

SECTION 16346

MEDIUM VOLTAGE SEALED DEADFRONT DISTRIBUTION SWITCHGEAR

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish and install assemblies of medium voltage sealed dead front distribution switchgear, together with appurtenances, complete and operable, as specified herein and as shown on the Contract Drawings.
- B. The Manufacturer shall be responsible to visit the job site to determine the exact configuration of the switch layout.

1.02 MEASUREMENT AND PAYMENT

- A. No separate payment will be made for the listed equipment. Include payment in lump sum for associated electrical work to be completed under Bid Item No. 7 as shown on document 00410-Bid Form.

1.03 RELATED WORK

- A. Section 16010 Electrical – Basic Electrical Requirements
- B. Section 01610 Basic Product Requirements
- C. Section 16055 Power System Study
- D. Section 16123 Medium Voltage Power Cables
- E. Section 16121 – 600V Control Cables
- F. Section 16195 – Electrical Identification
- G. Section 16080 Acceptance Testing and Calibration

1.04 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of Division 1, Section 01330 and as specified herein.
- B. Provide systems engineering with coordination curves, to demonstrate coordination between existing and proposed breakers and/or fuses submitted, such that protective device coordination is accomplished. Such curves and settings shall be included as a part of these submittals.
- C. Submittals shall also contain information on related equipment to be furnished under this Specification but described in the related Sections listed in the Related Work

**MEDIUM VOLTAGE SEALED
DEADFRONT DISTRIBUTION SWITCHGEAR**

paragraph above. Incomplete submittals not containing the required information on the related equipment will also be returned unreviewed.

- D. The original equipment manufacturer (OEM) shall create all equipment shop drawings, including all wiring diagrams, in the manufacturer's Engineering department. All equipment shop drawings shall bear the original equipment manufacturer's logo, drawing file numbers, and shall be maintained on file in the OEM's archive file system. Photocopies of the Engineer's ladder schematics are unacceptable as shop drawings.
- E. Shop Drawings and Product Data. The following information shall be submitted to the Engineer:
1. Master drawing index
 2. Front view elevation
 3. Floor plan
 4. Top view
 5. Single line
 6. Schematic diagram
 7. Nameplate schedule
 8. Component list with detailed component information, including original manufacturer's part number.
 9. Conduit entry/exit locations
 10. Assembly ratings including:
 - a. Short-circuit rating
 - b. Voltage
 - c. Continuous current
 - d. Basic impulse level for equipment over 600 volts
 11. Major component ratings including:
 - a. Voltage
 - b. Continuous current
 - c. Interrupting ratings

12. Number and size of cables per phase, neutral if present, ground and all cable terminal sizes.

F. Operation and Maintenance Manuals.

1. Operation and maintenance manuals shall include the following information:

- a. Manufacturer's contact address and telephone number for parts and service.
- b. Instruction books and/or leaflets
- c. Recommended renewal parts list
- d. Record Documents for the information required by the Submittals paragraph above.

G. The manufacturer shall submit for approval, a training agenda for all training specified herein. Training shall be conducted utilizing draft Operation and Maintenance manuals as specified in Section 01110 – Summary of Work.

1.05 REFERENCE CODES AND STANDARDS

A. The medium voltage pad mounted switchgear and protection devices in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. ANSI C57.12.28, Pad-Mounted Equipment --- Enclosure Integrity
2. ANSI C119.2, Separable Insulated Connectors
3. IEEE/ANSI 71, 72, 73, 74 Standard for Three Phase Manually Operated Subsurface Load Interrupting Switches.
4. ANSI/IEEE Std. 386, Separable Insulated Connector Systems for Power Distribution Systems Above 600 Volts.
5. ANSI/IEEE C57.13, Instrument Transformers, Requirements for
6. ASTM D-2472 Specification for Sulfur Hexafluoride, SF₆.
7. International Electrical Testing Association latest Acceptance Testing Specifications

B. All equipment components and completed assemblies specified in this Section of the Specifications shall manufactured and tested per the ANSI and IEEE Standard which apply.

**MEDIUM VOLTAGE SEALED
DEADFRONT DISTRIBUTION SWITCHGEAR**

1.06 QUALITY ASSURANCE

- A. The manufacturer of this equipment shall have produced similar equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- B. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. All assemblies shall be of the same manufacturer. Equipment that is manufactured by a third party and “brand labeled” shall not be acceptable.
- C. All components and material shall be new and of the latest field proven design and in current production. Obsolete components or components scheduled for immediate discontinuation shall not be used.
- D. Equipment submitted shall fit within the space shown on the Drawings. Equipment which does not fit within the space is not acceptable.
- E. For the equipment specified herein, the manufacturer shall be ISO 9001 2000 certified.

