimum of 4" above the top of the floor.
 - a. Pipe sleeves for CMU (concrete masonry unit) wall penetrations shall be set in place as the wall is constructed. The space between the wall and the sleeve shall be filled with non-shrink grout. The space between the conduit and sleeve shall be packed with fiberglass insulation. At each end of the conduit sleeve seal the space between the conduit and sleeve with a silicone caulk. If the sleeve is exposed inside of a process room, use an FDA approved caulk such as 732 by Dow Corning or Silicone Construction

- 1200 Sealant by General Electric. Contractor shall confirm with Owner that caulk is compatible with chemicals in use.
- b. Provide an escutcheon plate around the pipe penetration wherever it is exposed to view in an occupied area. The escutcheon plate shall be tight to the pipe and overlap the penetration by at least 1". Seal the plate to the pipe and the wall with silicone caulk. Where the penetration is exposed inside of a process room use a 304 stainless steel escutcheon plate and seal with an FDA approved caulk as noted above. For floor penetrations, a flashing cap around the top of the pipe sleeve.
- (3) Conduit penetrations through fire rated interior floors, ceilings, and walls. Provide a conduit sleeve sized in diameter as required to meet UL fire rated assembly requirements. Sleeves for walls and vertical partitions shall be flush with the wall on both sides. Sleeves for ceiling and floor penetrations shall be flush on the bottom side and extend a minimum of 4" above the top of the floor.
- a. Pipe sleeves for floor penetrations shall be set in place before the floor slab is poured and shall have an annular ring to secure it to the floor slab, ring shall be positioned midway through the floor slab. Pipe sleeves for CMU wall penetrations shall be set in place as the walls are constructed. The space between the wall and the sleeve shall be filled with non-shrink grout. The space between the conduit and sleeve shall be filled as required to meet the UL rated fire stop assembly requirements.
 - b. Provide an escutcheon plate around the pipe penetration wherever it is exposed to view in an occupied area. The escutcheon plate shall be tight to the pipe and overlap the penetration by at least 1". Seal the plate to the pipe and the wall with silicone caulk. Where the penetration is exposed inside of a process room use a 304 stainless steel escutcheon plate and use an FDA approved caulk such as 732 by Dow Corning or Silicone Construction 1200 Sealant by General Electric above. Contractor shall confirm with Owner that caulk is compatible with chemicals in use. For floor penetration, a flashing cap around the top of the pipe sleeve.
- (4) Building Roof Penetrations: Roof penetrations shall not be permitted unless approved by the owner.
- (5) Cored Pipe Penetrations: Any sleeves which cannot be installed during construction of the wall or floor assembly shall be cored in. Cored holes shall be finished in a neat and workmanlike manner. The contractor shall obtain the Owner's Representative's approval for the location of all cored penetrations before beginning work. Sleeves shall be set in cored holes and securely grouted with mortar. Sleeve/penetration assemblies shall be completed as detailed in the previous sections, according to the penetration type.
- (6) Multiple Conduit Penetrations: Where multiple pipes penetrate a floor or wall assembly a piping chase shall be provided in the structure. Piping shall be set in place and the penetration filled as noted below.
- a. For non-fire rated separations, provide a backing plate of rigid polyurethane foam insulation around the pipes. Fill the remainder of the pipe chase with RTV foam as manufactured by Dow Corning or equal. Backing plate may be left in place or removed after the foam has set. Where the piping chase is exposed inside a process room a 16 Ga., 304 stainless steel cover shall be provided. The cover shall be fitted tight to the piping and overlap the pipe chase by at least 2" on each side. Cover shall be secured in place with mechanical fasteners and sealed with silicone caulk around all edges and between the piping and the cover, use an FDA approved caulk such as 732 by Dow Corning or Silicone Construction 1200 Sealant by General Electric. Contractor shall confirm with Owner that caulk is compatible with chemicals in use.
 - b. For fire assemblies the pipe chase shall be filled with a UL rated fire stop assembly. Insulation shall be continuous through the penetration for lines which can operate below 50°F (including cold city water), all other insulation shall be interrupted at the penetration. Pipe chases which are exposed inside of process rooms shall have a

stainless-steel cover as described above.

- (7) Optional Sealants: In lieu of the fiberglass packing and silicone caulk, penetrations through non-fire rated, non-exposed location assemblies may be sealed with mechanical seals. Seals shall be constructed of interlocking rubber links with pressure plates and adjustment bolts. The sealing system shall be placed around the pipe inside of the sleeve and expanded by tightening the adjustment bolts. The seal shall be watertight when installed. Mechanical fasteners shall be link-Seal as manufactured by Thunderline Corp. Or approved equal.
- (8) Outside Walls or Floors Below Grade: Provide watertight external sealing fittings OZ type FSK and internal watertight sealing fittings, Crouse Hinds EZD or EYD or approved equal on all conduits passing from a building space through outside walls or floors below grade. Seal internal fittings with compound approved by cable manufacturer for use with installed cable.

13. **CLEANLINESS AND CLEANING UP**

- a. The Electrical Contractor shall keep the area where work is being always performed in a clean and orderly manner.
- b. The Electrical Contractor shall clean all the tools and excess materials from the work site.
- c. On completion of all work, the Electrical Contractor shall completely clean the motor control centers, unit substations, panelboards, and pull boxes which he either installed and/or had access to as part of this Contract, of all dirt, dust and other foreign objects, to the satisfaction of the Owner.

14. **WORKMANSHIP**

- a. All labor shall be performed by experienced workers. The finished work shall represent the best possible appearance. Exposed work shall be straight and true with the building lines and other work. Piping shall be parallel when lines are run in proximity.
- b. All equipment shall be handled and installed in accordance with the Manufacturer's recommended method.
- c. Provide and maintain all necessary guards, barriers, lights, etc. to protect against injury to persons and damage to property.

15. **TESTING AND START-UP**

- a. Upon completion, the entire system shall be tested under the direction of the Owner or Owner's Engineer to make sure the conditions of the Specifications have been met before the final acceptance of the work. The entire system shall test free from short circuits and unintentional grounds, and each part shall function properly. Tests shall be made in the presence of the Owner's Representative.
- b. Prior to the testing of any specific piece of equipment, remove all shipping hardware and inspect for broken or missing parts and proper connection in accordance with manufacturer's instructions. Ensure that all testing apparatus is in proper working condition prior to actual testing.
- c. All testing shall be performed according to the manufacturer's instructions and test value limitations. In the event of conflict, discrepancy or difference between manufacturer's instructions, test value limitations and the Contract Documents, the Project Engineer's decision shall be binding upon the Contractor. Visually check all connections against the wiring diagrams, including internal wiring of all equipment furnished.
- d. Insulation resistance between conductors and ground shall not be less than thirty (30) megohms for 600-volt cables and below when tested at 500 V.D.C. The Contractor, at his own expense, shall furnish such assistance together with the necessary calibrated instruments, as may be directed to make the tests. Materials not up to the Code requirements shall be replaced. Voltage shall be checked, and adjustments made to transformer taps as may be required.
- e. The Electrical Contractor shall take and tabulate "megger" readings on each feeder, showing values in insulation resistance between conductors and ground, and shall submit such data in duplicate to the Owner. All motors (uncoupled) shall be tested for correct rotation and re-connected when required.
- f. The Electrical Contractor shall consult Owner before energizing any circuit which is supplied from the existing electrical system. The Electrical Contractor shall provide adequate manpower during preliminary

- testing and start-up to correct any malfunctions which may occur due to incorrect power and control circuit wiring or due to malfunctions in equipment supplied by the Electrical Contractor, at no expense to the Owner.
- g. The Electrical Contractor shall set all protective relays per the coordination study. All control and protective relays, devices, etc. shall be tested and checked by the Electrical Contractor according to the manufacturer's approved method using the Owner approved testing firm.
 - h. All fuses, circuit breakers and overload heaters shall be checked for proper size before start-up.
 - i. Additional tests, not covered in this Specification, may be required for jobs where special equipment is installed or were called for by manufacturer's installation instructions. These tests, in general, shall be in accordance with the equipment manufacturer's recommendations. Such field tests as are necessary for this equipment shall be performed by an independent testing organization approved by the Owner and contracted by the Electrical Contractor.
 - j. Before inserting control fuses, use an ohm meter to check all AC and DC control circuits and for short circuit and extraneous grounds. Check all equipment for proper mechanical adjustment.
 - k. Operate all electrically operated breakers and contactors from their control devices. Check all closing, tripping, supervision, and alarm functions of all equipment.
 - l. All control circuits shall be energized and checked to see that their operation and sequence is correct. Any adjustable limit switches, timers, etc. are to be adjusted to give proper operation.
 - m. All panel board load readings shall be provided, and load balanced within ten percent (10%).
 - n. All transformers shall be checked for proper nameplate voltage. Contractor must adjust transformer taps to obtain the transformer nameplate voltage when first energized and later at Owner's direction prior to completion of the project. This work shall be performed at no additional cost to the Owner.
 - o. Inspection and test report sheets shall be prepared for each item of electrical equipment and apparatus. Said sheets shall indicate tests and inspections to be made as outlined above. After the work is complete, the inspection and test reports shall be signed by the Electrical Contractor responsible for preparation of same and submitted to the Owner.
 - p. The Electrical Contractor shall instruct the Owner's Representative in the proper operation of all new, revised, or modified systems installed under this Contract.
 - q. The Electrical Contractor shall provide all operating instructions, maintenance requirements, wiring diagrams, spare parts list, etc. in a bound booklet to the Owner for all equipment installed by the Electrical Contractor under this Contract.
 - r. Electrical Contractor shall provide proper sized fuses and overload heaters based on actual motor nameplate data including any power factor correction equipment. Provide fuse and overload list to Owner prior to installation for approval. Include motor designation horsepower, voltage, full load amp and motor service factor.
 - s. Electrical Contractor shall simulate operational tests of all functions and all modes of operation of the engine transformer set(s). Perform all operational tests of complete standby system at full connected load. Test to be performed at time and date and for three (3) hour minimum or time duration as directed by Owner in presence of Owner and in accordance with manufacturer's instructions.
 - t. Emergency lighting shall be complete and operational and shall be test operated, including simulated and actual loss of normal power; all control devices shall be operated to test their function.
 - u. If the load available to conduct the standby system test is not the full rated load of the set the Electrical Contractor shall provide all required dummy loads, circuitry, protective devices, and connections to perform a full load test. Electrical Contractor shall record connected load; observe temperature rises of engine and transformer, fuel usage; observe voltage and frequency regulation, record all readings, and submit to Owner for approval.

16. **GUARANTEE**

All equipment furnished shall be guaranteed against defective materials and workmanship for a period of (1) year from date of acceptance by the Owner. The warranty shall cover all material and labor or replacement or repair of defective parts or components. Owner's acceptance of this equipment shall be contingent upon the equipment satisfactorily meeting these specifications and tests stipulated herein, satisfactory start-up, final instructions to the

Owner and delivery of the required instruction books. Refer to General Provisions, Paragraphs 24 and 26.

17. SUBSTITUTIONS

- a. Wherever possible, several makes of materials, fixtures and devices have been specified. The Bid shall be predicated upon the use of materials, etc., as specified, or approved by the Owner.
- b. A list of material and equipment, including the name of the manufacturer which the bidder proposes to install, shall be submitted to the Owner for approval. All items listed shall conform to the Specifications. No substitution will be accepted unless approved in writing by the Owner.

18. TEMPORARY POWER

- a. Electrical Contractor shall provide temporary electricity from existing Owner electric service, if available, for project duration. The Electrical Contractor shall plan with the Owner for tie into existing service and shall ascertain that adequate power is available for temporary service. If Owner's electric service is not available or not adequate (capacity and/or characteristics) then Electrical Contractor must provide temporary service at his expense. Provide main fused switch and load center(s) with necessary wiring in work area. Provide reasonable working light in all areas and 120-volt utility receptacles to allow reaching all areas with approved extension cords.
- b. Energy charges shall be paid by the Owner only if temporary electric service is connected to Owner's source.
- c. Extension cords, large power outlets and wiring to trailers (offices) shall be furnished by all Prime Contractors and subcontractors requiring these items.

19. DEFINITIONS

- a. The terms "This Contractor", "The Contractor", "The Electrical Contractor", "The Electrical Trade Contractor" shall mean the Contractor or Contractors performing the Electrical Trades Contract Work in Division 16 of the Project Specifications.
- b. The words "Others", "Other Contractor", "Other Trade Contractor" shall mean the contractor or contractors performing Trade Contract Work in Divisions of the Project Specifications other than Division 16.
- c. The word "Provide" shall mean furnish, install, connect, adjust, test, operate and perform any additional work necessary to make ready for final acceptance.
- d. The word "Furnish", unless otherwise specified, shall mean supply, deliver, off-load on site, store in place in an on-site location as directed by the Project Engineer and obtain a receipt for material or equipment delivered. Equipment, devices, material with factory finishes and insulated wire shall be stored indoor in a dry location.
- e. The words "Install" in relation to material or equipment not furnished in Division 16, shall mean sign for and transport to final location, install, connect, adjust, test, operate and perform any additional work, in conjunction with the furnishing Trade, necessary to make ready for final acceptance.
- f. The word "Connect" in relation to material or equipment not installed in place in Division 16, shall mean connect, adjust, test, operate and perform any additional work, in conjunction with the installing trade, necessary to make ready for final acceptance.
- g. "Approval, "approved", refers to acceptance by Owner's representative, code enforcing authority, or utility inspecting authority.
- h. "Required" expressed or implied requirements of Specifications or Drawings, or of referenced applicable codes.
- I. "Drawings" refers to the Contract Drawing(s). Does not include Shop Drawings.

20. INSTRUCTIONS TO BIDDER

- a. Before request for final acceptance of Work, furnish necessary skilled labor to operate all systems for a period not less than two (2) days. Repeat instructions as required. Instruct designated Representatives of Owner, in proper operation and care of systems and equipment during these periods.
- b. Submit type written statement, signed by Owner's Representative describing:

- (1) Method of instruction.
 - (2) Equipment and systems operated.
 - (3) Length of instruction period.
- c. Contractor is fully responsible until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing.
- d. List under clear plastic (1/8" thick) all operating, maintenance and starting precautions and procedures to be followed by Owner for operating all systems and equipment.

