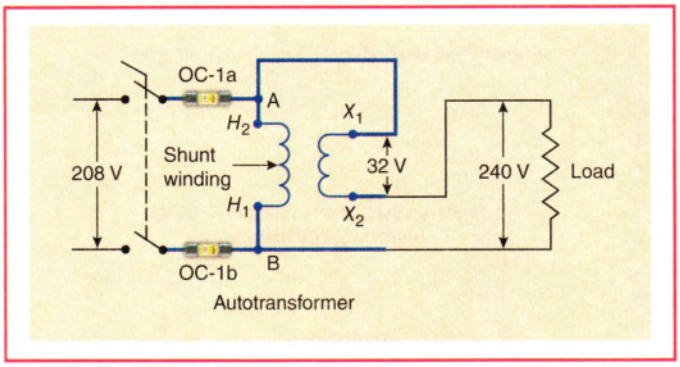

EXHIBIT 450.6 A disconnect switch with overcurrent devices properly connected to protect an autotransformer and located to meet the requirements of 450.4(A).

transformer connected to boost a 208-volt supply to 240 volts. The autotransformer is provided with a 2-pole disconnect switch with both overcurrent devices (OC-1a and OC-1b) located on the supply side of the autotransformer. If an overcurrent device were located in series with the shunt winding and the overcurrent device opened, the full 208-volt supply voltage would be applied across the 32-volt secondary winding. Under those conditions, a higher-than-normal voltage would appear across the primary winding. If the load impedance were very low, the voltage could approach $208/32 \times 208 = 1352$ V.

(B) Transformer Field-Connected as an Autotransformer. A transformer field-connected as an autotransformer shall be identified for use at elevated voltage.

Informational Note: See 210.9 and 215.11 for information on permitted uses of autotransformers.

This requirement is necessary because of the dielectric voltage withstand test requirements applied to transformers. The test is conducted at 2500 volts for windings rated 250 volts or less and at 4000 volts for higher-rated windings. A transformer intended for buck or boost operation would require that the test for the low-voltage winding be based on the sum of the primary and secondary voltage ratings.

450.5 Grounding Autotransformers. Grounding autotransformers covered in this section are zigzag or T-connected transformers connected to 3-phase, 3-wire ungrounded systems for the purpose of creating a 3-phase, 4-wire distribution system or providing a neutral point for grounding purposes. Such transformers shall have a continuous per-phase current rating and a continuous neutral current rating. Zigzag-connected transformers shall not be installed on the load side of any system grounding connection, including those made in accordance with 250.24(C), 250.30(A)(1), or 250.32(B), Exception No. 1.

Informational Note: The phase current in a grounding autotransformer is one-third the neutral current.

The installation of grounding autotransformers on the load side of a supply system grounding connection is prohibited. This restriction applies to services, to separately derived systems, and to feeders and branch circuits that supply separate buildings or structures. Where a zigzag transformer is used to create a neutral reference point on a circuit that is supplied from a grounded system, the current from a line-to-ground fault is shared through the supply system transformer and the zigzag transformer.

Where the rating of the circuit in which the line-to-ground fault occurs exceeds the rating of the circuit in which the zigzag transformer is used, the shared ground-fault current through the zigzag transformer has the potential to cause serious damage to the transformer. For instance, a zigzag transformer is installed on an existing 50-ampere, 3-phase, 3-wire branch circuit to create a neutral. The branch circuit is derived from a grounded wye service, from which large-capacity, 800-ampere and 1000-ampere feeders are also supplied. A line-to-ground fault in one of these feeder circuits can result in serious damage to the zigzag transformer as a result of its sharing the fault current with the system supply transformer.

(A) Three-Phase, 4-Wire System. A grounding autotransformer used to create a 3-phase, 4-wire distribution system from a 3-phase, 3-wire ungrounded system shall conform to 450.5(A)(1) through (A)(4).

(1) Connections. The transformer shall be directly connected to the ungrounded phase conductors and shall not be switched or provided with overcurrent protection that is independent of the main switch and common-trip overcurrent protection for the 3-phase, 4-wire system.

(2) Overcurrent Protection. An overcurrent sensing device shall be provided that will cause the main switch or common-trip overcurrent protection referred to in 450.5(A)(1) to open if the load on the autotransformer reaches or exceeds 125 percent of its continuous current per-phase or neutral rating. Delayed tripping for temporary overcurrents sensed at the autotransformer overcurrent device shall be permitted for the purpose of allowing proper operation of branch or feeder protective devices on the 4-wire system.

(3) Transformer Fault Sensing. A fault-sensing system that causes the opening of a main switch or common-trip overcurrent device for the 3-phase, 4-wire system shall be provided to guard against single-phasing or internal faults.

Informational Note: This can be accomplished by the use of two subtractive-connected donut-type current transformers installed to sense and signal when an unbalance occurs in the line current to the autotransformer of 50 percent or more of rated current.

(4) Rating. The autotransformer shall have a continuous neutral-current rating that is not less than the maximum possible neutral unbalanced load current of the 4-wire system.

Exhibit 450.7 illustrates the proper method of protecting a grounding autotransformer used to provide a neutral for a 3-phase system where necessary to supply a group of single-phase, line-to-neutral loads. Separate overcurrent protection is not provided for the autotransformer because there will be no control of the system line-to-neutral voltages if the