

(2) Multigrounded Neutral System Connection. The grounded conductor of the secondary system is part of a multigrounded neutral system or static wire of which the primary neutral conductor or static wire has at least four grounding connections in each 1.6 km (1 mile) of line in addition to a grounding connection at each service.

Maximum protection is achieved where the SPD protecting a transformer supplying a secondary system has the grounded conductor of the secondary system connected to at least four grounding locations for every one mile of primary neutral conductor.

(B) Through Spark Gap or Device. Where the surge arrester grounding electrode conductor is not connected as in 242.54(A), or where the secondary is not grounded as in 242.54(A) but is otherwise grounded as in 250.52, an interconnection shall be made through a spark gap or listed device as required by 242.54(B)(1) or (B)(2).

A spark gap device has two conductors separated by a gap often filled with a gas such as air. This permits an arc to pass between the conductors when the voltage difference between them exceeds the breakdown voltage of the gas within the gap. The arc forms, ionizing the gas, and reduces its electrical resistance, allowing the high voltage surge to pass to ground.

(1) Ungrounded or Ungrounded Primary System. For ungrounded or ungrounded primary systems, the spark gap or a listed device shall have a 60-Hz breakdown voltage of at least twice the primary circuit voltage but not necessarily more than 10 kV, and there shall be at least one other ground on the grounded conductor of the secondary that is not less than 6.0 m (20 ft) distant from the surge-arrester grounding electrode.

(2) Multigrounded Neutral Primary System. For multigrounded neutral primary systems, the spark gap or listed device shall have a 60-Hz breakdown of not more than 3 kV, and there shall be at least one other ground on the grounded conductor of the secondary that is not less than 6.0 m (20 ft) distant from the surge-arrester grounding electrode.

(C) By Special Permission. An interconnection of the surge-arrester ground and the secondary neutral conductor, other than as provided in 242.54(A) or (B), shall be permitted to be made only by special permission.

242.56 Grounding Electrode Conductor Connections and Enclosures. Except as indicated in this article, surge-arrester grounding electrode conductor connections shall be made as specified in Article 250, Parts III and X. Grounding electrode conductors installed in metal enclosures shall comply with 250.64(E).

ARTICLE 245

Overcurrent Protection for Systems Rated Over 1000 Volts ac, 1500 Volts dc

N 245.1 Scope. This article covers overcurrent protection requirements for systems over 1000 volts ac, 1500 volts dc, nominal.

New Article 245 has been created to cover overcurrent protection for systems rated over 1000 volts ac, 1500 volts dc. Former Article 240 Part IX has been relocated here as the basis for new Article 245, which was created to aid in the usability of the NEC® when locating medium-voltage overcurrent protection requirements.

N 245.2 Reconditioned Equipment.

N (A) Reconditioned Equipment Permitted. The following reconditioned equipment shall be permitted:

- (1) Medium- and high-voltage circuit breakers
- (2) Electromechanical protective relays and current transformers

N (B) Reconditioned Equipment Not Permitted. Medium-voltage fuseholders and medium-voltage nonrenewable fuses shall not be permitted.

N 245.21 Circuit-Interrupting Devices.

N (A) Circuit Breakers.

N (1) Location.

- (a) Circuit breakers installed indoors shall be mounted either in metal-enclosed units or fire-resistant cell-mounted units, or they shall be permitted to be open-mounted in locations accessible to qualified persons only.
- (b) Circuit breakers used to control oil-filled transformers in a vault shall either be located outside the transformer vault or be capable of operation from outside the vault.
- (c) Oil circuit breakers shall be arranged or located so that adjacent readily combustible structures or materials are safeguarded in an approved manner.

N (2) Operating Characteristics. Circuit breakers shall have the following equipment or operating characteristics:

- (1) An accessible mechanical or other identified means for manual tripping, independent of control power
- (2) Be release free (trip free)
- (3) If capable of being opened or closed manually while energized, main contacts that operate independently of the speed of the manual operation
- (4) A mechanical position indicator at the circuit breaker to show the open or closed position of the main contacts
- (5) A means of indicating the open and closed position of the breaker at the point(s) from which they may be operated

N (3) Nameplate. A circuit breaker shall have a permanent and legible nameplate showing the manufacturer's name or