22. PROTECTION COORDINATION STUDY

- a. The Owner's Engineer shall furnish a complete protection coordination study to include short circuit, Coordination and Arc Flash for the setting of relays and breakers for the new equipment installed under this contract.
- b. The results of the study shall be the basis for setting over-current devices and ground over-current protection by a third-party testing firm.

23. BILL OF MATERIALS

Furnished Products include all major components required for the project. This includes but not limited to:

- 1. All equipment shown on plans and including in the equipment specifications.

24. OPERATIONS AND MAINTENANCE MANUALS

- a. Provide five (5) complete sets of manufacturer's catalogues, technical and test data sheets, final approved shop drawings, installation instructions, maintenance procedures, operating instructions, servicing and repair instructions and parts lists with ordering information.
- b. Include protective device settings and fuse sizes, characteristic curves, single line diagrams, control diagrams, electric and key interlocking diagrams, and miscellaneous systems diagrams.
- c. Include safe, step-by-step, procedures for start-up and shut down, inspection and testing.
- d. Check for accuracy of data by actual comparison with equipment and systems installed and correct as needed.
- e. Index and assemble manuals and bind in Buchanan Type RL Binders covered with pyroxylin impregnated buckram covers, manufactured by Buchanan Loose Leaf Records Company, Clifton Heights, Pennsylvania. Binders shall not be greater than 3-1/2 inches thick and shall be adjustable to permit secure compact binding. Each binder cover shall be stamped with the proper title and identification submitted for approval before the manuals are assembled and submitted. Include index tabs and typed table of contents in each binder.
- f. Provide a separate binder or group of binders for each major category of equipment and systems; miscellaneous unrelated systems may be incorporated in the same binder. Submit proposed groupings for approval prior to assembly.
- g. Provide, in a separate binding, preprinted mylar schedules for distribution equipment, panel boards and motor control centers. Schedules shall include current up-to-date information taken from the As-Built Drawings.
- h. The manuals shall be processed in the same manner as Shop Drawings.

25. SPARE PARTS

- a. Submit seven (7) copies of Manufacturer and Contractor recommended spare parts and tools for equipment devices, materials and system incidentals provided under this Contract.
- b. Include descriptions, catalogue sheets, parts numbers, prices, including current discounts, ordering forms and quantities recommended.

26. FINAL ACCEPTANCE

- a. Final acceptance by the Owner for any portion of the Work shall be contingent on the following:
 - (1) Replacement of burned-out lamps.
 - (2) Replacement of devices or materials found to be defective.

- (3) Torque bus and cables connections to proper pressure.
- (4) Rust removal and touch-up painting.
- (5) Schedules, identifying tags and plates complete and in place.
- (6) Equipment and fixtures cleaned, and interiors vacuumed.
- (7) Locks and catches operational with hinged members properly aligned.
- (8) Correction of excessive noise conditions caused by vibration.
- (9) Guarantees and warranties delivered.
- (10) Other requirements, as stipulated in the Specifications and Standards.

27. DRAWINGS AND MEASUREMENTS

- a. The Drawings show the general arrangement, general design and extent of the Work and are to be considered diagrammatic. They are intended as working drawings for general layout of various equipment and materials and do not indicate every detail required for a complete installation which is required by these Specifications.
- b. The Drawings are not intended to be scaled for roughing-in measurements, nor to serve as Shop Drawings.
- c. Consult Other Trades drawings and equipment roughing drawings for exact locations of conduit turn-ups, connections, and similar terminations. Since roughing locations and types of connections vary with different manufacturers, provide connections to suit actual equipment to be installed.
- d. Follow the drawings in laying out the Work. Consult Site, Architectural, Structural, Elevator and Mechanical Construction Documents to ascertain all conditions affecting the Work and verify the suitability of all spaces in which the Work is to be installed. Take field measurements, where necessary, prior to ordering materials and fitting the installation to the building construction.
- e. Where job conditions require reasonable changes in indicated locations or arrangements, make such changes without extra cost.
- f. The Electrical Drawings and Project Specifications are to be complementary, and whatever is called for by either shall be binding as if called for by both.
- g. Electrical Work is shown on drawings by standard symbols. Special symbols, if used, are shown in a legend on drawings.

28. COOPERATION WITH OTHER TRADES

- a. Where the Work of the Electrical Trade will be installed near the Work of Other Trades, or where there is evidence that the Work of this Trade will interfere with the Work of Other Trades, the conflicting Trades shall coordinate together in working out space conditions to make an adjustment work to the satisfaction and approval of the Project Engineer.
- b. If the Electrical Trade installs his Work before coordinating with Other Trades or so as to cause interference with Work of Other Trades, he shall make necessary changes in his Work to correct the condition without extra charge.
- c. Should the conflict become unresolvable by the Coordinating Trades, the changes required to arrive at a satisfactory solution shall be as directed by the Project Engineer and executed by the Coordinating Trades so as not to result in a delay in construction scheduling. Any claims which may result shall be processed or rejected in accordance with the terms of the Contract.

29. EQUIPMENT INSTALLATION

- a. Obtain services of manufacturers' representative of major electrical equipment at site whether furnished by the Electrical Contractor during erection or construction of their respective equipment to insure proper installation.
- b. A letter of certification shall be required from each manufacturer certifying that his equipment has been checked and is properly installed and operating.
- c. Coordinate the installation of the items of equipment and apparatus to be provided under Division 16 or furnished under other Divisions for installation under Division 16.
- d. Where necessary to meet space conditions, arrange to bring the items to their ultimate location, in pieces

or otherwise disassembled, and then assemble in place. Provide flanges, studs, and similar hardware, for matching, alignment, and field assembly.

- e. Arrange for field test of the equipment after assembly under the direct supervision of a representative of the manufacturer. Obtain from the manufacturer a written statement certifying that there has been no invalidation of any warranties or guarantees, nor impairment of the capacity or functioning of the apparatus or equipment.
- f. Equipment and apparatus which may be necessary to install by means of such field assembly typically includes switchgear, motor control centers, multiple section cabinets and power centers. It is intended to avoid such field assembly wherever possible by suitable scheduling with the general construction work. No extra compensation will be allowed for those cases where it is necessary to field assemble equipment or apparatus.
- g. Furnish all wiring and miscellaneous accessories necessary for the complete installation of and final connections to equipment not furnished under electrical sections of the Work. Make final connections to this equipment, including installation of wire, raceways and disconnect switches, control devices furnished with such equipment, and furnish material necessary that is not supplied with the special equipment.
- h. Unless otherwise detailed, roughing of proper size and capacity for electrical equipment indicated as "Future" or "N.I.C.", shall be provided and installed in such manner and location that future final connections can be made with a minimum of work and without cutting or patching permanent walls, partitions, ceilings or floors.

30. INTERRUPTION OF SERVICES

- a. Where the Work makes temporary shutdowns of energized electric equipment unavoidable, they shall be made at such a time designated by the OWNER or Project Engineer.
- b. Give ample written notice in advance to the Project Engineer of any required shutdown in any area required and estimated duration. Arrange to work continuously including overtime, if required, to assure that services will be shut down only during the time actually required to make the necessary connections.
- d. Shutdowns in areas occupied by the Owner are not permitted during Owner working hours.

31. CONTINUITY OF SERVICES IN EXISTING BUILDINGS

- a. Wherever existing buildings are affected by execution of this contract, the existing buildings will be in use during construction operations. This Contractor shall always keep all existing systems in operation within all rooms of the building unless specifically noted or approved by the owner.
- b. Provide, necessary temporary connections and relocations as required to accomplish the above.
- c. Schedules for various phases of Contract Work shall be coordinated with all other trades and the Owner.
- d. When connecting new facilities, do not shut off any existing Mechanical/Electrical facilities or services without prior written approval of the Owner 24 hours in advance.
- e. When connecting new circuits to existing panels, the contractor shall get prior approval from job owner.

32. ACCESSIBILITY

- a. Locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include, but not be limited to switchgear, miscellaneous outlet boxes and similar items.
- b. Minor deviations from drawings may be made to allow for better accessibility, but changes of substantial magnitude or which involve extra cost shall not be made without approval.

33. SEALING OF OPENINGS AND PENETRATIONS

- a. Wherever slots, sleeves or other openings are provided in floors or walls for the passage of conduits or other forms of raceway, such openings, if unused, or if there is space left in such openings after installation of the conduit and raceways, shall be filled.
- b. Filling materials for openings in floors or walls shall be fire-resistive, similar to the material of the floor or wall itself and finished so as to prevent passage of water, smoke and fumes.
- c. Where raceways passing through the openings are exposed in finished rooms, the finishes of the filling

- materials shall match and be flush with the adjoining floor, ceiling or wall finishes.
- d. Where unused sleeves or slots are provided for future installation of conduit or other raceways, they shall be so identified when closed.
 - e. Sleeves for future use shall be extended two (2) inches above and below the floor slab, or wall on both sides, and shall be threaded and capped at both ends and filled with fire rated RTV silicone foam as made by Dow Corning.
 - f. Slots and openings for future use shall be filled with fire rated silicone foam except where provided for telephone or data wiring. Furnish enough compound for future closing by the user.
 - g. Sleeves for telephone and data wiring shall be open type, inside treated with fire rated materials which expands when exposed to heat, O.Z. or Nelson.

34. SINGLE EQUIPMENT SUPPLIER

- a. The manufacturer of the low-voltage circuit breaker switchgear for the 480 and/or 208-volt substation shall be the Supplier of all substation transformer and primary switch assembly equipment and all elements of the substations shall be finished in the same color.
- b. Individual components of an assembly may be tested in different plants of the Supplier. They shall be brought to the building for assembly, inspection, energizing and operating tests. For purpose of definition, the entire low-voltage section of a substation center shall be considered an assembly.
- c. The Supplier shall coordinate alignment between assemblies, shipping sections, construction and finishes of all enclosures to present a unified appearance.
- d. Should the Supplier not be the manufacturer of any component specified in the base and alternate specifications, he shall comply with all of the above requirements as if the component were of his manufacturer.
- e. The Supplier shall assume manufacturer responsibilities and hold guarantees and warranties for all equipment supplied by him but manufactured by another.
- f. The manufacturer of the medium-voltage motor controller must coordinate with the medium-voltage switch supplier. All elements of the line up must be finished in the same color.

35. SPECIAL TOOLS

- a. The manufacturer shall supply all special tools, lifting devices, fuse removal device, draw-out type transfer dolly, etc. required tools, for installing, operating and maintaining all equipment furnished under these specifications.

36. TAGGING AND LABELING

- a. All equipment shall be tagged.
- b. All power and control wiring shall be tagged.

37. OWNER SAFETY AND CONVENIENCE

- a. The Contractor shall obtain and read the Owner's Company Safety Policies and Procedures and sign all required certification documents.
- b. The Contractor shall conduct work to insure the least possible obstruction to traffic and inconvenience to the Owner and the residents in the vicinity of the work, and to insure protection of persons and property in a manner satisfactory to Owner. No road or street shall be closed to the public except with permission of Owner and proper government authority. Fire hydrants on or adjacent to the work shall be kept accessible to fire fighting equipment at all times. Make temporary provisions to insure use of sidewalks and proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches. All work in the public right-of-way shall be subject to authority having jurisdiction.
- c. In accordance with generally accepted construction practices, the Contractor will be solely and completely responsible for the condition of the job site, including safety of all persons and property during performance of the Work. This requirement will apply continuously, and not be limited to, normal working hours. The duty of the Owner, Architect or Engineer to conduct construction review of Contractor's performance is not intended to include review of the adequacy of Contractor's safety

- measures in, on, or near construction site.
- d. The Contractor shall provide all reasonable safety devices and precautions such as safety warning signs and tags, temporary heat, coupling guards, temporary screens and rail guards, and such other precautions or devices as necessary or as directed, to protect personnel and workmen during construction.
- e. The Contractor shall not store material, scraps, debris in any emergency egress path during any phase of the work. This also applies to non-working hours.

38. FIRE SAFETY

- a. Fire Watch - Wherever welding, brazing, cutting, or other processes involving an open flame or potential for generating sparks (hot work) is used, the Contractor shall assign a dedicated fire watch person. The fire watch shall consist of a person assigned to man a ten (10) pound carbon dioxide fire extinguisher. While on fire watch, the person so assigned shall have no other duties or assignments and must be present wherever hot work is being executed.
- b. Fire Blanket - In addition to providing a fire watch, an approved fire blanket shall be used to cover any combustible materials in the immediate area.
- c. Any work on the site involving the use of equipment or tools which may produce heat or sparks shall require a HOT WORK PERMIT. The following are examples of jobs requiring HOT WORK PERMITS: Welding, burning, torch soldering, sandblasting, chipping, grinding, drilling and the use of portable pumps or tools powered by internal combustion engines or non-explosion proof motors, explosion actuated stud drivers, and any other powder activated devices.
- d. The Contractor shall not perform any of these activities prior to obtaining a HOT WORK PERMIT from the Owner's Fire and Safety Specialist or, in his absence, the Area Supervisor and the Maintenance Supervisor.

END OF SECTION 260500.10

SECTION 260500.20 ELECTRICAL SPECIFIC PROVISIONS

1.0 SCOPE OF WORK

1. The overall scope is to install, energize and fully test and commission the new transformer by the installing contractor and 3rd party testing firm.
2. The bulk of the installation and testing work shall be performed while maintaining continued uninterrupted power to the site with minimum of downtime. The contractor shall submit his or her own project schedule prior to commencement of work for all required shutdowns. The primary goal with respect to interruptions to site is to limit shutdowns to several (minimum required) weekends.
3. BASE BID DESIGN is included for pricing as follows:
 - a. The work includes but is not limited to furnishing of all labor, material, equipment (except the equipment noted herein as "Purchased by Owner") and services necessary for and incidental to the proper and complete installation of all electrical work as follows:
 - 1) Preparation to replace the existing transformer and auxiliary wiring.
 - 2) Rigging of existing and new transformer and alignment/leveling of same.
 - 3) Installing, wiring, programing, testing, and commissioning the new transformer and associated controls.
 - 4) Supplemental ground system to existing grid system.
4. ADD/ALTERNATE: Contractor shall provide cost and lead time for a third part vendor to fully rebuild/remanufacture the existing T1 transformer after removal to be used as an onsite spare. Cost should also include shipping to factory and delivery to NJSEA designated storage location. The remanufactured transformer shall be prepared and delivered to the site prepared and weather sealed for long term storage outdoors.