1.07 JOBSITE DELIVERY, STORAGE AND HANDLING

- A. Prior to jobsite delivery, the Contractor shall have successfully completed all submittal requirements, and present to the Owner/Engineer upon delivery of the equipment, an approved copy of all such submittals. Delivery of incomplete constructed equipment, or equipment which failed any factory tests, will not be permitted.,
- B. Equipment shall be handled and stored in accordance with manufacturer's instructions. Two (2) copies of these instructions shall be included with the equipment at time of shipment, and shall be made available to the Contractor and Owner.
- C. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.
- D. Equipment shall be equipped to be handled by crane. Where cranes are not available, equipment shall be suitable for skidding in place on rollers using jacks to raise and lower the groups.
- E. Equipment shall be installed in its permanent finished location shown on the Drawings within thirty (30) calendar days of arriving onsite. If the equipment cannot be installed within thirty (30) calendar days, the equipment shall not be delivered to the site, but stored offsite, at the Contractor's expense, until such time that the site is ready for permanent installation of the equipment.
- F. Where space heaters are provided in the equipment, provide temporary electrical power and operate space heaters, during jobsite storage and after the equipment is installed in permanent location, until equipment is placed in service.

1.08 WARRANTY

- A. The Manufacturer shall warrant the equipment to be free from defects in material and workmanship for 3 years from date of substantial completion of the equipment. Within such period of warranty the Manufacturer shall promptly furnish all material and labor necessary to return the equipment to new operating condition. Any warranty work requiring shipping or transporting of the equipment shall be performed by the Manufacturer, at no expense to the Owner. Warranty shall comply with requirements in accordance with document 00700 – General Conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. G & W Electric TNI Series
 2. Or Owner approved equal
- B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 RATINGS

- A. The ratings for the integrated pad-mounted gear shall be as designated below per ANSI Standard.
1. General
 - a. kV, Max. 15.5
 - b. Impulse Level (BIL), kV 95 110
 - c. Frequency, Hz 60
 - d. Short Circuit Rating, 18
kA RMS Sym.
 - e. Short Circuit Rating, 32
kA Asym.
 - f. Main Bus, Continuous Amps. 630, 900 per drawing
 2. Three Pole Load Interrupter Switches

**MEDIUM VOLTAGE SEALED
DEADFRONT DISTRIBUTION SWITCHGEAR**

- | | | |
|-------|---|---------------------|
| a. | Continuous Amperes | 630 |
| b. | Load Dropping Amps. | Same as continuous. |
| c. | kV, Max. | <u>15.5</u> |
| (i) | One Minute
Withstand, AC kV | 35 |
| (ii) | One Min. Wthstd, Prod.
Test kV | 34 |
| (iii) | 15 Min. Withstand,
DC kV | 53 |
| (iv) | Continuous and Load Break, | 630 Amps |
| (v) | Fault-Close Current
kA Asym. (3 times) | 40 |
| (vi) | One Second Current
kA Sym. | 25 |
| (vii) | Mechanical Endurance,
Operations | 2000 |
3. Fault Interrupter Switches
- | | | |
|-------|---|----------------------------|
| a. | Continuous Amperes | 630 |
| b. | Load Dropping Amps. | Same as continuous amperes |
| c. | kV, Max. | 15.5 |
| (i) | Impulse level (BIL) | 110 |
| (ii) | One minute withstand
AC kV | 35 |
| (iii) | One minute withstand,
Production test rating | 34 |

69th Street WWTP - Pump Station, Digester and Thickener
 Blower Switchgears, Sub-Station
 Transformers and Starter Replacement
 WBS No. R-000509-0027-4

**MEDIUM VOLTAGE SEALED
 DEADFRONT DISTRIBUTION SWITCHGEAR**

- (iv) 15 minute withstand, 53
 DC kV
- (v) Symmetrical interrupting 18kA
 rating

d. IEEE62271-111/ANSI C37.60 Fault Interrupting Duty

Percent of Maximum Interrupting Duty	Fault Interrupter Duty @ 12,500 Amperes	Fault Interrupter Duty @ 25,000 Amperes	Number of Fault Interruptions
15 – 20%	2,000	4,000	44
44 – 55%	6,000	12,200	56
90 – 100%	12,000	24,500	16
			116 Total

2.03 CONSTRUCTION

A. General

1. Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, components; protective relays, voltage ratings of devices, components and assemblies; and other required details.
2. Switchgear units shall be arranged as shown on the Drawings.
3. The switchgear tank assembly shall be arc resistant and shall be able to withstand available pressure rise during arc fault for a minimum of .25 seconds.

