

SECTION 16300 - MEDIUM VOLTAGE DISTRIBUTION

City of San Diego, CWP Guidelines

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing all electrical service sections, distribution switchgears, special control panels, control and terminal cabinets, control devices, circuit breakers, interrupter switches, and all appurtenant work, complete and operable.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 16030 Electrical Tests
2. Section 16050 Basic Electrical Materials and Methods
3. Section 16360 Medium Voltage Switching Center
4. Section 16431 Short Circuit and Coordination Report

1.3 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. National Electrical Code (NEC) NFPA 70

1.4 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

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| 1. ANSI/IEEE C37.06 | Preferred Ratings and Related Required Capabilities for AC High Voltage Circuit Breakers on a Symmetrical Current Basis |
| 2. ANSI/IEEE C37.09 | Test Procedures for AC High Voltage Circuit Breakers Rated on Symmetrical Current Basis |
| 3. ANSI/IEEE C37.20 | Switchgear Assemblies, including Metal-Enclosed Bus |
| 4. ANSI/NEMA ICS-2 | Devices, Controllers, and Assemblies for Industrial Control |
| 5. NEMA SG6 | Metal Enclosed Switchgear |

1.5 SHOP DRAWINGS AND SAMPLES

- A. The following shall be submitted in compliance with Section 01300:

1. Shop drawings of the service section and switchgear. After review of shop drawings of the service section by the CONSTRUCTION MANAGER, said drawings shall also be submitted to the utility company for approval prior to fabrication.
2. Certified design test reports conducted in the factory testing facilities on similar assemblies.
3. Time/current characteristics for each type of protective device.

1.6 OWNER'S MANUAL

- A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:
 1. Operating procedures.
 2. Maintenance procedures.
 3. Manufacturer's parts list, illustrations, assemblies and diagrams.
 4. Recommended spare parts list.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. **Materials:** All equipment and materials furnished under this specification shall be new and shall bear the Underwriters' Laboratories label where such service is regularly available.
- B. **Equipment:** All equipment for the same purpose shall be of the same make.
- C. **Enclosure Requirements:** All outdoor equipment, fixtures, and wiring devices shall be of weatherproof construction.
- D. **Standard Products:** Materials and equipment submitted for approval shall be the cataloged products of companies regularly engaged in the manufacture of such items, shall be the latest standard design that conforms to the specification requirements, and shall essentially duplicate material and equipment that has been in satisfactory use for several years.

2.2 SWITCHGEAR (MEDIUM VOLTAGE)

- A. The main circuit breaker shall be a metal-clad vacuum circuit breaker and shall be rated [15 KV, 1200 AMP] continuous current and [750 MVA] interrupting capacity at nominal system voltage, and shall be complete with all necessary devices and hardware to result in a complete operable unit. Incoming and outgoing sections shall have ample spaces for 15 kV, 133 percent] shielded, jacketed single conductor stress-cone terminations, and lightning arresters. All terminals and lugs shall be of the solderless type suitable for copper cables of the size indicated. The following devices and provisions shall be included:
 1. A wheel-mounted, draw-out type vacuum circuit breaker with operating, test and isolation positions. Switchgear cubicle or compartment shall be provided with a mechanical means for moving the circuit breaker to and from its operating position. Suitable guide rails and positive stops shall be provided for centering the circuit breaker in the proper position when inserting or removing the circuit breaker. All necessary accessories required for removing and transferring the circuit breaker shall

be furnished. Cubicle shall be provided with a positive stop to prevent overtravel of the circuit breaker when moving it into the OPERATING and TEST position. An indicator or equivalent indicating means shall be provided to clearly show when the circuit breaker is in the TEST or OPERATING position.

2. A complete mechanical interlock system to prevent moving the vacuum breaker from and into operating position when the vacuum breaker is closed. Removal of the circuit breaker shall be possible only by operating a mechanical device.
3. A power terminal disconnecting system with automatic shutter, covering all high-voltage parts when the vacuum breaker is moved out of operating position. All disconnecting devices shall be accurately jig aligned and securely mounted to maintain alignment.

The main contacts and their supports shall be guaranteed not to distort or fail under any or all of the following conditions, individually or concurrently:

- a. Mechanical stresses resulting from the momentary current specified.
- b. Misalignment of disconnects of plus or minus 1/8-inch.

All contact surfaces shall be silver-to-silver pressure contacts. In general, these contacts, whether stationary or movable, shall be of rugged silverplated copper one-piece construction, with springs on fingers to provide uniform contact with the male part of all operating and environmental conditions.