2.0 GENERAL REQUIREMENTS

All work under this Division shall be subject to the applicable parts of the General Conditions of the Contract and the Special Conditions of the Contract Documents. Refer to Division 1 for additional requirements.

- a. The work includes but is not limited to furnishing of all labor, material, equipment (except equipment noted as "Purchased by Owner") and services necessary for and incidental to the proper and complete installation of all electrical work as follows:
 1. Preparation and conversion of an existing building transformer room.
 2. All incoming and outgoing line work including any required new or existing conduit and wire to the new equipment shall be furnished and installed by the contractor as part of this project. Location of new equipment and transformer accessories shall be coordinated in the field with respect to final location and routing to avoid existing utilities and obstructions.
 3. Contractor shall be responsible for receiving, inspecting, accepting, handling, rigging, setting, leveling, testing, and commissioning of all equipment and all equipment purchased by contractor.

4. All necessary control wiring and auxiliary low voltage power to/from all new equipment installed under this contract or existing equipment to be re-fed or reused. All wiring counts and sizing shown on plans are for bidding purposes and shall be verified with final vendor shop drawings prior to installation.
 5. Wire and cable, primary cables and terminations and cable testing.
 6. Conduit, conduit supports and raceways.
 7. Branch circuit wiring.
 8. Control and power circuit wiring
 9. Wiring devices and plates.
 10. Sleeving.
 11. Pull boxes and cable troughs/trays, handholes and manholes.
 12. Building and system grounding.
 13. Supervision and approval.
 14. Cutting and patching related to electrical work.
 15. Removal, and proper disposal of removed equipment from site.
 16. Nameplates, labels, and tags.
 17. Other systems and equipment as indicated on the drawings.
 18. Initial testing/commissioning of installed systems as well as manpower and material support for final testing and commissioning by 3rd party testing firms.
 19. Operating and maintenance instructions and manuals.
 20. Coordination drawings and shop drawings.
 21. Coordination with other trades, Owner's project manager, Owner's facilities as required.
 22. Short circuit protection and coordination study (by others).
- b. Work Schedule
1. Preliminary Progress Schedule: Within 10 days after notice of award, the CONTRACTOR shall present to the COMPANY'S representative a Preliminary Progress Schedule based on the items indicated in the Bidding Documents, except as otherwise agreed to, for starting and completing the Work. This schedule will be used for coordinating the Work of all Subcontractors, material suppliers, etc., providing the Work for the project. The CONTRACTOR shall coordinate the Work with the COMPANY and adjust the Preliminary Progress Schedule and issue a Final Progress Schedule satisfactory to the Owner and all concerned.

- c. Project Closeout:
 - 1. Miscellaneous construction
 - a) Install “danger high voltage” signs.
 - b) Touch-up painting
 - c) Final Site Clean-up
 - d) Submittal of all equipment manuals, permit approvals, and testing reports.

END OF SECTION
260500.20

SECTION 260526.00 GROUNDING GENERAL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Minimum requirement for equipment grounding shall be governed by the latest National Electrical Code, IEEE and OSHA and utility requirements. Grounding requirements shown on Drawings and specified herein are intended to exceed such minimum requirements. The Electrical Contractor shall furnish and install all items necessary to meet this requirement, at no extra cost, even if such items are not detailed in the Drawings or listed herein.
- B. The work specifically entails an equipment ground system which shall be a permanent continuous bonding together of non-current carrying parts of the electrical system, building steel, and major structures and equipment.

PART 2 - PRODUCTS

2.01 CADWELD PROCESS

- A. Manufacturer - Erico Products Co.

2.02 MECHANICAL GROUNDING CONNECTIONS

- A. Manufacturer - Burndy Corporation or O-Z Electric Manufacturing Co.

2.03 GROUND RODS

- A. Copper clad steel.
- B. Size - As shown on drawings.

2.04 CONDUCTORS

- A. All grounding cables and wires shall be annealed copper conductors; stranded. Buried cables shall be tinned.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All distribution system grounding shall originate from the main ground cable loop and/or service. The grounding wire in feeders shall be connected to high voltage switchgear ground bus on one (1) end and equipment ground buses on the other. Cable feeders shall also be bonded to grounding type bushings at the feeder terminations.
- B. Equipment grounding conductors with green insulation shall be extended inside the conduit enclosing the conductors and properly connected to each motor, control, switch, receptacle, junction box, panel board and luminaire.
- C. All underground (or concealed) splices and connections, and all connectors to grounding rods shall be Cadweld Process.
- D. All other connections may be by either the above method or mechanical grounding connections.
- E. Step Down Transformers: Connect neutral point of secondary to transformer case and ground case neutral through a separate ground conductor run in conduit to an effectively grounded structural metal member of the structure and /or ground bus in distribution equipment supplying transformers. Refer to drawing details.
- F. Protect all grounding conductors from physical damage and provide necessary slack at termination points to prevent breakage.
- G. Connections to equipment and ground buses shall be made with lugs attached to the equipment by means of bolts. Anchor bolts of equipment housings shall not be used for fastening lugs of grounding cable.
- H. Cable tray sections, fittings, and connected raceways shall be bonded using bolted mechanical connectors and bonding jumpers sized and installed in accordance with National Electrical Code Article 250 Grounding.

END OF SECTION
260526.00

SECTION 260533.00 RACEWAYS, FITTINGS & BOXES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Rigid steel conduit shall be used throughout all indoor areas for medium and high voltage power cable unless otherwise noted on drawings.
- B. Ridged aluminum shall be used outdoor and above ground for all low, medium and high voltage cable unless otherwise noted on drawings.
- C. All underground conduit shall be PVC schedule 40. Refer to Section 16345.00 Underground Conduit.
- D. All other conduit used indoors shall be EMT unless otherwise noted on the drawings.
- E. Minimum size conduit shall be three quarter inch (3/4").

PART 2 - PRODUCTS

2.01 RIGID STEEL CONDUIT AND COUPLINGS

- A. Rigid steel conduit shall be mild steel, hot dip galvanized inside and outside and produced to ANSI Specification C80.1 and UL Standard 6.
- B. Make: Allied, LTV, Republic, Wheatland or approved equal.

2.02 FITTINGS

- A. All rigid conduit installations shall have threaded type fittings and gasketed cover.
- B. Outdoor fittings shall be UL approved for such usage.
- C. Make: Crouse-Hinds or approved equal.

2.03 ELECTRICAL METALLIC TUBING (EMT)

- A. Metallic tubing shall be mild steel, electrically welded, galvanized and produced to ANSI Specification C80.3 and UL Standard 797.
- B. Couplings, Connectors: Compression Type T & B or approved equal.
- C. Make: Allied, LTV, Republic, Wheatland or approved equal.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Flexible metal conduit (Sealtite) shall be constructed of extruded polyvinylchloride cover over flexible galvanized steel core. Cover shall be gray or black as directed by Project Engineer.

2.05 OUTLET BOXES

- A. Outlet boxes shall be provided on all raceway systems to facilitate pulling and installation of wires and/or devices. Boxes shall be FD type of sufficient size to accommodate the wiring and device being installed and box covers shall be accessible after installation.

2.06 WIREWAYS

- A. Where indicated on the Drawings, approved wireways shall be furnished and installed complete with the necessary complement of fittings, connectors and parts, and shall be supplied with anti-sway braces.
- B. Material: Enclosed steel wiring throughout with gasketed and screwed covers NEMA 12.
- C. Make: Square D or approved equal.

2.07 RACEWAYS

- A. Non-metallic conduit shall be Schedule 40 100% virgin polyvinyl chloride (PVC), 90 deg C UL-rated, by Carlon or approved equal.
- B. Conduit shall meet NEMA requirements and shall be UL-listed as required by Article 347 of NEC.
- C. Conduit, fittings and solvent cement shall be by single approved manufacturer.
- D. Material shall have minimum tensile strength of 7,000 psi at 73.4°F, minimum flexural strength of 11,000 psi, and minimum compressive strength of 8,600 psi.

PART 3 - EXECUTION

3.01 CONDUIT INSTALLATION

- A. Location: Concealed above ceilings and in walls in finished rooms unless otherwise indicated on the

Drawings. Surface mounted in all other rooms.

- B. Runs: Straight, parallel to wall and floor lines, pitch to provide drainage. Minimum of six inches (6") from outside surface of insulation of hot water and/or steam piping. Do not install under water and/or solvent piping. Do not install in concrete floor slabs unless noted on Drawings.
- C. Bends: Make without injury to conduit and without effective reduction in diameter.
- D. Finishing: Ream ends of conduit to remove rough edges.
- E. Support: Use approved galvanized devices and hangers (perforated strap or wire not acceptable), space to hold conduit rigidly. Conduit hanger spacing will be per NEC requirements.
 - 1. Conduit mounted on concrete surfaces must be supported at least one-quarter inch (1/4") away from surface.
 - 2. Attachment to other pipes or ducts is not acceptable.
 - 3. Use of wood plugs in masonry is not acceptable.
 - 4. Drilling of structural steel is not permitted.
- F. Plug all openings until wire is pulled.
- G. Bushings: Install insulated type with grounding type lock nut at all sheet metal enclosures except distribution feeders to panels, boxes, motor control centers, substations, etc. where grounded type bushings are required including wet locations where Myers Hubs are installed.
- H. Drain fitting shall be installed at low point and a breather fitting at the high point of all outdoor exposed conduit runs.
- I. Raceways passing from one (1) area to another of different temperature shall be sealed; provide internal watertight fitting with approved compound, or if this is impossible, suitable drainage fittings shall be installed.
- J. Weatherproof expansion joints shall be installed every two hundred (200) feet in straight conduit runs and whenever required by structural conditions. Bonding jumper is required at each expansion joint.
- K. Protect all metallic materials against corrosion including steel bolts, nuts, washers, screws, hangers, rods, beam clamps, etc. Replace all damaged raceways; existing and new.
- L. Apply Burndy Penetrax A13 on all rigid aluminum conduit threads and a protective zinc coating on all rigid galvanized steel conduit threads.

3.02 FITTINGS

- B. LB fittings shall be avoided for all conduit above one inch (1"). LBD fittings may be substituted with Owner approval.

3.03 ELECTRICAL METALLIC TUBING (EMT)

- A. Usage - Only where specified on drawings.
- B. Installation methods where applicable for Rigid Metal Conduit as previously listed must be used for EMT.

3.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Flexible metal (Sealtite) conduit with jacket, required for final connection to motors, unit heaters, transformers, adjustable equipment and any equipment, which is subject to vibration. Flexible conduits to enter bottom of motor terminal boxes. Flexibility must exist to permit alignment and/or removal of motor.
- B. Armored cable is not permitted.

3.05 POLYVINYLCHLORIDE (PVC) COATED CONDUIT AND FITTINGS

- A. Usage - Only where specified on drawings.
- B. Installation methods where applicable for Rigid Metal Conduit as previously listed and in accordance with the manufacturer's recommendations.

3.06 OUTLET BOXES

- B. Installation: Outlet boxes shall be securely fastened to ceilings, walls or columns. Boxes installed in finished ceilings, walls or columns, shall be set so that the front edge of the box shall be flush with the finished ceilings, walls or columns. Boxes installed in all other unfinished locations shall be surface mounted.

1. Mounting height in block walls shall be adjusted for joint locations.
2. Switch outlets shall be installed with their centerlines four feet (4'-0") above the floor.
3. Unless otherwise noted on the Drawings or specified herein, receptacle outlet center lines shall be installed one and a half feet (1'-6") above the floor
4. Clock outlets installed over doors shall be set so that the clock is installed, centered between top of door trim and the ceiling. Where installed at other locations, outlet centerlines shall be set eight feet (8'-0") above the floor, unless noted otherwise on the Drawings.
5. Telephone/data outlet center lines shall be one and a half feet (1'-6") above the floor unless otherwise noted on Drawings.
6. Signal/security system outlets shall be installed as shown on the Drawings and/or as specified by signal/security system vendor/installer.
7. Boxes, which are not covered with a fixture, shall be closed with a metal cover.
8. Provide barriers in boxes containing 277-volt switches connected to different phases.

3.07 WIREWAYS

- A. Size shall be as indicated on the Drawings as per latest edition of NEC and installation shall be in accordance with the manufacturer's recommendations.

3.08 RACEWAY APPLICATIONS

- A. Raceway Applications
 1. Outdoors: Use the following raceway applications:
 - a. Exposed: rigid aluminum conduit.
 - b. Concealed: rigid aluminum conduit.
 - c. Underground: Non-metallic sched 40 PVC conduit in concrete encasement, unless noted otherwise.
 - d. Connection to Vibrating Equipment or equipment subject to relative motion (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquid-tight flexible metal conduit.
 2. Indoors: Use the following raceway applications:
 - a. Connection to Vibrating Equipment or equipment subject to relative motion (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Flexible metal conduit, except in wet or damp locations use liquid-tight flexible metal conduit.
 - b. Damp or Wet Locations: Rigid galvanized steel conduit.
 - c. MV/HV Power Feeders: Rigid galvanized steel conduit.
 - d. Mechanical Room: Rigid galvanized steel conduit.
 - e. Telephone/data conduits and low voltage wiring: EMT.

END OF SECTION
260533.00

SECTION 260553.00 EQUIPMENT IDENTIFICATION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Electrical Contractor shall furnish and install identification tags as specified in this section.

1.02 SUBMITTALS

- A. Contractor shall submit to Owner two (2) copies of "Proposed Equipment Identification Schedule" for review and approval.
- B. Pre-tensioned Flexible Wraparound Colored Plastic Sleeves for Raceway and Cable Identification: Flexible acrylic bands sized to suit the raceway diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the raceway or cable.
- C. Underground Line Marking Tape: Permanent, bright-colored, continuous-printed, plastic tape with foil backing compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.
1. "Danger high voltage ductbank" (medium voltage).
 2. "Danger electric ductbank" (600 volts and below).
 3. "Caution communications duct-bank".

