

(c), see section 509 of Pub. L. 91-173, set out as an Effective Date note under section 801 of this title.

§ 866. Trailing cables

(a) Requirements established for flame resistant cables

Trailing cables used in coal mines shall meet the requirements established by the Secretary for flame-resistant cables.

(b) Circuit breakers; markings and visual observation of position of disconnection devices

Short-circuit protection for trailing cables shall be provided by an automatic circuit breaker or other no less effective device approved by the Secretary of adequate current-interrupting capacity in each ungrounded conductor. Disconnecting devices used to disconnect power from trailing cables shall be plainly marked and identified and such devices shall be equipped or designed in such a manner that it can be determined by visual observation that the power is disconnected.

(c) Distribution center junctions; safety connections

When two or more trailing cables junction to the same distribution center, means shall be provided to assure against connecting a trailing cable to the wrong size circuit breaker.

(d) Temporary splices; usable period; exceptions; quality

One temporary splice may be made in any trailing cable. Such trailing cable may only be used for the next twenty-four hour period. No temporary splice shall be made in a trailing cable within twenty-five feet of the machine, except cable reel equipment. Temporary splices in trailing cables shall be made in a workmanlike manner and shall be mechanically strong and well insulated. Trailing cables or hand cables which have exposed wires or which have splices that heat or spark under load shall not be used. As used in this subsection, the term "splice" means the mechanical joining of one or more conductors that have been severed.

(e) Permanent splices; quality

When permanent splices in trailing cables are made, they shall be—

- (1) mechanically strong with adequate electrical conductivity and flexibility;
- (2) effectively insulated and sealed so as to exclude moisture; and
- (3) vulcanized or otherwise treated with suitable materials to provide flame-resistant qualities and good bonding to the outer jacket.

(f) Clamping of cables

Trailing cables shall be clamped to machines in a manner to protect the cables from damage and to prevent strain on the electrical connections. Trailing cables shall be adequately protected to prevent damage by mobile equipment.

(g) Making and breaking of connections to junction boxes

Trailing cable and power cable connections to junction boxes shall not be made or broken under load.

(Pub. L. 91-173, title III, §306, Dec. 30, 1969, 83 Stat. 779.)

§ 867. Grounding of equipment

(a) Metallic enclosed power conductors; metallic frames and other equipment; methods

All metallic sheaths, armors, and conduits enclosing power conductors shall be electrically continuous throughout and shall be grounded by methods approved by an authorized representative of the Secretary. Metallic frames, casings, and other enclosures of electric equipment that can become "alive" through failure of insulation or by contact with energized parts shall be grounded by methods approved by an authorized representative of the Secretary. Methods other than grounding which provide no less effective protection may be permitted by the Secretary or his authorized representative.

(b) Frames of offtrack direct current machines; enclosures of related detached components

The frames of all offtrack direct current machines and the enclosures of related detached components shall be effectively grounded, or otherwise maintained at no less safe voltages, by methods approved by an authorized representative of the Secretary.

(c) Stationary high-voltage equipment powered by underground delta systems

The frames of all stationary high-voltage equipment receiving power from ungrounded delta systems shall be grounded by methods approved by an authorized representative of the Secretary.

(d) Repairs of high-voltage lines; exceptions

High-voltage lines, both on the surface and underground, shall be deenergized and grounded before work is performed on them, except that repairs may be permitted, in the case of energized surface high-voltage lines, if such repairs are made by a qualified person in accordance with procedures and safeguards, including, but not limited to a requirement that the operator of such mine provide, test, and maintain protective devices in making such repairs, to be prescribed by the Secretary prior to the operative date of this subchapter.

(e) Deenergizing of underground power circuits on idle days; exceptions

When not in use, power circuits underground shall be deenergized on idle days and idle shifts, except that rectifiers and transformers may remain energized.

(Pub. L. 91-173, title III, §307, Dec. 30, 1969, 83 Stat. 780.)

REFERENCES IN TEXT

For the operative date of this subchapter, referred to in subsec. (d), see section 509 of Pub. L. 91-173, set out as an Effective Date note under section 801 of this title.

§ 868. Underground high-voltage distribution

(a) Circuits entering underground areas of mines; circuit breakers

High-voltage circuits entering the underground area of any coal mine shall be protected by suitable circuit breakers of adequate interrupting capacity which are properly tested and maintained as prescribed by the Secretary. Such breakers shall be equipped with devices to pro-

vide protection against under-voltage, grounded phase, short circuit, and overcurrent.