- [4. The circuit breaker control voltage shall be 125V DC. A control bus with all necessary control battery, battery charger and an AC auxiliary power source, fuses and control disconnects shall be provided. The wires shall be carried in a wire trough, gutter, or equivalent method within the switchgear assembly. All wiring shall be protected from sharp edges and corners. Terminal blocks shall be provided on one side of a shipping split for termination of the interconnecting wires, with adequate lengths and identification furnished to permit reconnecting the circuits. Wiring provided for the external connection to other locations shall be wired to terminal blocks.]
- [4. The circuit breaker control voltage shall be 120 VAC. A capacitor trip device shall be provided with circuit breaker shunt trip and a lockout relay to ensure that energy will be available for tripping during fault conditions. A control power transformer complete with fuse protection shall be provided and connected to the source side of the circuit breaker.]
5. The vacuum circuit breaker shall be operated by an electrically charged, mechanically and electrically trip-free, stored energy operating mechanism. Provision shall be included for manual charging of the mechanism and for slow closing of the main contacts for inspection or adjustments. A manual charging lever shall be furnished with the main circuit breaker. The stored energy mechanism shall discharge when the breaker is withdrawn from the cubicle.
6. Facilities shall be provided for padlocking the trip mechanism to block the closing of the circuit breaker.
7. The withdrawable vacuum circuit breaker assembly shall be equipped with self-coupling primary, secondary and grounding contacts.

8. In addition to the "Operating" and "Isolated" positions, an intermediate "Test" position shall be provided to facilitate the operation of the vacuum circuit breaker with the primary circuit disconnected. Transfer of the vacuum circuit breaker between the service, test, and isolated positions shall be mechanically prohibited with the circuit breaker closed.
9. Auxiliary switches shall be directly coupled to the circuit breaker mechanism to indicate the open and closed positions of the circuit breaker positively.
10. Mechanical indication of the following circuit breaker positions - open, closed, operating, test, and isolated, shall be positively indicated at the operating face of the equipment. Electrical indication of the following circuit breaker status - open, closed, and spring charged, shall also be provided at the operating face of the equipment.
11. Close and trip circuits for breaker shall be separately fused with cascaded connection for the closing circuit. Fuse blocks shall be dead front, pullout type to provide the control disconnecting means.
12. Protective Relays:

It shall be the responsibility of the switchgear manufacturer or supplier to complete the detail design of the complete protective relaying system in accordance with the functional requirements indicated in the one-line diagram. The switchgear manufacturer shall provide the quantity, type and rating of protective relays as indicated.

Protective-type relays shall be suitable for operation at a frequency of 60 Hz with current transformers having 5-ampere secondary circuits, and with potential transformers having 120-volt secondary circuits. The relays shall not be damaged by the stresses resulting from the momentary and short-circuit currents indicated. The manufacturer shall guarantee the compatibility of ground sensor current transformers and the associated instantaneous overcurrent relays.

Protective-type relays shall have draw-out type cases of a uniform dull black finish, shall be semi-flush-mounted on the front door operating face of the equipment, and shall be of the rectangular dust-tight type. The relay cases shall be provided with glass covers and gaskets to render them dust-tight. Auxiliary relays shall be surface mounted at easily accessible locations in each cubicle. All protective relays shall be equipped with built in targets or indicating lights which indicate a trip condition.

Resistors and other auxiliary components associated with the relays shall be furnished to provide a complete and functional system.

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NTS: The following subparagraph may not be required if the designer elects to use only vacuum circuit breakers.

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- B. The main interrupter switch shall be three-pole, single-throw unit, operated by a stored energy spring mechanism such that the speed of switch opening or closing shall be

independent of the operator. Switch shall have a means for manually opening or closing if control power is not available or if a motor fails.

Incoming and outgoing switch sections shall have ample spaces for 15 kV, 133 percent shielded, jacketed single conductor stress-cone terminations and lightning arresters. All terminals and lugs shall be of the solderless type suitable for copper cables of the size indicated.