PART 2 - PRODUCTS

2.01 TAGS

- A. Tags shall be laminated, Bakelite plastic plate, three (3) ply, one-eighth inch (1/8") thick, engraved with three-sixteenths inch (3/16") minimum standard Gothic letters unless otherwise specified.

2.02 TAGGING GUIDELINES

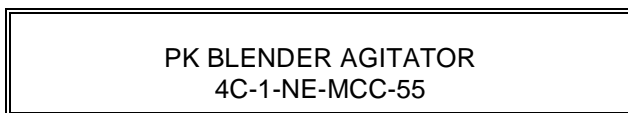
Type A - Tag to be applied to motor starters and disconnect switches showing duty of and location of motor.



On black (1"x3-1/8")

SAMPLE

Type B - Tag to be applied on PB and at motor showing duty of and source of potential.



On white (1"x3-1/2"), set off center to be applied at motor and PB

SAMPLE

Type C - Tag to indicate interlocking or other pertinent information.



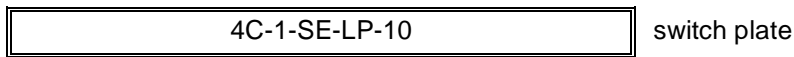
On yellow sized same as Item A

SAMPLE

Type D - Tags for lighting, receptacles, etc.



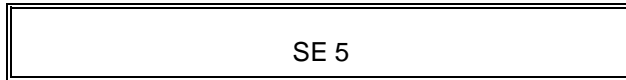
On white (1/2"x2") for gluing on receptacle or



switch plate

SAMPLE

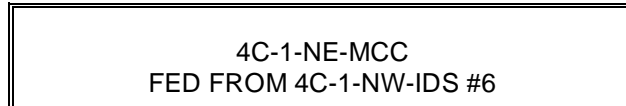
Type E - Tag to be applied to motor starters and disconnect switches for identification in MCC or MCR.



On white (1"x2")

SAMPLE

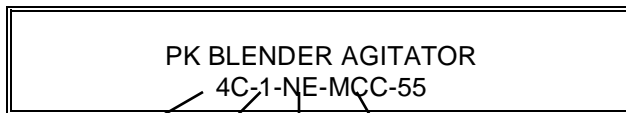
Type F - Tag to be applied to MCC designating MCC and power source.



On white (1"x4")

SAMPLE

Sample Tag:



→ Application number of switch, breaker or circuit number

Building
Floor
Type of Distribution
Geographical area on floor

PART 3 - EXECUTION

3.01 Installation

A. Methods of Tagging

1. Starters and Panels: Fasten the tags using screw holes provided by equipment manufacturer. If none are available, use vinyl adhesive, double face scotch grip #1099 by 3M Company.
2. Motors: Fasten the tags on the conduit near the motor junction box with TY-Raps.
3. Field Mounted Control Devices: Fasten the tags on the conduit near the device with TY-Raps.
4. Lighting Fixtures, Receptacles and all 120-Volt Equipment: Use the proper panel and circuit number for equipment tagged. Fasten using either TY-Raps or vinyl adhesive, scotch grip #1099 by 3M Company.
5. Conduits and Junction Boxes: Use Brady or approved equal adhesive cloth markers.
6. Underground Electrical Line Identification: During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground plastic line marker with foil backing, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.
7. Install line marker for underground wiring, both direct buried and in raceway.
8. Power Circuit Identification: Securely fasten identifying metal tags of aluminum wrap-around marker bands to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms with ¼-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-lb test monofilament line or one-piece self-locking nylon cable ties.
9. Tag or label conductors as follows:
 - a. Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.

10. Apply warning, caution, and instruction signs and stencils as follows:
 - a. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation.

END OF SECTION
260553.00

SECTION 260800.10 COMMISSIONING ELECTRICAL

PART I - GENERAL

1.01 DESCRIPTION

- A. The purpose of this section is to specify the Contractor's responsibilities and participation in the commissioning process.
- B. Commissioning is primarily the responsibility of the CONTRACTOR's Commissioning Agent (CA) or CONTRACTOR appointed personnel or Project Manager as the Commissioning Agent (CA), with support for start-up, testing, and commissioning responsibility of Contractor. The commissioning process does not relieve Contractor from participation in the process or diminish the role and obligations of this Contractor to complete all portions of work in a satisfactory and fully operational manner.
- C. The CA's responsibility is to verify and document the following field tests and observations:
 - 1. Field Installation Verification (FIV). Verification of all installed systems for compliance to plans and specification. These inspections are to be described in detail in the commissioning plan.
 - 2. Operation Performance Tests (OPT). Operational tests which verify proper start-up of all equipment and systems. These tests are to be described in detail in the commissioning plan.
 - 3. Functional Performance Tests (FPT). Functional system tests that verify all systems are functioning and interacting with other systems correctly and includes the use of failure analysis. These tests are to be described in detail in the commissioning plan.
- D. Work includes:
 - 1. Programing equipment required for proper operation of the system including but not limited to one (1) new generator controller, two (2) existing protective relays, and one (1) existing ATS controller. Testing and start-up of the equipment.
 - 2. Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial commissioning.
 - 3. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process, which fulfill contract and warranty requirements.
 - 4. Providing operation and maintenance information and as-built drawings to the CA for verification, organization, and distribution.
 - 5. Providing assistance to the CA to develop and edit system operation descriptions.
 - 6. Providing training for the systems specified in this Division with coordination by the CA.

1.02 COOPERATION

- A. The electrical contractor coordinate with the Commissioning Agent (CA) in the following manner.
 - 1. Complete equipment and system start up in accordance with the commissioning schedule.
 - 2. Attend all commissioning planning and scheduling meetings as scheduled by the Commissioning Agent (CA).

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

- A. The Contractor shall provide test equipment for electrical systems testing. Equipment shall be provided as necessary to start-up, test, and commission the electrical systems.

2.02 TEST EQUIPMENT - PROPRIETARY

- A. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the CA in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.

PART 3 - EXECUTION

COMMISSIONING ELECTRICAL

3.01 GENERAL

- A. Prior to final turnover, the following items listed in Section B shall be complete. The Contractor shall demonstrate that all systems and equipment follow manufacturer recommendations, code requirements, specifications, and design parameters. Specialized and trained manufacturer representatives shall start-up and demonstrate performance of systems and equipment.
- B. The following lists of equipment, systems and responsibilities are a summary only. Comply with the design document requirements, manufacturer's recommendations, and detailed specifications wherever they are more stringent.
1. Electrical: The following equipment shall be tested per manufacturer's recommendation and systems shall be demonstrated to verify compliance with contract documents.
 - a. Generators and associated transfer equipment shall be tested under direct supervision of manufacturer, mechanical and electrical service engineers.
 - b. Switchboards shall be tested under direct supervision of manufacturer's electrical service engineer.
 - c. Transformers:
 1. Shall be tested under the direct supervision of manufacturer's electrical service engineer.
 2. Winding resistance tests shall be performed for each winding.
 3. Insulation resistance and absorption test shall be per manufacturer's recommendations.
 - d. Motor control centers (MCCS) shall be measure with I 000-voltmeter, phase-to-phase, and phase-to-ground, prior to energization by the electric company.
 - e. Motors:
 1. Check motor for horsepower, rotation, speed, phase, and voltage.
 2. Test motor for current reading at full load.
 3. Check overload elements.
 - f. All circuits shall be tested for proper phasing.
 - g. Ground system tests.
 - h. Ground fault systems shall be checked for operation and coordination.
 - i. Circuit breakers shall be checked for proper mounting, conductors' size, and feeder designation,
 - j. Proper size fuses and overload heaters installed.
 - k. Metering and instrumentation devices shall have calibration verified.
 - l. Fire, paging, security and monitoring alarm systems shall be tested per manufacturer's recommendations and sequence of operation shall be demonstrated in the presence of the local authorities.
 - m. Edstrom Watchdog System shall be tested per the manufacturer's recommendations. The manufacturer shall preload system software including employee codes, access privileges, etc.
 - n. All lighting fixtures lamped.
 - o. All receptacles functional.
 - p. All LISP and / or standby systems tested, operational and batteries fully charged.
 - q. All labeling complete.
 2. Instrumentation:
 - a. All field instruments installed, calibrated, documented, and functionally tested,
 - b. All control valves and automated on / off valves installed, calibrated where required, documented, and operationally tested.
 - c. All safety relief devices (valves I rupture discs) installed and operational. All gags or blanks removed. Any required documentation completed.
 - d. All tubing and signal / control wiring dressed and secured.
 - e. Control panels installed, tested, cleaned up and dressed out.
 - f. I / O panels installed, tested, cleaned up and dressed out.

- g. All control loops tested for functionality per loop sheets and P&ID's.
- h. All intrinsically safe systems checked for proper system grounding.
- i. All interfacing control circuits (instrumentation / controls) to be checked for continuity and functionality for loop sheets and P&ID's. All manual back-up panels to be installed, wired, and tubed, instruments calibrated, documented and components functionally tested.

3.02 WORK PRIOR TO COMMISSIONING

- A. Complete all phases of work so the systems can be energized, started, tested, and otherwise commissioned. Contractor has primary start-up responsibilities with obligations to complete systems, including all sub-systems so they are functional. This includes the complete installation of all equipment, materials, raceways, wire, terminations, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.
- B. The CA will develop a commissioning plan. Upon request of the CA, Contractor shall aid and consultation. Contractor is obligated to assist the CA in preparing the commissioning plan by providing all necessary information pertaining to the actual equipment and installation. If system modifications/clarifications are in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner.

If Contractor initiated system changes have been made that alter the commissioning process; the CA will notify the OWNER or OWNER's engineer.

- C. Specific pre-commissioning responsibilities are as follows:
 - 1. Factory start-up or Contractor startup of all equipment and systems installed under this contract.
 - 2. Normal start-up services required to bring each system into a fully operational state. This includes motor rotational check, cleaning, bolt tightening, control sequences of operation, etc. The CA will not begin the commissioning process until each system is complete, including normal contractor startup.

3.03 PARTICIPATION IN COMMISSIONING

- A. Provide skilled technicians to start-up and debug all systems within the systems. These same technicians shall be made available to assist the CA in completing the commissioning program as it relates to each system and their technical specialty. Work schedules: time required for testing, etc. will be requested by the CA and coordinated by the Contractor. Contractor will ensure the qualified technicians are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustment, and/or problem resolutions.
- B. System problems and discrepancies may require additional technician time, CA time, redesign and/or reconstruction of systems, and system components. The additional technician time shall be made available for the subsequent commissioning periods until the required system performance is obtained.
- C. The CA reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or subsystem. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the CA to get the job done. A liaison or intermediary between the CA and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.

3.04 WORK TO RESOLVE DEFICIENCIES

- A. In some systems, mis-adjustments, misapplied equipment and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work will be completed under the direction of the Architect, with input from the Contractor, equipment supplier, and CA. Whereas all members will have input and the opportunity to discuss, debate and work out problems, the Architect per

Division I will have final jurisdiction on the necessary work to be done to achieve performance.

- B. Corrective work is completed in a timely fashion to permit the timely completion of the commissioning process. Experimentation to render system performance will be permitted. If the CA deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the CA will notify the Architect indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities. If the deadline(s) pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner will be the Contractor's responsibility.

3.05 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

- A. Seasonal commissioning pertains to testing under full load conditions during peak heating and peak cooling seasons, as well as part load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.
- B. All equipment and systems will be tested and commissioned in a peak season to observe full load performance. Heating equipment will be tested during winter design extremes. Cooling equipment will be tested during summer design extremes, with a fully occupied building. Each Contractor and supplier will be responsible to participate in the initial and the alternate peak season test of the systems required to demonstrate performance.

3.06 TRAINING

- A. In addition to the requirements of Division 1, arrange for and participate in the training of Owner's engineering and maintenance staff on each system and related components. Training will be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids.
- B. The Commissioning Agent (CA), the design engineers, the equipment vendors, and the Contractor will conduct training jointly. The Contractor will be responsible for highlighting system peculiarities specific to this project.

3.07 EQUIPMENT COMMISSIONING

- A. The equipment specified shall be started up and tested by a factory authorized and certified technician. The manufacturer shall coordinate startup of the equipment with the Commissioning Agent (CA) as specified in Section 15999, 16999, and 18000 of these specifications. Give cooperation to the Commissioning Agent (CA) by providing all tests, startup services, documentation and training as required.

3.08 SUBCONTRACTOR COMMISSIONING

- A. This subcontractor shall provide all start up and testing by an authorized and certified technician. The subcontractor shall coordinate startup of the equipment with the Commissioning Agent (CA) as specified herein. Give cooperation to the Commissioning Agent (CA) by providing all tests, startup services, documentation and training as required.

END OF SECTION
260800.10

SECTION 260800.20 EQUIPMENT TESTING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Inspection and test report sheets shall be prepared by an Independent Testing Contractor for each item of electrical equipment and apparatus described herein. Said sheets shall indicate tests and inspection to be made as outlined below. After the work is complete, the inspection and test reports, seven (7) copies, shall be signed by the Testing Contractor responsible for preparation of same and submitted to the Owner for approval.
- B. Prior to the testing of any specific piece of equipment: remove all shipping hardware and inspect for broken or missing parts and proper connection in accordance with manufacturer's instructions; insure that all testing apparatus is in proper working condition and perform all required cleaning.
- C. All testing shall be performed according to the manufacturer's instructions and test value limitations. In the event of conflict, discrepancy or difference between manufacturer's instructions, test value limitations and the Contract Documents, the Owner's decision shall be binding upon the Testing Contractor.
- D. Visually check all connections against the wiring diagrams including internal wiring of all equipment furnished.
- E. Before inserting control fuses, use an ohmmeter to check all alternating-current and direct-current control circuits for short circuit and extraneous grounds.
- F. Check all equipment for proper mechanical adjustment.
- G. Operate all electrically operated breakers and contactors from their control devices.
- H. Check all closing, tripping, supervision, and alarm functions of all equipment.
- I. All control circuits shall be energized and checked to see that their operation and sequence is correct. Any adjustable limit switches, timers, etc. are to be adjusted to give proper operation.
- J. Electrical Contractor shall provide the necessary manpower to assist with such testing. Electrical Contractor shall include this cost in his bid.
- K. Independent Testing Contractor will be approved by the Owner and contracted by the Electrical Contractor.