B. Enclosures

1. All enclosures shall be made of galvanized steel, single welded, sized as shown on the Drawings, and manufactured to ANSI C37.72 and C57.12.28 standards.
2. Enclosures for switch tanks shall be mounted independent of the switch tank allowing removal for ease of cable installation or future replacement, if required. All doors for enclosures shall have tamper-resistant incorporating hinged access doors with penta-head locking bolts and provisions for padlocking. The enclosure shall be provided with lifting provisions.
3. Furnish nameplates for each device as indicated in drawings In Accordance with Specification 16195 – Electrical Identification. All nameplates shall be laminated plastic, black lettering on a white background, attached with stainless steel screws. Each unit of switchgear shall be provided with a nameplate indicating the manufacturer’s name, catalog number, model number, date of manufacture, serial number a stainless steel three line diagram nameplate and a corrosion-resistant

**MEDIUM VOLTAGE SEALED
DEADFRONT DISTRIBUTION SWITCHGEAR**

nameplate. Each unit of switchgear shall be provided with a ratings label indicating the following: voltage rating; main bus continuous rating; short-circuit rating; fault interrupter ratings including interrupting and duty-cycle fault-closing; and load break switch ratings including duty-cycle fault-closing and short-time.

4. Provide wire markers at each end of all control wiring. Wire tags shall be heat shrink type "Brady" or approved equal with the tag numbers typed with an indelible marking process, as specified in Section 16195 – Electrical Identification.
5. The enclosure shall be oversized to install electrical operator in the future.
6. The size of the enclosure shall be adjusted based on field conditions. Enclosure shall be oversized to accommodate elbow connected lightning arresters.
7. The enclosure shall be oversized to accommodate elbow connected lightning arresters.
8. Provide one set of 15 kV Station Class lightning arresters elbow connected to each incoming line.
9. The enclosure shall be coated using the Durham PMD Duplex Coating system.

Comment [a1]: Doesn't fit in page, needs to be updated

C. Switch Tanks (SF6)

1. Switch tanks shall be constructed of 316 stainless steel; single welded, sized for the switch arrangement as shown on the Drawings, and manufactured to ANSI C37.72 and C57.12.28 standards. Construction shall be dead front. Switches shall be shipped filled with SF6 gas conforming to ASTM D-2472. Switch tanks shall be made with manual operating mechanisms and viewing windows.
2. Each tank shall contain the following:
 - a. Welded stainless steel tank with 316 stainless steel fasteners.
 - b. Lifting provisions.
 - c. Door lifting handles.
 - d. Gas pressure gauge and fill valve.
 - e. Deadbreak bushing for each cable, as shown on the Drawings.
 - f. Parking stand for each cable with insulated parking bushing and cap.
 - g. Stainless steel three-line diagram and corrosion-resistant nameplates
 - h. Switch operating handles with padlock provision and end stops.

D. Load Interrupter Switches

**MEDIUM VOLTAGE SEALED
DEADFRONT DISTRIBUTION SWITCHGEAR**

1. Switch Configuration. All switches shall be front and rear access designs. The operating handles shall be on the front and all incoming and outgoing bushings shall be out the back.
 2. Switch contacts and cable entrances shall be contained in a single welded, 316 stainless steel tank as specified above.
 3. Switch Operation.
 - a. Each switching way shall be equipped with an internally mounted spring assisted operating mechanism capable of providing quick-make, quick-break operation in either switching direction. The mechanism shall be capable of delivering sufficient torque and shall be provided with latches for each position to assure load interrupting, fault closing, and momentary ratings. All switch positions shall be clearly identified, pad lockable, and adaptable to key lock schemes.
 - b. The operating mechanism shall be actuated from outside the switch tank with an operating handle. The operating shaft shall be made of stainless steel.
 - c. Switch Contacts. Switch contacts shall be of plated, high-conductivity copper alloy with arcing tips of copper/tungsten alloy. The contacts shall be designed such that arcing does not occur in the area of main current interchange and contact pressure will increase with increasing current flow. Contact travel shall have sufficient open contact separation to assure efficient arc extinction and withstand field DC testing levels and maintain BIL levels.
 4. Kirk Key Interlocks. Provide Kirk Key interlocks between switchgear lineups, or between a switchgear lineup and other switchgear, where multiple sources of power are present, to prevent paralleling sources of power, as shown on the Drawings. Kirk keyed interlocks shall be Kirk HD Series (Heavy Duty) 316 Series of 316 stainless steel, or approved equal.
- E. Fault Interrupter Switches
1. Design Ratings and Standards
 - a. The Fault interrupter shall be a non-reclosing, manual reset device incorporating vacuum bottles. It shall be designed, tested, and built per applicable sections of ANSI C37.60. The vacuum interrupter assembly shall be rated as specified in this Section.
 - ~~b. Each fault interrupter way shall be provided with a ground position.~~
 2. Vacuum Interrupter Operation
 - a. The vacuum interrupter shall consist of vacuum bottles and a spring-assisted operating mechanism. Where shown on the Drawings, or specified