1. The interrupter switch shall be the air-break type, 3-pole, 2-position with arc chutes or other suitable method of cooling and quenching an arc quickly, rated [600] [1200] amps continuous, as indicated. The switch shall be for use in a [13.8 kV, 3-phase low resistance grounded system] and shall have the following ratings:

- [a. Switch with 1200 amps continuous rating:

Design voltage	[15 kV]
Impulse withstanding rating	[95 kV]
Interrupting ampere rating	1,200 amps
Fault closing ampere	[61,000 amps]
Momentary rating	[80,000 amps]]

- [b. Switch with 600 amps continuous rating:

Design voltage	[15 kV]
Impulse withstanding rating	[95 kV]
Interrupting ampere rating	600 amps
Fault closing ampere	[40,000 amps]
Momentary rating	[40,000 amps]]

- C. Power fuses shall be provided for fault protection. Fuse rating shall be as indicated. Provisions shall be made to indicate blown fuses. The fuses shall be one of the types indicated below.

1. Current limiting type, where available in rating, of the self-contained design to provide fast clean interruption with minimum let-through current. Fuses shall operate during the first half cycle on maximum fault condition with no expulsion of gas or vapor.
2. Where ratings of current limiting fuses are not available, expulsion power fuses with fast acting characteristics shall be provided.

- D. Access control shall be provided as follows:

1. Doors providing access to interrupter switch with power fuses shall be mechanically or key interlocked to guard against:

- a. Opening the fuse door if the interrupter switch on the source side of the power fuse is closed.
 - b. Closing the interrupter switch if the door is open.
2. The fuse compartment door shall be interlocked with the switch mechanism to prevent access when the switch is closed.

E. A high impact type contact viewing window shall be provided in door over the switch.

2.3 MAIN SERVICE SWITCHGEAR

- A. **General:** The main service switchgear shall consist of a free-standing assembly which complies with the Contract Documents. The assembly shall consist of pull section, main breaker, metering section, transition section, and distribution switchgear.
- B. **Main Circuit Breaker Section:** The main circuit breaker shall be as described in subsection 2.2 above and shall have the rating indicated. The service neutral shall be brought to a terminal in the main circuit breaker compartment. A disconnecting link shall be provided in a buss bar connection between the neutral terminal and the switchgear ground bus. Protective relays shall be provided and shall be coordinated and set per utility requirement.
- C. **Metering Section:** The metering section shall comply with all utility requirements.
- D. **Distribution Switchgear:** Switchgear shall be [front- and side-accessible] [rear-front- and side-accessible]. The distribution circuit breaker shall be constructed similar to the main circuit breaker as described in subsection 2.2 above.

2.4 SWITCHBOARD INSTRUMENTS

- A. Indicating instruments shall be approximately 4-1/2-inch square with 250-degree scales and white dials with black graduations. Case shall be semi-flush mounted with anti-glare glass. Front access zero adjustment shall be provided. Indication accuracy shall be within one percent.

Indicating meters shall be of the following type and manufacture (or equal):

1. Main incoming [switch] [breaker]:

1 - voltmeter [0-15 kV], single-phase, one percent accuracy

1 - voltmeter transfer switch with pistol grip handle to permit a single-phase voltmeter to indicate voltage between phase of a three-phase system. Switch shall have an "Off" position

1 - AC indicating ammeter, five amperes full scale, single-phase, 0-XXX amperes dial, one percent accuracy

1 - Ammeter transfer switch with pistol grip handle to permit a single-phase ammeter to indicate current in each phase of a three-phase system. Switch shall have an "Off" position

1 - Watt-hour demand meter with 15-minute demand register, three-phase, two-element

1 - Varmeter with 3-phase, three-wire, cross-phase, three current coils on open-delta potential transformers, coil rating five ampere

2. Distribution feeder [switch] [breaker]:

1 - AC indicating ammeter, five amperes full scale, single-phase, XXX amperes dial, one percent accuracy

1 - Ammeter transfer switch with pistol grip handle to permit a single-phase ammeter to indicate current in each phase of a 3-phase system. Switch shall have an "Off" position

Where they are shown on the single line diagram, the following shall be provided:

1 - Watt-hour demand meter with 15-minute demand resister, 3-phase, two-element

1 - Varmeter with three-phase, three-wire, cross phase, three current coils on open-delta potential transformers, coil rating 5-amperes

B. Instrument transformers shall comply with ANSI/IEEE C37.20 and shall have standard accuracy for relaying and metering with the burdens imposed. Mechanical and thermal ratings of current transformers shall be coordinated with short circuit ratings of related circuit breakers. Potential transformers shall be mounted on a disconnecting rack and shall have primary fuse protection.

C. Protective relays shall be mounted within draw-out cases; current measuring circuits shall be fitted with jacks to short circuit current transformers when relays are withdrawn. Relays shall have means for testing measuring circuitry with the relay in place. Relays may be induction disc or solid state type but shall be products of the switchboard manufacturer.