1.02 Scope

- A. Contractor shall be responsible for testing of all equipment installed by him under this contract, either supplied by him, another contractor or by owner, unless specifically stated otherwise.
- B. Contractor shall provide the services of a BMS approved testing firm.
- C. In addition, contractor shall provide supervision and assistance with all testing by PSE&G, BMS third party, as required.

1.03 Testing Schedule:

- A. Three (3) weeks prior to performing the specified test, furnish the Owner with the following:
 - 1. Date, time, duration, and location of tests.
 - 2. Test outline description and sequence.
 - 3. Test report forms to be used.
 - 4. Qualifications of testing personnel.
 - 5. Make and model number of test equipment and date of last calibration adjustment.
 - 6. Name and position of manufacturer's representative(s) who will be present during all testing at Electrical Contractor's cost.
- B. Electrical Contractor shall provide safety equipment where required for use by all personnel to be present, including Owner's Representative.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.01 SWITCHYARD EQUIPMENT – OUTDOOR (NOT USED)

3.02 SWITCHGEAR (MEDIUM-VOLTAGE)

- A. Inspect all connections (mechanical and electrical), parts and arrangement of the Switchgear lineup to insure installation conforms to the manufacturer's recommendations. Inspect for physical damage, inspect anchorage alignment and grounding.
- B. Check adjustments and characteristics of all control, protective relays, fuses, etc. in accordance with manufacturer's instructions. Verify proper fuse size. Relay calibration is required. Set relays per Owner's direction.
- C. Verify wiring of all CT's and PT's is correct.
- D. Inspect for any insulator, surge arrestor and other component damage during shipment and installation.
- E. The bus conductors shall be checked with a 1,000 volt megger, each phase to ground with the other bus conductors grounded, before feeders are connected. A minimum value of one hundred (100) megohms maintained for five minutes is required.
- F. Manually test all circuit breakers, switches and/or disconnects for proper mechanical performance as per manufacturer's instructions.
- G. Check ground bus and ground cable connections for tightness. Test ground resistance using a Biddle Megger Earth Tester. Ground resistance to be five (5) ohms or less.
- H. Calibrate all metering per manufacturer's instructions. Verify all PT and CT ratios for agreement with associated metering, relays, etc.
- I. Check tightness of bolted joints by calibrated torque wrench method.
- J. Perform all mechanical operator and contact alignment tests in accordance with manufacturer's recommendations.
- K. Measure contact resistance.
- L. Perform minimum pickup voltage tests on trip and close coils. Perform trip operation with each protective device.
- M. Measure travel time test if unit is equipped for this test.
- N. Perform an insulation resistance test on each pole to ground on pole to pole and across open pole.
- O. All control wiring shall be tested at 1,000 volt direct-current. Do not perform this test on wiring connected to solid state relays.
- P. On oil circuit breakers, sample insulating liquid and test for: dielectric strength, acid neutralization number, interfacial tension, color and power factor.
- Q. Clean all insulators.
- R. If outdoor enclosure exists, verify proper operation of lighting, air conditioning, outlets, door hardware, air filters in place and waterproof integrity.

3.03 SURGE ARRESTORS

- A. Visually inspect each surge arrestor for physical damage and conformance with design specifications and manufacturer's recommended installation procedures.
- B. Inspect for physical damage such as chipped or fractured porcelain on surge arrestors. Clean all insulating materials.
- C. Inspect ground and discharge connection integrity.
- D. Perform an alternating-current dielectric loss test to determine the quality of the dielectric of the insulating material used. Apply recommended manufacturer alternating-current potential across the specimen and measure voltage, charging current and losses. Data must agree with manufacturer's published specifications and curves.

3.04 PT'S AND CT'S

- A. Outdoor (NOT USED)
- B. Indoor
 - 1. Inspect for physical damage.
 - 2. Check mechanical clearances and proper operations of all disconnecting and grounding devices associated with potential transformers.

3. Verify proper operation of grounding or shorting devices.
4. Confirm transformer polarity.
5. Verify connection at secondary current transformers.
6. Confirm transformer ratio.
7. Measure insulation resistance of transformer secondary and leads with 500-volt megohm meter.

3.05 RELAYS AND CIRCUITRY

- A. Inspect, set as instructed and test each protective relay as required by design specifications, manufacturer's published instructions and calibration data.
- B. Inspect each relay as follows:
 1. Verify that each relay is the correct unit for the application with proper characteristics and ranges as specified. Record all nameplate data.
 2. Check cover glass for cleanliness, tightness, and condition of gasket.
 3. Remove all dust, rust, lint, and metallic filings.
 4. Check bearings for condition, adjustment, and cleanliness.
 5. Check shorting bar for proper action and all wiring connections for tightness and continuity.
 6. Check contacts for condition, continuity, and proper action.
 7. Verify proper mechanical operation of the relay components, such as induction disc, directional element, targets, seal-in circuits, etc., as applicable.
 8. Check continuity of internal and external wiring and test for shorts and grounds.
- C. Electrically calibrate the relay for correct operation over their full range in accordance with the manufacturer's curves and recommendations. All electrical characteristics applicable to the relay under test shall be checked, adjusted, and calibrated such as pickup time, instantaneous trip, seal-in and targets, directional pickup, and time, etc. Use relay manufacturer's recommended relay tester or approved equal for electromechanical and solid-state relays.
- D. After all calibration and tests are completed, trip each switch or breaker by manually activating each of its protective relays. Seal each relay case with a suitable tamper proof meter seal.

3.06 GROUND GRID

- A. Perform a visual and mechanical inspection to the substation grounding grid system to ensure that all connections (both compression and exothermal) have been properly made.
- B. Apply resistance test to each substation ground loop using a Biddle Megger Earth Tester or approved equal. Use two (2) auxiliary ground rods (as described in IEEE Standard No. 550). Place the auxiliary rods so that their regions of resistance do not overlap. Ground resistance shall be calculated and a ground loop resistance over five (5) ohms will not be accepted. If resistance is found to be in excess of five (5) ohms, immediately report test to the Owner's Representative and the Electrical Contractor.
- C. Record all readings.

3.07 BATTERY CHARGER AND BATTERIES

- A. Visually inspect batteries and charger for physical damage and conformance with design specifications and manufacturer's recommended installation procedures.
- B. Take specific gravity and temperature readings.
- C. Verify charging equipment operation by measuring charging current and voltage using manufacturer's recommended procedure.
- D. Record temperature, electrolyte level, charging rate, specific gravity, overall battery bank voltage and individual battery cell voltages.

3.08 POWER AND CONTROL WIRING

- A. Perform an operational and continuity test on controls, relaying station service power runs, all wiring, connections, terminal blocks and instruments.
- B. Apply actual voltage/current supplies or an equal power source to simulate functions for every operating condition.
- C. Control wiring shall be isolated and subjected to an insulation resistance test using a 500 volt megger before it is energized and a minimum value of five (5) megohms must be obtained.

3.09 CABLE - MEDIUM-VOLTAGE

- A. The cable installation, including splices and terminations, shall be completed before testing. Cable shall be tested as a separate entity, that is, disconnected from all transformers, switchgear, etc.
- B. The following test voltages should be used.

DC FIELD TEST VOLTAGES

Non-Shielded Cables or Shielded Cables

(Refer to IEEE Standard 400 dated 1980 or latest edition for testing details)

DC Field Test Voltages (kV - Conductor to Ground)

RATED VOLTAGE kV RMS (PHASE-TO-PHASE)	SYSTEM BIL kV (PEAK)	NEW INSTALLATIONS ANY LOCATION DC TEST VOLTAGES
0.6		10
2.0		20
2.5	60	25
5.0	75	35
8.0	95	40
15.0	110	55
25.0	150	80
35.0	200	100
46.0	250	120
69.0	350	170
84.0	425	200
115.0	550	226
138.0	650	240

- C. This test is basically a go no-go type test. The test voltage shall be applied in a few steps, selecting a uniform step level to reach final voltage. For example, a test on 5 kV cable might be applied in 3 kV steps; a 15 kV cable test might have the voltage applied in 5 kV steps. After reaching each step level, the voltage is held for one (1) minute and then the apparent leakage current is recorded. Upon reaching the final level, the voltage is held for fifteen (15) minutes with leakage current readings taken at fifteen (15) second intervals up to one (1) minute and at two (2), three (3), four (4), five (5), six (6), nine (9), twelve (12) and fifteen (15) minutes.
- D. At the end of the test duration, the applied voltage should be removed and the residual voltage on the cable reduced to one-fourth (1/4) of the full value before solid grounding of the cable under test. The residual voltage can be allowed to "bleed off" back through the test set or through a resistor (high voltage type of at least one (1) megohm resistance). The cable should be left solidly grounded after the test for a period at least as long as the test duration.

- E. Caution: When testing non-shielded cables, ground any metallic objects in the vicinity to the cable being tested to prevent voltage pick-up. REFER TO IEEE Standard 400 (latest revision) for further cautions.
- F. A constant voltage power source must be used during the direct-current testing period.
- G. Test Procedure:
 - 1. Set up test equipment. Do not connect test lead to cables but temporarily hang the lead free with a plastic bag or bottle over the clip. Raise the voltage to the same final level at which the cables are going to be tested. The leakage current seen on the direct-current meter is leakage in the test lead and should be subtracted from the readings taken later during the cable test. Shut the set off and discharge the lead.
 - 2. Apply the test voltage to each phase separately, making sure that all other phases, all cable shields, any armoring or neutral conductors, and other nearby metallic objects are grounded to prevent voltage pickup.
 - 3. Raise the voltage to each increment level, recording the leakage current value after a one (1) minute wait at each level. Upon reaching the final level, record the leakage current values at one (1) minute intervals. These final level values should remain fairly constant or drop off slightly. A continuously rising current at any voltage level indicates an imminent failure.
 - 4. Upon completion of a successful test, shut down the test set and allow the voltage to decay to one-fourth (1/4) the full value. Record the decay time.
 - 5. Solidly ground the conductor and allow the ground to remain in place for a period at least as long as the test time.
 - 6. Repeat the same test sequence for each phase cable.

- H. Test Results
 - 1. Assuming proper precautions have been taken to eliminate "end corona", the leakage currents and the voltage decay times should be similar for the individual phases of the same cable circuit. Also, a graphic plot of the current versus voltage values of the step-rise test should show a reasonably straight line (equal increments of current rise for equal increments of voltage increases), the current readings always being taken after the same duration of time (one (1) minute) after reaching each voltage.
 - 2. If test results do not conform to the above, consult the Owner's Representative immediately.

3.10 UNIT SUBSTATION (UP TO 34.5KV)

- A. Inspect all connections (mechanical and electrical), parts and arrangement of the Unit Substation (Primary Switch or Terminal Compartment, Transformer and Low-Voltage Switchgear or Fused Switches) to ensure installation conforms to the manufacturer's recommendations.
- B. Check adjustment and characteristics of all control protective relays, fuses, etc. in accordance with manufacturer's instructions. Verify proper fuse size. Relay calibration is required.
- C. Verify wiring of all CT's and PT's is correct.
- D. Inspect for any insulator, surge arrester and other component damage during shipment and installation.
- E. The transformer shall be checked for proper tap setting and for correct functional operation of all auxiliary devices such as liquid level indicator, temperature indicator and alarm contacts, pressure relief and sudden-pressure relays, etc. and fans. Verify proper liquid level based on existing ambient temperature prior to energizing. Transformer insulating liquid shall be tested per manufacturer's recommendations. Megger test high and low-voltage windings phase to phase and phase to ground. Verify proper turns ratio for all taps.
- F. Inspect transformer cooling fans and controls for proper operation.

- G. Low-voltage bus conductors shall be checked with a 600 volt megger, each phase to ground with the other bus conductors grounded, before feeders are connected. A minimum value of one hundred (100) megohms maintained for five (5) minutes is required.
- H. Manually and/or electrically test all switches and/or disconnect switches for proper mechanical performance including draw-out mechanism as per manufacturer's instructions.
- I. Check ground bus and ground connections and ground resistance per above Switchgear Section of the Specification.
- J. Calibrate all metering per manufacturer's instructions. Verify all PT and CT ratios for agreement with associated metering, relays, etc.
- K. Clean all insulators and bushings.
- L. If outdoor enclosure(s) exist, verify proper operation of lighting, air conditioning, outlets, door hardware, air filters in place and waterproof integrity.
- M. Verify all space heater(s) and related circuitry are functioning properly.

3.11 SWITCHBOARDS - LOW-VOLTAGE

- A. Visual and Mechanical Inspection:
 - 1. Inspect for physical damage, proper alignment, anchorage and grounding.
 - 2. Check tightness of accessible bolted bus joints using a calibrated torque wrench method. Refer to manufacturer's recommendations.
 - 3. All doors, panels, etc. shall be inspected for paint, dents, scratches and fit.
 - 4. Key interlock systems shall be physically tested to insure proper function.
 - 5. Clean all insulators and bushings.
 - 6. If an outdoor enclosure exists, verify proper operation of lighting, air conditioning, outlets, door hardware, air filters in place and waterproof integrity.
 - 7. Verify all space heater(s) and related circuitry are functioning properly.
- B. Electrical Tests:
 - 1. Clean and check all breakers, check all connections.
 - 2. Rack out breakers where applicable and verify that they cannot be restored to operating position with contacts closed.
 - 3. Remove arc chutes and check for broken porcelain and Bakelite.
 - 4. Open and close breaker manually at least three (3) times to check for friction and binding.
 - 5. Check contacts for alignment, mating and pressure.
 - 6. Check trip bar travel to insure position tripping and contact resistance (micro-ohms).
 - 7. Megger test all breakers and bus work (megohms) phase to phase and phase to ground for one (1) minute. Test voltage as per manufacturer's recommendations. Adjust trip units in accordance with Owner's direction.
 - 8. Test trip all breakers for each band of operation.
 - 9. Adjust and test other protective relays as per Owner's direction.
 - 10. Verify current transformers polarity.
 - 11. Calibrate all metering per manufacturer's instructions. Verify all PT and CT ratios for agreement with associated metering, relays, etc.