**MEDIUM VOLTAGE SEALED
DEADFRONT DISTRIBUTION SWITCHGEAR**

elsewhere, a switch shall be provided in series with the vacuum interrupter. The switch shall be readily visible through the viewing window.

- b. The vacuum interrupter operating mechanism shall consist of the support assembly, linkage, spring latch mechanism, and solenoid utilized for electronic tripping. Interrupting time shall be 3.0 cycles maximum (50 msec.). The movable contact shaft shall be flagged to indicate the contact position, open or closed. The contact position indicator shall be fully visible through viewing windows in the switch tank.
- c. Each tap phase shall be equipped with an individual vacuum interrupter fully enclosed in the switch tank. Electrical opening of the vacuum interrupter shall be by a solenoid that is activated from sources external to the switch tank. Closing (reset) of the vacuum interrupter shall be mechanical with the use of lever mounted external to the switch tank.
- d. Mechanical load break or reset shall be activated by an operating lever mounted external to the switch tank. The mechanical linkage assembly shall provide for a "trip-free" operation which allows the vacuum interrupter to interrupt independent of the operating lever if closing into a faulted or heavily loaded phase or circuit.

F. Electronic Control

1. An electronic assembly shall be provided to sense load and fault current on each phase of the load tap circuits. Where a Schweitzer 501-2 relay is shown on the drawings, the relay shall be powered from a potential transformer to be added to the inside of the tank. Where a standard G&W type 2 control is shown on the drawings, the electronic control shall be powered from current transformers mounted inside the switch tank. No external power source shall be required for over-current protection.
2. The electronic control shall monitor the current on the individual phases of the tap circuits using input from the internal current transformers. Temperature range shall be -40°C to +70°C.
3. Control settings shall be field programmable by using a personal computer or dip switches. For computer programming the personal computer shall be connected via a data port to the control. The data port shall be accessible from the exterior of the enclosure. Neither external power nor energization of the switchgear shall be required to set or alter control settings. Trip characteristics (TCC curves) shall be field selectable. Maximum time for power up and ready to trip when closing on a circuit shall be ten percent of the trip time or ½ cycle, whichever is greater. Trip selection shall be selectable with the load taps energized.
4. Control shall record and store overcurrent events.
5. A clear window cover shall be provided for interrupter controls.

6. The manufacturer shall be responsible to set the relay to protect the transformers based on the coordination study.
7. Control relays one per way shall be the Schweitzer's SEL 501-2

G. High-Voltage Bus

1. Bus and interconnections shall consist of copper bus bar, sized as shown on the Drawings.
2. Bus and interconnections shall withstand the stresses associated with short-circuit currents up through the maximum rating of the pad-mounted switchgear.
3. Bolted copper to copper connections shall be made with a suitable number of bolts and with two Belleville spring washers per bolt, one under the bolt head and one under the nut. Bolts shall be tightened to 50 ft-lbs torque.

H. Ground-Connection Pads

1. A ground-connection pad shall be provided in each compartment of the pad-mounted gear.
2. The ground-connection pad shall be constructed of 3/8" thick steel, which shall be nickel plated and welded to the enclosure, and shall have a short-circuit rating equal to that of the integrated assembly.
3. Ground-connection pads shall be coated with a uniform coating of an oxide inhibitor and sealant prior to shipment.

I. Viewing Windows

1. Each switch and vacuum interrupter shall be provided with a viewing window sufficient in size to allow visual verification of the switch position. Open and closed positions shall be verified with position indicators that are tied directly to the movable shaft of the interrupter.

2.04 TESTING

A. The switchgear equipment and circuit breakers shall receive factory production test as listed below:

1. Each switch shall be factory filled with SF6 gas. The gas shall be checked for moisture content.
2. Each switch shall undergo an SF6 leak check to verify the integrity of the tank, seals, and gaskets.
3. A mechanical operation check of each switching mechanism.