2.5 SURFACE PREPARATION, PAINTING AND CLEANLINESS

A. Cleanliness of the equipment furnished shall be such that it is smooth and free of all foreign matter such as scales, sand, blisters, weld splatters, metal chips and shavings, oil, grease, organic matter and rust.

B. All metal enclosures shall be chemically cleaned and treated in a process which provides a phosphate coating, then primed and finished with a corrosion resistant enamel paint.

1. Exterior surfaces shall be finish painted with dark gray ANSI 61 finish coat, in accordance with the manufacturer's standard practice for the environmental conditions indicated. In addition, the undersurfaces shall be covered with a corrosion resistant protective coating.

2.6 NAMEPLATES, TOOLS AND SPARE PARTS

A. Nameplates shall be black and white 1/8-inch thick lamicoïd, with lettering engraved through the white surface exposing the black lamination beneath. Letter height shall be 1/8-inch minimum unless otherwise indicated. Nameplates shall be fastened near top side of front panel using two matching screws.

- B. A warning nameplate shall be provided on each compartment with external circuit. Warning nameplates shall be red background with white letters and shall read:

"CAUTION - THIS UNIT CONTAINS AN EXTERNAL VOLTAGE SOURCE"

Permanently attached tags shall be provided inside each compartment to indicate location of remote disconnecting means.

- C. A circuit-breaker lifting device, which is capable of lifting the rollout circuit breakers from the switchgear assembly, shall be provided. The lifting device shall have 40-inch diameter locking wheels, a steel platform base, and a hoist mechanism to lift the circuit breaker from the assembly and lower it to the platform base. The entire assembly shall be suitable designed to prevent capsizing during movement of circuit breaker to the platform.
- D. The CONTRACTOR shall furnish paint, matching each color used, for field "touch-up" after installation of the equipment. Two one-pint aerosol spray cans of each color shall be supplied per assembly.

2.7 MANUFACTURERS

- A. Products of the type indicated shall be manufactured by one of the following (or equal):

1. Metal-clad switchgear with vacuum breaker:

Westinghouse, VacClad
General Electric, Power/VAC

2. Protective and auxiliary relays shall be the following make and type. In order to assure a high degree of reliability and service continuity required, substitutes for any of these relays listed below shall not be acceptable:

<u>Device No.</u>	<u>Relay Description</u>	<u>Westinghouse (W)</u>	<u>General Electric (GE)</u>	<u>Brown Boveri BBC (ITE)</u>
[]	Phase Overcurrent	CO	IAC/SFC	ITE-51
[]	Ground Overcurrent	ITH	PJC	ITEGR5
[]	Lockout Relay with Overcurrent Manual Reset	WL	HEA	--

3. Load interrupting switch:

Westinghouse, Type WLI
S&C Electric Company
General Electric

4. Switchboard instruments:

Voltmeter

Westinghouse Type KA-251
General Electric Type AB-40

Voltmeter transfer switch

Westinghouse Type W
General Electric Type SB-1

AC indicating ammeter

Westinghouse Type KA-241
General Electric Type AB-40

Ammeter transfer switch

Westinghouse Type W
General Electric Type SB-1

Watt-hour demand meter

Westinghouse Type CB
General Electric Type DSM 63

Varmeter

Westinghouse Type KP-261
General Electric Type AB-40

PART 3 -- EXECUTION

3.1 INSTALLATION - GENERAL

- A. All electrical equipment materials shall be installed securely in place. Equipment shall be mounted parallel and perpendicular to the walls, floors, and ceilings.
- B. All anchors and fasteners shall be types designed for the intended purpose and shall be capable of adequately, safely, and permanently securing the material in place. Screws shall be used on wood surfaces, masonry anchors in concrete or brick, toggle bolts on hollow walls, machine screws, bolts, or welded studs on steel. Nails shall be used only for temporary attachment or support.
- C. Floor standing equipment shall be leveled with shims as required to maintain horizontal surfaces within 1/32-inch per horizontal foot; after leveling, equipment shall be anchored, then grouted so that no space is existing between concrete and equipment support beams.

3.2 TESTING

- A. The WORK of this Section shall be tested in compliance with the requirements of Section 16030.

3.3 PROTECTIVE RELAY SETTINGS

- A. The relays shall be set in the field by a qualified representative of the manufacturer, retained by the CONTRACTOR in accordance with settings designated in the coordination study specified in Section 16431.

** END OF SECTION **