3.12 MOTOR CONTROL CENTERS (NOT USED)

3.13 ROTATING MACHINERY (NOT USED)

3.14 TRANSFORMERS – LIQUID-FILLED

A. Visual and Mechanical Inspection

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect physical and mechanical condition.
3. Verify removal of any shipping bracing after final placement.
4. Inspect impact recorder prior to unloading, if applicable.
5. Verify settings and operation of all temperature devices, if applicable.
6. Verify that cooling fans and pumps operate correctly, and that fan and pump motors have correct overcurrent protection, if applicable.
7. Verify operation of all alarm, control and trip circuits from temperature and level indicators, pressure relief device, and fault pressure relay, if applicable.
8. Inspect all bolted electrical connections for high resistance using one of the following methods:
 - Use of low-resistance ohmmeter in accordance with Section 7.2.2.2 (Electrical Tests).
 - Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or Table 10.12.
 - Perform thermographic survey in accordance with Section 9.
9. Verify correct liquid level in all tanks and bushings.
10. Verify that positive pressure is maintained on nitrogen-blanketed transformers.
11. Perform specific inspections and mechanical tests as recommended by manufacturer.
12. Verify correct equipment grounding.
13. Verify the presence of transformer surge arrestors.

B. Electrical Tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter.
2. Perform insulation-resistance tests, winding-to-winding and each winding-to-ground in accordance with:

Transformer Insulation-Resistance

Acceptance Test Voltage and Minimum Results

Transformer Insulation Resistance Test Voltages	
Transformer Winding Rated Voltage	Minimum DC Test Voltage
0-600	1000
601-5000	2500
>5000	5000

Recommended Minimum Transformer Insulation Resistance Results:

In the absence of consensus standards for minimum acceptable transformer insulation resistance, the NETA Standards Review Council recommends the use of the following formula. Although the origin of this formula is not identified, NETA recognizes its wide use in the electrical testing industry.

$$IR = \frac{CE}{\sqrt{kVA}}$$

IR = Minimum recommended one minute insulation resistance

C = Constant

E = Phase-to-phase voltage for delta connected windings; phase-to-neutral voltage for star connected windings.

KVA = Rated kVA of transformer.

Values of C @20°C for 60 Hz transformers

Oil-filled C = 1.5

Dry-type C = 30

3. Calculate polarization index.
4. Perform turns-ratio tests at all tap positions.
5. Test load tap-changer if applicable.
6. Perform insulation power-factor/dissipation-factor tests on windings in accordance with test equipment manufacturer's published data.
7. Perform power-factor/dissipation-factor tests or hot collar watts-loss tests on bushings in accordance with test equipment manufacturer's published data.
8. Perform excitation-current tests in accordance with test equipment manufacturer's published data.
9. Measure resistance of each high-voltage winding in each no-load tap-changer position. Measure resistance of each low-voltage winding in each load tap-changer position, if applicable.
10. If core ground strap is accessible, measure core insulation resistance at 500 volts dc.
11. Measure the percentage of oxygen in the nitrogen gas blanket, if applicable.
12. Remove a sample of insulating liquid in accordance with ASTM D-923. Sample shall be tested for the following:
 - Dielectric breakdown voltage: ASTM D-877 and/or ASTM D-1816.
 - Acid neutralization number: ANSI/ASTM D-974.
 - Specific gravity: ANSI/ASTM D-1298.
 - Interfacial tension: ANSI/ASTM D-971 or ANSI/ASTM D-2285.
 - Color: ANSI/ASTM D-1500.
 - Visual Condition: ASTM D-1524.
 - Measure dissipation factor or power factor in accordance with ASTM D-924.
13. Remove a sample of insulating liquid in accordance with ASTM D3613 and perform dissolved gas analysis (DGA) in accordance with ANSI/IEEE C57.104 or ASTM D-3612.
14. Perform tests on all instrument transformers in accordance with Section 3.05.

C. Test Values

1. Compare bolted connection resistance to values of similar connections.
2. Bolt-torque levels should be in accordance with manufacturer specified values.
3. Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from similar connections by more than 50 percent of the lowest value.
4. Insulation-resistance test values at one minute should not be less than the values calculated in accordance with the formula in Transformer Insulation-Resistance Table. Results shall be temperature corrected in accordance with Conversion Factor Table.

Insulation Resistance
Conversion Factors

For Conversion of Test
Temperature to 20°

<u>TEMPERATURE</u>		<u>MULTIPLIER</u>	
°C	°F	Apparatus Containing Immersed Oil Insulations	Apparatus Containing Solid Insulations
0	32	0.25	0.40
5	41	0.36	0.45
10	50	0.50	0.50
15	59	0.75	0.75
20	68	1.00	1.00
25	77	1.40	1.30
30	86	1.98	1.60
35	95	2.80	2.05
40	104	3.95	2.50
45	113	5.60	3.25
50	122	7.85	4.00
55	131	11.20	5.20
60	140	15.85	6.40
65	149	22.40	8.70
70	158	31.75	10.00
75	167	44.70	13.00
80	176	63.50	16.00

5. The polarization index shall be greater than 1.0 and shall be recorded for future reference.
6. Turns-ratio test results shall not deviate more than one-half percent from either the adjacent coils or the calculated ratio.
7. Maximum power factor of liquid-filled transformers shall be in accordance with manufacturer's published data.
8. Investigate bushing power factors and capacitances that vary from nameplate values by more than ten percent. Investigate any bushing hot collar watts-loss results that exceed the test equipment manufacturer's published data.

9. Typical excitation-current test data pattern for three-legged core transformer is two similar current readings and one lower current reading.
10. Winding-resistance test results, after factoring in temperature correction, should compare within one percent of factory obtained results except in instances of extremely low resistance values.
11. Consult manufacturer if core insulation is less than one megohm at 500 volts dc.
12. Investigate presence of oxygen in the gas nitrogen blanket.
13. Insulating liquid test results shall be in accordance with:

Test Limits for New Insulating Oil Received in New Equipment

MINERAL OIL ¹		
TEST	ASTM METHOD	69 KV AND BELOW
Dielectric breakdown, kV minimum	D877	30
Dielectric breakdown, kV minimum @0.04" gap	D1816	20
Dielectric breakdown, kV minimum @0.08" gap	D1816	40
Interfacial tension MN/m minimum	D971	35
Neutralization number, mg KOH/g maximum	D974	0.03
Water content, ppm maximum	D1533	25
Power factor at 25°C, %	D924	0.15
Power factor at 100°C, %	D924	1.50
Color	D1500	1.0
Visual condition	D1524	Bright & Clear

¹IEEE C57, 106-1991 (Guide for Acceptance and Maintenance of Insulating Oil in Equipment), Tables 1, 2 and 3.

14. Evaluate results of dissolved-gas analysis in accordance with ANSI/IEE Standard C57.104. Use results as baseline for future tests.

END OF SECTION
260800.20

TAB 4 – PURCHASE SPEC

**SECTION 261200
LIQUID FILLED SUBSTATION TRANSFORMERS**

1.0 SCOPE

- 1.1** Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for medium voltage liquid filled substation transformers (also identified as MV XFMR, XFMR) as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- 1.2** This specification covers the requirements for one (1) new liquid-immersed transformer to be installed for the following facility:

***New Jersey Sports & Exposition Authority
East Rutherford, NJ 07073
Main Engineering and Facility Office***

- 1.3** Utility is PSE&G 26.4kV 3-wire resistive grounded system.

- 1.4** The specific electrical requirement parameters are:

KVA: @55° OA	10,000	@65° OA	12,500
@55° FA	11,200	@65° FA	14,000
Primary voltage connection:	26,400 Volts	DELTA connected.	
Secondary voltage connection:	13,800 Volts	WYE connected.	
Secondary Grounding Connection:	Solid		
Phase:	3 Phase		
Frequency	60 Hz		
BIL (Primary):	200 kV		
BIL (Secondary):	95 kV		
Tap changer:	no load tap changer (2) 2-1/2 +/-		
Impedance:	6.10% (match existing +/-)		

- 1.5** The new transformer shall replace an existing Westinghouse 10MVA transformer (refer to Section 13 Reference for existing site pictures and phasing). The new transformer shall be designed to be mounted on the existing concrete pad and reutilize the existing secondary conduit and 120VAC fan circuit stub ups.
- 1.6** The acceptable manufacturers are as follows (No Equal):

SQUARE D/SCHNEIDER ELECTRIC
VIRGINIA TRANSFORMER
NIAGARA TRANSFORMERS
ABB/HITACHI
EATON
GE

2.0 REFERENCES

- 2.1** The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The

edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

2.2 Unless otherwise specified, the design, fabrication, testing and performance of the transformers and associated neutral grounding resistors shall be in accordance with the applicable section of the latest edition of the following standards and codes:

2.2.1 American National Standards Institute (ANSI) and Institute of Electrical and Electronics Engineers

2.2.2 American Society for Testing and Materials ASTM D877, "Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes"

2.2.3 Institute of Electrical and Electronics Engineers, Inc. (IEEE)

- a. IEEE C57.12.00, "Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers."
- b. IEEE C57.12.01, "Standard for General Requirements for Dry Type Distribution and Power Transformers"
- c. IEEE C57.12.10, "Standard Requirements for Liquid-Immersed Power Transformers"
- d. IEEE C57.12.36, "Standard Requirements for Liquid Immersed Distribution Substation Transformers"
- e. IEEE C57.12.70, "Terminal Markings and Connections for Distribution and Power Transformers"
- f. IEEE C57.12.80, "Standard Terminology for Power and Distribution Transformers"
- g. IEEE C57.12.90, "Standard Test Code for Liquid-Immersed Distribution Power and Regulating Transformers."
- h. IEEE C57.13, "Requirements for Instrument Transformers"
- i. IEEE32 Standard Requirements, Terminology, and Test Procedure for Neutral Grounding Devices.
- j. IEEE48 Standard Test Procedures and Requirements for High Voltage Alternating-Current Cable Terminations.
- k. UL 1561, "Standard for Dry-Type General Purpose and Power Transformers".
- l. USA Federal Regulations, Policies and Acts Energy Policy and Conservation Act 1975 & Energy Policy Act 2005.
- m. 10 CFR 429 - Certification, Compliance, and Enforcement for Consumer Products and Commercial and Industrial Equipment.
- n. 10 CFR 431 – Energy Efficient Program for Certain Commercial and Industrial Equipment.

2.2.4 National Electrical Manufacturers Association (NEMA)

A. ICS6 Enclosures for Industrial Control and Systems

2.2.5 National Fire Protection Association (NFPA)

- A.** National Electrical Code (NEC), 2020 or latest approved code accepted by client and local authority.

2.3 For the purpose of this Specification, the word "should" shall be replaced with the word "shall" wherever it appears in the above referenced standards.

2.4 Any conflicts between the referenced documents shall be identified to Faust Consulting Engineers in writing for resolution. In general, when resolving conflicts, the following order of precedence shall apply:

1. Purchase order
2. This specification
3. Referenced standards.

3.0 DOCUMENTATION

3.1 Vendor shall furnish all drawings and other documents as indicated herein. In addition, all final drawings shall be provided in electronic format compatible with AutoCad computer aided drafting system.

3.2 The following information shall be submitted to the Engineer:

1. Master drawing index
2. Front view elevation and weight, as well as all dimensional data.
3. Plan view
4. Schematic diagrams
5. Nameplate diagram
6. Component list
7. Conduit entry/exit locations
8. Ratings including:
 - a. kVA
 - b. Primary and secondary voltage
 - c. Taps
 - d. Primary and secondary continuous current
 - e. Basic Impulse Level
 - f. Impedance
 - g. Insulation class and temperature rise
 - h. Sound level
9. Cable terminal sizes
10. Product data sheets.
11. Primary and secondary cable connection details, secondary air terminal chamber (ATC) assemblies and junction boxes.
12. Transformer top mounted Lightning arrestors suitable for resistance grounded 26.4kV PSE&G grid.

3.3 Manufacturer's Proposal:

3.3.1 The information submitted with the bid shall include, but not be limited to, the following items:

- a. Complete drawings indicating dimensional data (main tank, cooling fins, etc.), configuration, physical layout, cable/bus connection details, stub up locations, air terminal chambers, etc.
- b. Oil type: ~~mineral if containment is installed or~~ environmentally friendly (no existing containment).
- c. Qualifications.
- d. Delivery date.
- e. Shipping method.
- f. Physical dimensions and weight of all items to be shipped. Verify that all items can be delivered to the point of service and indicate what reassembly, if any, shall be required.
- g. The transformer equipment is optimum and recommended minimum environmental operating conditions. Provide heat of rejection for all equipment provided under this Contract at full load conditions.
- h. Affirmation that all equipment proposed has been used in successful operation for a period of not less than 5 years. Provide a list of comparable installations.
- i. Bidders shall provide a Compliance Review by adding the following notations:
 - “C”: Comply with no exceptions.
 - “D”: Comply with deviations. For each deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the specification can be satisfied.
 - “E”: Exception, do not comply. For each exception, provide a numbered footnote with reasons and possible alternatives.
- j. Unless a deviation or exception is specifically noted in the Compliance Review, it is assumed that the Bidder is in complete compliance with the plans and specifications. Deviations or exceptions taken in cover letters, subsidiary documents, by omission, or by contradictions do not release the Bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review.

3.3.2 Provide the following information on service and maintenance:

- a. Locations of factory authorized service capability, number of full-time factory trained personnel at each location, specific experience on the equipment, and skill levels.
- b. Location and response time of local service organization providing primary service to the facility. Include listing of spare parts that are stocked at the local service location.

- c. Escalation procedures if problems fail to be resolved. Include name, title, telephone number and address of the responsible parties.
- d. Recommended preventive maintenance tasks and intervals.
- e. Price list of a complete list of spare parts, noting which spare parts are recommended, that the Owner should maintain on site to ensure minimum downtime for repair. Include spare parts for all equipment being furnished under these specifications.