**MEDIUM VOLTAGE SEALED
DEADFRONT DISTRIBUTION SWITCHGEAR**

4. AC hi-pot tested one minute phase-to-phase, phase-to-ground and across the open contacts.
 5. Circuit resistance shall be checked.
 6. Primary current injection test to test CTs, trip mechanism, and electronic control.
- B. Manufacturer shall provide to the Engineer documents verifying completion of factory production tests.

PART 3 EXECUTION

3.01 MANUFACTURER'S REPRESENTATIVE

- A. Provide the services of a qualified factory-trained manufacturer's engineer to assist the Contractor in installation and start-up of the equipment specified under this Section for a period of not less than 3 working days. The manufacturer's engineer shall provide technical direction and assistance to the contractor in general assembly of the equipment, connections and adjustments, and shall perform all testing of the assembly and components contained therein.
- B. The Contractor shall provide three (3) copies of the manufacturer's field start-up report.

3.02 INSTALLER'S QUALIFICATIONS

- A. Installer's Certificate of ISO 9001 2000 Compliance.
- B. Installer shall be specialized in installing medium voltage pad-mount switchgear with minimum 5 years documented experience.

3.03 EXAMINATION

- A. Examine installation area to assure there is enough clearance to install the switchgear.
- B. Check concrete pads for uniformity and level surface.
- C. Verify that switchgear is ready to install.
- D. Verify field measurements are as instructed by manufacturer.

3.04 INSTALLATION

- A. The Contractor shall install all equipment per the manufacturer's recommendations and Contract Drawings.
- B. The switches shall be mounted outdoors on a concrete pad. Cable entrance shall be through the bottom of the switchgear. The contractor shall coordinate the required locations of the line side and load side stub-outs.
- C. Bond all conduits to the switchgear housing using grounding bushings.

- D. Make cable connections with 600A separable elbows suitable for termination on the switchgear primary and secondary bushings. Refer to Section 16123 Medium Voltage Cables and the Drawings, for cables to be connected on the primary and secondary sides.
 - E. Installed required safety labels.
- 3.05 FIELD QUALITY CONTROL
- A. Inspect installed switchgear for anchoring, alignment, grounding and physical damage.
 - B. Check tightness of all accessible electrical connections. Minimum acceptable values are specified in manufacturer's instructions.
- 3.06 FIELD ADJUSTING
- A. Adjust all switches, access doors and operating handles for free mechanical and electrical operation as described in manufacturer's instructions.
 - B. The Power Monitoring and Protective Relays shall be set in the field by a qualified representative of the manufacturer, retained by the Contractor, in accordance with settings designated in a coordinated study of the system as required in Section 16105 Power System Study. All such settings, including the application of arc flash labels, shall have been made and Approved by the Owner/Engineer, prior to energizing of the equipment.
 - C. The manufacturer shall provide curves, etc., as may be required for the Power System Study.
 - D. Return "odd" Kirk keys to the Owner before energizing equipment.
- 3.07 FIELD TESTING
- A. In accordance with section 16080.
- 3.08 CLEANING
- A. Clean interiors of switchgear, switchboards, panels, separate enclosures to remove construction debris, dirt, shipping materials.
- 3.09 EQUIPMENT PROTECTION AND RESTORATION
- A. Touch-up and restore damaged surfaces to factory finish, as approved by the manufacturer. If the damaged surface cannot be returned to factory specification, the surface shall be replaced.
- 3.10 MANUFACTURER'S CERTIFICATION
- A. A qualified factory-trained manufacturer's representative shall personally inspect the equipment at the jobsite and shall certify in writing that the equipment has been

**MEDIUM VOLTAGE SEALED
DEADFRONT DISTRIBUTION SWITCHGEAR**

installed, adjusted, and tested, in accordance with the manufacturer's recommendations, including all settings designated in the Power System Study.

- B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

3.11 TRAINING

- A. Provide manufacturer's services for training of plant personnel in operation and maintenance of the equipment furnished under this Section.
- B. The training shall be for a period of not less than one (1) eight hour day.
- C. The cost of training program to be conducted with Owner's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the equipment being supplied.
- D. Provide detailed O&M manuals to supplement the training course. The manuals shall include specific details of equipment supplied and operations specific to the project.
- E. The training session shall be conducted by a manufacturer's qualified representative. Training program shall include instructions on the assembly, circuit breaker, protective devices, metering, and other major components.

END OF SECTION