

CenterPoint Energy SPECIFICATION FOR CUSTOMER 138 KV SUBSTATION DESIGN

- 7.1.2. Power transformers shall have a minimum of two 600:5 A multi-ratio current transformers (CT's) per 138 kV bushing. Each CT shall have IEEE C57.13 accuracy C400 or better. Where applications require additional CT's and/or different ratios, CenterPoint Energy shall provide ratios to support equipment purchase schedule. The secondary resistance of power transformer bushing CT's shall not exceed 0.0025  $\Omega$  per turn. CT secondary rated continuous current shall be 10 A minimum. Rating Factor (R.F.) shall equal 2.0.
- 7.1.3. High side surge arresters shall be provided in accordance with Sub-Article 7.4.
- 7.1.4. The customer shall determine the need for, and if applicable, settings for a tap changer for de-energized operation (no load tap) and automatic on-load tap changer. CenterPoint Energy recommends power transformers be equipped with automatic on-load tap changer.

7.2. CIRCUIT BREAKERS

- 7.2.1. Circuit breakers shall be of the three-pole, outdoor type, 138 kV nominal, in accordance with ANSI C37.06 and IEEE C37.60, C37.04 and C37.40.
- 7.2.2. Continuous current rating of 138 kV circuit breakers shall be 4,000 A, with a three phase symmetrical short circuit interrupting capability of 63 kA rms symmetrical. For substations with four or more 138 kV transmission lines, circuit breakers may be required to have a higher continuous rating. The rated interrupting time of the circuit breakers shall be three cycles or less. In some applications, the installation of TRV shaping capacitors may be required in order to achieve the circuit breaker interrupting capability of 63 kA rms symmetrical for line faults. CenterPoint Energy shall determine the placement of TRV shaping capacitors, when required.
- 7.2.3. Each 138 kV circuit breaker shall be equipped with two 3,000:5 A multi-ratio CT's per 138 kV bushing. Each CT shall have an accuracy of C800 on the 2,000:5 A tap in accordance with IEEE C57.13. The secondary resistance of circuit breaker bushing CT's shall not exceed 0.0025  $\Omega$  per turn. CT secondary rated continuous current shall be 10 A minimum. Rating Factor (R.F.) shall equal 2.0 (i.e. to accommodate interface with any existing circuit breakers with 2000:5 multi-ratio CT's in an existing substation while maintaining the design capability for 4000 ampere operation in the future and in a new substation).
- 7.2.4. Two trip coils shall be provided with independent 125 VDC control circuits. If both trip coils operate a single armature, both coils shall be designed or marked in such a way as to prevent their being connected in a manner that would result in the breaker not tripping in the event that both coils are energized simultaneously.
- 7.2.5. Trip and close DC current shall not exceed 15 A (instantaneous and steady state) per trip circuit and shall not be less than 4 A per trip and close circuit.
- 7.2.6. Trip circuits shall not be fused inside the circuit breaker control cabinet.
- 7.2.7. Surge suppression shall be provided on each trip and close coil. Reference CenterPoint Energy Specification, 007-400-02.
- 7.2.8. The circuit breaker operating mechanism shall be both mechanically and electrically trip-free in any position. For oil circuit breakers, a latch check switch shall be provided.
- 7.2.9. Circuit breakers with air closing mechanisms shall have stored energy for 5 close-open operations. Circuit breakers with spring closing mechanisms shall have the spring charging

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motor circuit connected to a 125 VDC battery source utilizing a DC supply cable dedicated for this purpose. Voltage rollover from AC to DC shall not be installed for the spring charging motor circuit for circuit breakers.

- 7.2.10. ~~Gas circuit breakers shall have low gas pressure alarm and close inhibit contacts.~~
- 7.2.11. Circuit breaker internal time delay circuitry for reclosing shall not be utilized. External time delayed automatic reclosing, when utilized, shall be wired/connected directly to the circuit breaker close circuit. External time delay for reclosing circuit is to be provided by other relays.

**Comment [DRS4]:** Add language to require the customer to specify which option on whether to 'trip' or 'block trip' on loss of gas they are implementing and label the breaker how it is configured.

7.3. AIR BREAK SWITCHES

- 7.3.1. Transmission line disconnect switches and all disconnect switches in the substation "loop" shall be of the outdoor, three pole, gang operated type rated 138 kV nominal, 4,000 A continuous, 164 kA peak withstand minimum. The transmission line disconnect switches shall have a 2-hr emergency rating of 4,400A. Disconnect switches that are not in the substation "loop" (i.e. transformer high side disconnect switch) may be rated for less than 4,000 A continuous, but must be rated for 164 kA peak withstand minimum. For substations with four or more 138 kV transmission lines, contact CenterPoint Energy for the required rating of switches. The switch air gap BIL shall coordinate with the BIL rating of the switch insulators.
- 7.3.2. Transmission line disconnect switches are required for "full loop" substations or "loop tap" substations converted to "full loop".
- 7.3.3. "Loop tap" substations must be configured and designed with equipment to permit switching for the scheduled outage of either transmission line section without interrupting service to the customer's load. An interrupting device attached to a disconnect switch in a "loop tap" substation for transmission line load breaking, loop switching or line dropping is not acceptable.
- 7.3.4. Two auxiliary "a" contacts shall be provided on the disconnect switch between transformers in a three circuit breaker, two transformer substation and the disconnect switch between lines in a two circuit breaker substation.

7.4. SURGE ARRESTERS

- 7.4.1. Surge Arresters must be installed to protect substation 138 kV equipment including instrument transformers.
- 7.4.2. All surge arresters shall be metal oxide varistor type 108 kV class minimum, with a maximum continuous over voltage (MCOV) rating of 88 kV minimum. The minimum required energy absorption capability is 7 kilojoules/ kV of MCOV rating. The surge arrester must have directional pressure relief device and minimum required pressure relief capability is 63 kA rms symmetrical.
- 7.4.3. To allow for grading / leakage current monitoring, CenterPoint Energy recommends that surge arresters be mounted on plates using insulated spacers and associated hardware. The insulated ground conductor from the bottom flange of the arrester must be isolated from any other ground until it passes the point where a tong ammeter reading can be taken. The independent, insulated ground leads should be adequately marked to indicate A, B, and C phases.