3.4 Submittals for Construction

3.4.1 After receipt of Contract or specific direction from the Owner, prepare and submit for review, detailed shop drawings for the equipment furnished under this specification. In case of question, the Owner shall be the final judge as to the requirement for shop drawings for specific areas of work. All submittals shall be complete and shall contain detailed information for all components of the system, and the necessary wiring diagrams and/or interconnecting cable schematics for connection of this equipment. The shop drawings shall include, but not be limited to, the following:

- a. Installation drawings of transformer including front elevation, rear elevation, bus phasing, instruments, switches, nameplates, bill of material, cable identification and location, all dimensional data, weights, shipping splits and arrangements of all equipment components.
- b. Floor mounting plan showing materials, sizes, anchoring, location and quantity of power and control wiring and conduit and cable entries.
- c. Handling, installation, and assembly drawings.
- d. Sample maintenance manuals and documentation to be supplied.

3.4.2 The review of any submitted data or shop drawings for material, equipment apparatus, devices, arrangements and/or layout shall not relieve the manufacturers from the responsibility of furnishing same of proper dimensions and weight, capacities, sizes, quantity, quality, and installation details to efficiently perform the requirements and intent of the Contract. The review shall not relieve the manufacturer from responsibility for errors of any sort on the submitted data or shop drawings.

3.4.3 After final review of the shop drawings, the manufacturer shall furnish PDF copies of the same drawings corrected to include all comments developed in the review. In addition, this manufacturer shall assist the Contractor and his Subcontractor.

3.4.4 PDF copies of operation and maintenance instructions and manuals, covering completely the operation and maintenance of the equipment furnished under this specification, shall be submitted to the Owner. PDF copy of recommended parts lists and "as-built" drawings which shall incorporate all of the coordination items shall be furnished to the Owner. Maintenance manuals shall outline all necessary periodic functions required and shall include a recommended system for keeping logs and records. Include trouble-shooting charts, schematics of all assemblies and wiring

diagrams, in sufficient detail and clarity to enable the Owner's technicians to understand, operate, and maintain the system.

3.4.5 The following information shall be submitted for record purposes:

- a. Final as-built drawings and information for items listed herein.
- b. Wiring diagrams.
- c. Certified production test reports.
- d. Installation information.
- e. Seismic certification.
- f. Qty of oil (gallons)
- g. Total Weight (lbs) with and without oil

3.4.6 The final (As-Built) drawings shall include the same drawings as the construction drawings and shall incorporate all changes made during the manufacturing process.

4.0 SITE CONDITIONS

- 4.1** Location: existing outdoor substation, non-hazardous area.
- 4.2** Existing concrete pad and conduit stub ups to be re-utilized.
- 4.3** Design ambient temperature: 30°C average, 40°C maximum
- 4.4** Altitude: Less than 100 feet above sea level
- 4.5** Earthquake Zone: 2 (UBC of the USA)

5.0 GENERAL

- 5.1** The transformer(s) shall be UL listed and labeled substation type per UL1561 with top cover mounted cable connected primary terminations and sidewall mounted secondary terminations.
- 5.2** Transformers shall comply with 10 CFR 431 as registered on US Department of Energy's Compliance Certification Database per 10 CFR 429.
- 5.3** The transformer shall carry its continuous rating with average winding temperature rise by resistance that shall not exceed 55 degrees C, based on average ambient of 30 degrees C over 24 hours with a maximum of 40 degrees C. The insulation system shall allow an additional 12% kVA output at 65 degrees C average winding temperature rise by resistance, on a continuous basis, without any decrease in normal transformer life. One (1) stage of forced air cooling shall be provided.
- 5.4** Transformers shall be 3-phase, 60 Hertz, **FR3** (or approved equal) liquid-filled with voltage and winding configuration as specified. PCB or any derivatives of PCB are not allowed as a cooling medium. Transformer impedance shall be based on its lowest self-cooled (OA) rating and mid-tap voltage ratio at ambient temperature specified. Transformers shall be designed for outdoor installation on a concrete foundation. All transformer windings, connection and terminals shall be of copper.

- 5.5** The transformer shall be designed and constructed to be completely self protected by its ability to withstand external short-circuits, as defined by ANSI C57. 12.00.
- 5.6** The transformer and auxiliary cooling equipment shall be designed and constructed to minimize the audible noise generated with the transformer energized at rated voltage and with all auxiliary cooling equipment in operation. The acceptable noise level shall be in accordance with the latest NEMA standard TR 1. The measurement procedure shall be as specified in ANSI C57.12.90.
- 5.7 Windings**
 - 5.7.1** The transformer winding configuration shall be ANSI Standard Delta-Wye (Dyn-1) with the high voltage vector leading the low voltage vector by 30 degrees. Transformer winding connections and angular vector differences between primary and secondary voltages shall be approved by Faust Consulting Engineers, Inc.
 - 5.7.2** Transformer primary and secondary windings shall not be electrically interconnected. Secondary Wye-connected windings shall be provided with a fully insulated neutral bushing with a removable ground strap.
 - 5.7.3** The windings shall be made of copper. The main transformer core and coil shall be circular type construction. The main transformer high voltage and low voltage coils shall be of disc for helical type construction. Thermally upgraded paper shall be used on high and low voltage windings. The core shall be clamped and braced to resist distortion caused by short-circuit stresses within rating or transportation handling and to prevent the shifting of core laminations.
 - 5.7.4** The core shall be constructed of high-grade, grain oriented, silicon steel laminations, with high magnetic permeability. Core construction shall include step-lap mitered joints to keep core losses, excitation current and noise level at a minimum.
- 5.8 Base**
 - 5.8.1** The transformer base shall be constructed of structural shapes and/or plates to form a rigid skid on which the transformer can be slid or rolled on main center line axis.
 - 5.8.2** Base shall have points designed to provide ventilation to the bottom of the transformer tank.
 - 5.8.3** Base shall be of sufficient strength to allow the transformer to be lifted using its lifting lugs without damage.
- 5.9 Tank**
 - 5.9.1** Transformer shall feature sealed-tank construction.
 - 5.9.2** The transformer tank, cooling equipment and compartments subject to pressures shall be designed to withstand, without permanent deformation, pressures of at least twenty-five percent greater than maximum operating

pressures. The maximum design withstand pressure shall be indicated on the nameplate.

- 5.9.3** Tank design shall include sufficient expansion volume to allow operation under specified load conditions.

5.10 Primary Connection

- 5.10.1** The incoming primary shall be overhead and connected via EPR shielded copper cable terminations to manufacturer installed bushings mounted on top of the transformer. All terminals shall be copper. (see pictures of existing in appendix).
- 5.10.2** The manufacture shall also provide lightning arrestors mounted on the top of the transformer. Lightning arrestors shall be station class 36kV type suitable for a 26.4kV utility system that is resistive grounded at the upstream utility substation and the 200kV BIL rated transformer specified herein.
- 5.10.3** Refer to Appendix for photos of existing installation.

5.11 Secondary Compartment

- 5.11.1** Secondary terminals shall be copper and brought out into a secondary air terminal chamber. The air terminal chamber shall align with the existing 4" secondary RGS conduits (refer to Appendix for photos of existing installation).
- 5.11.2** The transformer secondary throat connection shall be provided with a raised flange to mate with the secondary air terminal chamber.
- 5.11.3** The air terminal chamber shall be NEMA 4X design and shall be equipped with a bolted cover equipped with two (2) metal handles for ease of removal.
- 5.11.4** Copper lugs shall be provided on the neutral bushing terminal for customer's connection.
- 5.11.5** Secondary chamber shall have a separate set of insulators below the transformer secondary terminal for termination of the incoming dual set of 3-500kCMil cables. A removable copper link shall be supplied between each cable terminating insulator and transformer secondary terminal above it to allow isolation of secondary cables for testing purposes. The cable terminating insulator shall be equipped to accept customer cables as specified and temporary ground cable for cable testing purposes. Vendor shall also provide a grounding terminal within chamber for cable testing purposes.
- 5.11.6** The secondary cables shall enter the chamber from the bottom (unless otherwise specified). A cut-out at the bottom shall be provided with a gasketed cover plate which shall be field drilled for incoming cables. A clearance of approximately 30 inches shall be provided for stress cones (when required) and cable seals. Cable supports and a ground bus shall be provided.
- 5.11.7** For transformers with a secondary winding voltage above 600-volts, the secondary neutral shall be brought out on the side of the transformer tank using an insulating bushing. A bushing current transformer shall be installed

on the neutral bushing inside the tank and shall be accessible without removing the tank cover. The ratio of the current transformer (CT) shall be as specified on the data sheet.

6.0 TRANSFORMER ACCESSORIES

6.1 In addition to the standard accessories listed in ANSI C57.12.10, the following accessories shall be included with all power and distribution transformers:

- 6.1.1** An externally operated no-load tap changer with two (2) 2-1/2 percent full-capacity taps above and two (2) 2-1/2 percent full-capacity taps below rated primary voltage shall be provided. Tap Changer shall have provisions for padlocking. The tap changer operating mechanism shall be located on the side of the transformer, accessible, and near the transformer data plate.
- 6.1.2** A sudden pressure relay (Device 63) and an auxiliary device 63X including resistors shall be provided. All relays shall be capable of being operated on either 120VAC or 125-volt DC supply. Liquid temperature thermometer (Device 26), winding temperature (Device 49) and liquid level indicator (Device 71) shall be provided with normally open and normally closed alarm contacts. All relays including the 63X relay and resistors shall be included and prewired in a stainless steel NEMA 4X junction box mounted on the transformer in the same general location as the existing (right side if facing secondary air terminal chamber). All relay output alarms, and shutdown/trip contacts shall be provided and pre-wired to terminal blocks.
- 6.1.3** Transformers shall be provided with a dial type thermometer with two (2) hands; one (1) to show the temperature at time of reading, and the other to show the maximum temperature reached since the last resetting. When forced air cooling or future forced cooling is specified, the thermometer shall be provided with two (2) switches to operate forced cooling fans at 55°C and one (1) alarm circuit at 60°C (Device 26). Thermometer shall have a normally closed hermetically sealed alarm contact calibrated to open when the maximum self-cooling rate is reached.
- 6.1.4** A globe-type upper filter valve shall be provided. The upper filter valve shall have the same flange size connections as the drain valve.
- 6.1.5** The transformer shall be fitted with cooling fans to obtain the full fan cooled rating to 14MVA or as specified herein. The fan protective and control equipment shall be installed in a separate NEMA 4X stainless steel terminal box mounted on the transformer tank. The fans shall be automatically operated through the contacts of a temperature relay(s) (Device 26) and shall also be operable manually. The fan motors shall be totally enclosed fan cooled design and shall be rated at 120-volt, single-phase, 60 Hertz. Fans shall be mounted on separate mounting brackets, and not directly to the cooling fins. Fans shall be Krenz with stainless steel construction and hardware mounting, no equals. Power for the cooling fan motors shall be supplied by Owner.
- 6.1.6** Radiators shall be welded to tank.
- 6.1.7** Pressure relief device(s) with indication shall be provided.

- 6.1.8** Pressure-vacuum gage and bleeder device (sealed-tank construction) shall be provided.
- 6.1.9** Cooling fans (FFA) shall include the temperature control device with two (2) contacts, (one for alarm and one for fan control rated for the fan load), mounting space and brackets for fans, and mounting space and brackets for the control cabinet.
- 6.1.10** All the control, signal, and alarm wires from every device on the transformer shall be connected to a NEMA 4X stainless steel junction box mounted on the side of the transformer. The box shall be provided with a minimum of four (4) 2-inch plugged conduit hubs. All control wires shall be connected to terminals and properly tagged with sleeve type wire markers. Wire terminals shall be ring tongue type.
- 6.1.11** All secondary leads of each specified CT (where applicable) shall be run in rigid metal conduit to a separate NEMA 4X stainless steel terminal box. The leads for each CT shall be crimped in self-insulated compression ring-type lugs and terminated to adjacent terminals of a shorting screw-type terminal block. The terminal blocks shall be clearly marked designating the CT phase and tap number in accordance with referenced standards. All wires shall be connected to terminals and properly tagged with sleeve type wire markers.
- 6.1.12** All CT's, where applicable, shall have relaying and metering accuracy for all required relays. All CT secondaries shall terminate into a shorting terminal block. The primary shall be equipped with 400/5 bushing mounted CT's for existing remote analog metering.
- 6.1.13** All current carrying components of the terminal blocks shall be nickel plated copper.
- 6.1.14** CT lead wire shall be No. 10 AWG copper minimum, cooling fan power wiring shall be No. 12 AWG copper minimum, and alarm and cooling fan control wiring shall be No. 14 AWG copper minimum.
- 6.1.15** All control, signal and alarm wiring shall be run in rigid metal conduit, (with short runs of flexible metal conduit to the sensors), to the NEMA 4X stainless steel terminal box.
- 6.1.16** Lifting eyes for removing cover shall be provided.
- 6.1.17** Facilities for lifting core and coil assembly from the tank shall be provided.
- 6.1.18** Facilities for lifting, moving, and jacking complete transformer shall be provided.
- 6.1.19** Minimum two stainless steel ground pads shall be provided on diagonal corners of transformer base with standard NEMA 2-hole pattern.

7.0 NAMEPLATES

- 7.1** In addition to the ANSI standard stainless-steel nameplate the transformer shall be provided with a 6" x 3" laminated plastic nameplate showing customer's equipment tag number (T 2) secured to the secondary air terminal chamber cover with stainless steel fasteners.
- 7.2** Nameplates with engraved letters shall be installed to designate the purpose of all circuits, instruments, meters, relays, switches, fuses, breakers, terminal strips, indicating lights, compartments, etc. Nameplates shall be manufactured from laminated plastic with white letters on a black background.
- 7.2.1** Lettering height shall be as follows:
- A.** ¼ inch minimum for miscellaneous items.
 - B.** 5/16 inch for main titles such as circuit or cubicle designation, motor or feeder number and service title.
 - C.** ½ inch for equipment designation.
- 7.2.2** Nameplates shall be mounted with stainless steel screws.
- 7.2.3** Neutral grounding resistor, when specified, shall be provided with stainless steel nameplates showing rated amps, watts, and resistance values.

8.0 PAINTING

- 8.1** Tank, radiators, and terminal chambers, if provided, shall be treated to remove oil and scale by either shot blast or phosphatizing treatment to provide proper paint adhesion. All exterior surfaces shall be primed, using a high quality solid two-paint catalyzed epoxy. Minimum dry film thickness shall be 2 mils. A durably hard polyurethane topcoat with a minimum dry film thickness of 1 mil shall be applied to all primed surfaces. The color of the finish coat shall be ANSI 61.
- 8.2** The base of the transformer, inside and outside of the primary terminal chambers, and the outside of the transformer tank up to a height of 10 inches shall be provided with heavy tar-based protective coating.

9.0 INSPECTION AND TESTING

- 9.1** The following standard factory tests shall be performed on all equipment provided under this section. Testing shall be done in accordance with IEEE C57.12.91 and shall include, as the minimum, the following tests summarized below:
- a. Ratio
 - b. Polarity
 - c. Phase Rotation
 - d. No-Load Loss
 - e. Excitation Current
 - f. Impedance Voltage
 - g. Load Loss
 - h. Applied Potential
 - i. Induced Potential
 - j. QC Impulse Test

- k. Temperature Test [Typical test data from previous testing may be used.]
- l. Sound Test [Typical test data from previous testing may be used.]

9.2 All tests shall be in accordance with the latest version of ANSI test code C57.12.90 and NEMA TR1 standards. In addition to ANSI standard routine tests, the following tests shall be performed on each transformer:

- 9.2.1** Transformer load loss test at operating conditions (no-load, half, and full load; OA rating), for each transformer in the order. No-load loss at rated voltage on the rated voltage connection.
- 9.2.2** Impedance and load loss at rated current on the rated voltage connection of each unit and on the tap extremes of one unit only of a given rating on this project.
- 9.2.3** All alarm contacts, sudden pressure sensors, current transformers, etc.
- 9.2.4** Applied potential test, Induced potential tests, exciting current at rated voltage on the rated voltage connection.
- 9.2.5** Ratio tests on the rated voltage connection and on all tap connections and polarity and phase-relation tests on the rated voltage connections.

9.3 A complete final test report for each transformer shall be provided, indicating all transformer losses and efficiencies under all operating conditions (no-load, half, and full load) including voltages and impedances.

9.4 The following special factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest revision of ANSI and NEMA standards.

- a. Temperature test(s) shall be made on all units. Tests shall not be required when there is available a record of a temperature test on an essentially duplicate unit. When a transformer is supplied with auxiliary cooling equipment to provide more than one rating, temperature tests as listed above shall be made on the lowest kVA OA or AA rating and the highest kVA FA rating.
- b. ANSI impulse test on all windings

9.5 The Vendor shall notify the customer two (2) weeks prior to factory tests being performed. The customer reserves the right to inspect the equipment and/or witness the tests at the factory.

9.6 The manufacturer shall provide three (3) certified copies of factory test reports.

10.0 PACKING, CRATING AND DELIVERY

10.1 After the satisfactory completion of the acceptance test at the factory, the equipment shall be suitably packed to prevent any damage in transit. Crates, where used, shall be of sufficient strength to prevent damage and shall be suitable for handling with a forklift truck or equipped with lifting eyes.

10.2 All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Equipment assemblies, materials, and equipment shall be listed and labeled by Underwriter's Laboratories or by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

- 10.3** The transformer shall be shipped by the manufacturer filled with insulating liquid under a nitrogen blanket, unless otherwise approved by the Owner's engineer.
- 10.4** Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents. Packing shall be labeled as to contents, to facilitate the unpacking and assembly sequence at the job site.
- 10.5** Crates containing critical electronic components shall include bags of desiccant to absorb moisture. Heavy gauge transparent plastic covers shall be used to protect all equipment from water damage during shipping and/or storage.
- 10.6** All finished painted surfaces and metal work shall be protected from the weather during shipment. The owner shall be advised 72 hours prior to delivery at site of any equipment. Staging of delivery to site shall be subject to Owner's approval. Spare parts shall be held at the factory until released by the Owner.
- 10.7** The date of delivery of the equipment or system(s) shall be included in the Bid. A progress chart shall be included in the Bid, indicating when the assembly is performed, factory testing, crating, and shipping is finalized, and the equipment is ready to be delivered for installation at the job site to demonstrate how the projected delivery date would be met. No less than two additional progress reports shall be submitted by the equipment manufacturer during the production phase to support the established delivery schedule.
- 10.8** Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

11.0 INSTALLATION

- 11.1** All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Equipment assemblies, materials, and equipment shall be listed and labeled by Underwriter's Laboratories or by a testing agency acceptable to authorities having jurisdiction and marked for intended use. The Owner's installation and testing Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.
- 11.2** All necessary hardware to secure and level the assembly in place shall be provided by the Contractor.
- 11.3** The equipment shall be installed and checked in accordance with the manufacturer's recommendations.
- 11.4** Installation of the equipment and any field installed devices shipped loose or separately shall be by the installing Contractor. in full accordance and under the technical supervision of qualified technicians provided by the manufacturer as part of this Contract. In addition, the manufacturer shall make available a qualified engineer for any site assistance. The assistance is intended to provide instruction to the installing Contractor as to the proper handling, installation and wiring of the vendor's equipment and field installed devices, as well as a review of the Contractor's questions

and installation methods during the installation of the equipment. Contact info shall be supplied by the manufacturer at time of delivery of unit to site.

- 11.5** Upon completion of the installation and prior to the site acceptance tests, the manufacturer shall provide certification to the Owner that the complete system(s) has been assembled and installed in full accordance with the requirements, recommendations, and complete satisfaction of the manufacturer. This certification shall not relieve the manufacturer from any of his obligations or responsibilities or guarantees for the successful and proper performance of the equipment or system(s).
- 11.6** All special tools needed for proper operation, adjustment and maintenance of equipment shall be delivered to the Owner with the unit.
- 11.7** All necessary hardware to secure the assembly in place shall be provided by the Contractor.
- 11.8** The contractor is responsible for the planning, approval process and execution of rigging and removing existing transformer T-1 from its current location and rigging the new transformer into the same location.
- 11.9** The existing transformers have been retro filled with non-PCB dielectric fluid; however, the contractor shall be responsible for the removal and handling of this fluid that may contain residual PCB's.
- 11.10** The contractor shall be responsible for developing a rigging plan for removal and installation of the transformers signed and sealed by a NJ PE that has five (5) years rigging experience.
- 11.11** The contractor is responsible for transporting the new and existing transformers to and from the site (including rigger's yard).
- 11.12** The contractor shall be responsible for the disposal of existing transformer and dielectric fluid in a responsible manner with documented proof of proper disposal to be submitted to the owner.
- 11.13** The contractor shall be responsible for any necessary changes to the foundation and/or grade beams.
- 11.14** The Contractor shall provide proof of proper disposal of existing transformer and insulating oil (if transformer is not to be remanufactured per add/alternate below).
- 11.15** ADD/ALTERNATE: See part 1, Section 1 – General Scope for details.

12.0 FIELD TESTING AND COMMISSIONING

- A. Functional testing, commissioning, and first parameter adjusting shall be carried out by a factory-trained manufacturer's field service representative. This manufacturer's field service technician shall provide all material, equipment, labor, and technical supervision to perform inspection, testing and adjustments to ensure equipment is installed, adjusted, and tested in accordance with the manufacturer's recommendations and is ready for operation. The manufacturer's field service technician shall replace damaged or malfunctioning equipment and report to the Engineer any discrepancies or issues with the installation.
- B. The manufacturer's representative shall, upon satisfactory completion of inspection and testing, attach a label to all serviced devices indicating the date serviced and testing company responsible.
- C. Operational Readiness Testing
 - 1. The Contractor shall inspect and test furnished equipment and associated systems for conformance to the contract documents, including equipment manufacture's recommendations, and readiness for operation. The test shall include the following as a minimum:
 - a. Visually inspect for physical damage and proper installation
 - b. Perform tests in accordance with manufacturer's instructions.
 - c. Perform tests to ensure compliance with Contract Documents
 - d. Perform tests that equipment is ready for operation.
 - e. Touch-up paint all chips and scratches with manufacturer-supplied paint and transfer remaining paint to Owner.
 - 2. Contractor shall submit an operational readiness test report documenting all test results, including all assumptions, conditions, allowances, and corrections made during the test. The report shall provide a listing of all modifications and adjustments made onsite to include any settings / parameters not identified as factory defaults within the equipment's O&M documentation. The test report shall include a signed statement from the Contractor, installer(s) and the factory-trained manufacturer's representative(s) certifying that the furnished equipment and associated system have been installed, configured, and tested in accordance with the manufacturer's recommendations, completely conforms to the requirements of the Contract Documents and is ready for operation.

13.0 WARRANTY

- 13.1 All equipment shall be new, of first-class material, and of a proven design, Workmanship shall be of the best quality, free from any defects that might render the equipment unsuitable or inefficient for the purpose for which it is to be used. The service person shall be capable of affecting all necessary repairs and restoring the system when necessary.
- 13.2 Equipment vendors shall provide a written sample of the equipment warranty in order to comply with this specification.
- 13.3 Although the guarantee shall be enforceable as provided, no requirement of this Contract with respect to guarantees by the manufacturer shall be deemed to be a

limitation upon any rights which the Owner would have, either expressed or implied, in the absence of such guarantees, the said guarantees being given only for the greater assurance of the Owner.

14.0 APPENDIX (EXISTING SITE PICTURES)



TRANSFORMER T1 – TO BE REPLACED (13.8KV SECONDARY)



**TRANSFORMER T1 – TO BE REPLACED (PRIMARY CONNECTION
WITH LIGHTNING ARRESTORS AND
400/5 BUSHING CT'S ON TOP)**

LIGHTNING ARRESTORS (BACK) AND PRIMARY BUSHINGS (FRONT)



**TRANSFORMER T1 PRIMARY BUSHINGS AND LIGHTNING ARRESTORS (PRIMARY
CONNECTION - TOP)
LIGHTNING ARRESTORS (BACK) AND PRIMARY BUSHINGS (FRONT)**



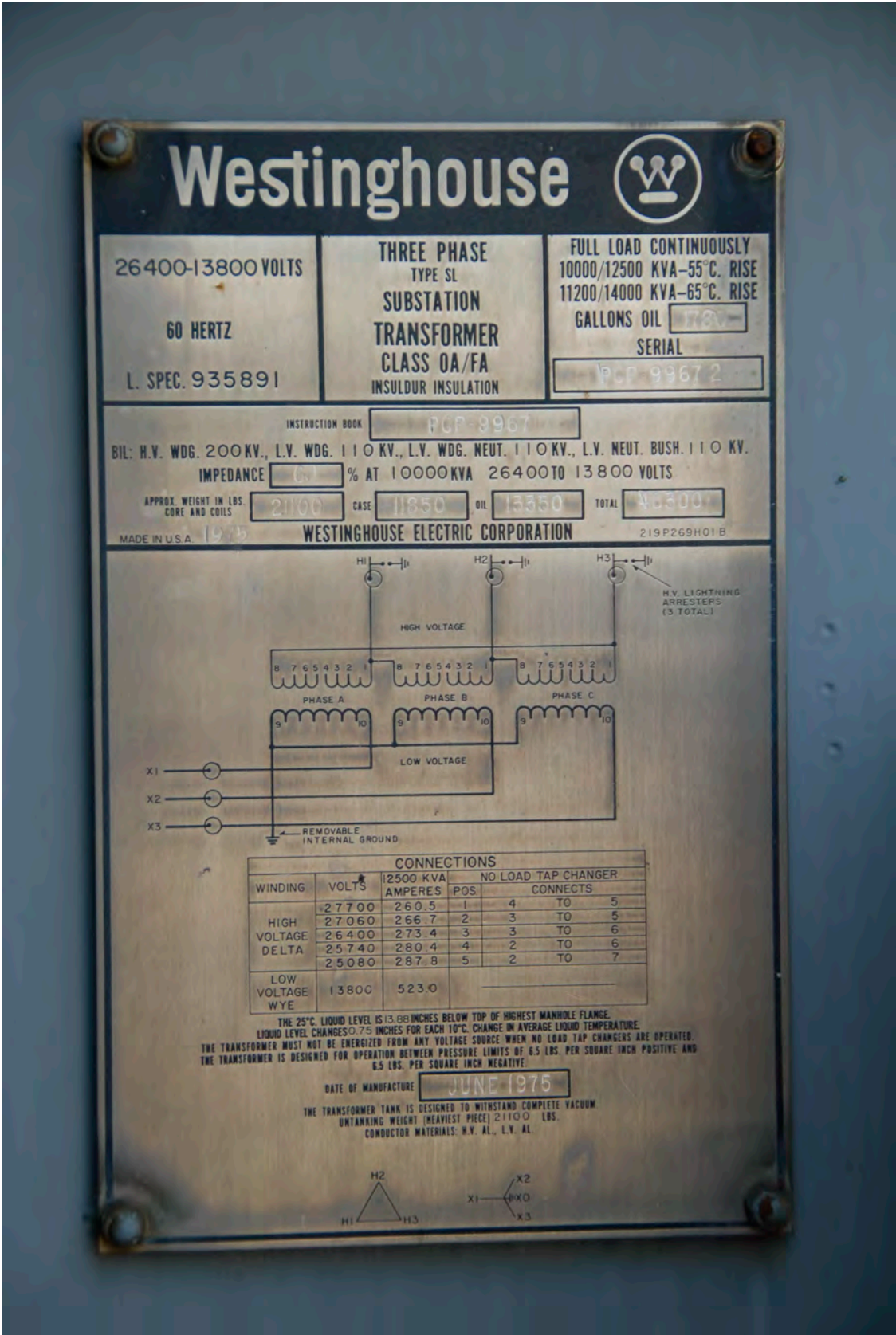
CONTROL TERMINAL BOX (RIGHT SIDE IF FACING SECONDARY ATC)



CONTROL TERMINAL BOX



CONTROL POWER & CT WIRING J-BOX EXTENSION



EXISTING TRANSFORMER NAMEPLATE