(b) Circuits extending underground and supplying equipment; direct neutral grounds; ground conductors for frames, exceptions; location of disconnection devices, exceptions

High-voltage circuits extending underground and supplying portable, mobile, or stationary high-voltage equipment shall contain either a direct or derived neutral which shall be grounded through a suitable resistor at the source transformers, and a grounding circuit, originating at the grounded side of the grounding resistor, shall extend along with the power conductors and serve as a grounding conductor for the frames of all high-voltage equipment supplied power from that circuit, except that the Secretary or his authorized representative may permit ungrounded high-voltage circuits to be extended underground to feed stationary electrical equipment if such circuits are either steel armored or installed in grounded, rigid steel conduit throughout their entire length, and upon his finding that such exception does not pose a hazard to the miners. Within one hundred feet of the point on the surface where high-voltage circuits enter the underground portion of the mine, disconnecting devices shall be installed and so equipped or designed in such a manner that it can be determined by visual observation that the power is disconnected, except that the Secretary or his authorized representative may permit such devices to be installed at a greater distance from such area of the mine if he determines, based on existing physical conditions, that such installation will be more accessible at a greater distance and will not pose any hazard to the miners.

(c) Grounding resistors

The grounding resistor, where required, shall be of the proper ohmic value to limit the voltage drop in the grounding circuit external to the resistor to not more than 100 volts under fault conditions. The grounding resistor shall be rated for maximum fault current continuously and insulated from ground for a voltage equal to the phase-to-phase voltage of the system.

(d) Inclusion of fail safe ground check circuits in resistance grounded systems; operative functions; time extension

Six months after the operative date of this subchapter, high-voltage, resistance grounded systems shall include a fail safe ground check circuit to monitor continuously the grounding circuit to assure continuity and the fail safe ground check circuit shall cause the circuit breaker to open when either the ground or pilot check wire is broken, or other no less effective device approved by the Secretary or his authorized representative to assure such continuity, except that an extension of time, not in excess of twelve months, may be permitted by the Secretary on a mine-by-mine basis if he determines that such equipment is not available.

(e) Underground cables used in resistance grounded systems; metallic shields for power conductors; standards; splices

(1) Underground high-voltage cables used in resistance grounded systems shall be equipped

with metallic shields around each power conductor, with one or more ground conductors having a total cross-sectional area of not less than one-half the power conductor, and with an insulated internal or external conductor not smaller than No. 8 (AWG) for the ground continuity check circuit.

(2) All such cables shall be adequate for the intended current and voltage. Splices made in such cables shall provide continuity of all components.

(f) Couplers for power circuits; guidelines for construction

Couplers that are used with medium-voltage or high-voltage power circuits shall be of the three-phase type with a full metallic shell, except that the Secretary may permit, under such guidelines as he may prescribe, no less effective couplers constructed of materials other than metal. Couplers shall be adequate for the voltage and current expected. All exposed metal on the metallic couplers shall be grounded to the ground conductor in the cable. The coupler shall be constructed so that the ground check continuity conductor shall be broken first and the ground conductors shall be broken last when the coupler is being uncoupled.

(g) Connections of single-phase loads

Single-phase loads, such as transformer primaries, shall be connected phase to phase.

(h) Installation of underground transmission cables

All underground high-voltage transmission cables shall be installed only in regularly inspected air courses and haulageways, and shall be covered, buried, or placed so as to afford protection against damage, guarded where men regularly work or pass under them unless they are six and one-half feet or more above the floor or rail, securely anchored, properly insulated, and guarded at ends, and covered, insulated, or placed to prevent contact with trolley wires and other low-voltage circuits.

(i) Disconnection devices; location; visual observation of position of switch

Disconnecting devices shall be installed at the beginning of branch lines in high-voltage circuits and equipped or designed in such a manner that it can be determined by visual observation that the circuit is deenergized when the switches are open.

(j) Circuit breakers and disconnection devices; markings

Circuit breakers and disconnecting switches underground shall be marked for identification.

(k) Splices in cables used as trailing cables; terminations and splices in other cables

In the case of high-voltage cables used as trailing cables, temporary splices shall not be used and all permanent splices shall be made in accordance with section 866(e) of this title. Terminations and splices in all other high-voltage cables shall be made in accordance with the manufacturer's specifications.

(l) Grounding of frames of underground equipment

Frames, supporting structures, and enclosures of stationary, portable, or mobile underground

high-voltage equipment and all high-voltage equipment supplying power to such equipment receiving power from resistance grounded systems shall be effectively grounded to the high-voltage ground.

(m) Moving of power centers, transformers, and cables; deenergizing; exceptions; safety guidelines; record of examinations

Power centers and portable transformers shall be deenergized before they are moved from one location to another, except that, when equipment powered by sources other than such centers or transformers is not available, the Secretary may permit such centers and transformers to be moved while energized, if he determines that another equivalent or greater hazard may otherwise be created, and if they are moved under the supervision of a qualified person, and if such centers and transformers are examined prior to such movement by such person and found to be grounded by methods approved by an authorized representative of the Secretary and otherwise protected from hazards to the miner. A record shall be kept of such examinations. High-voltage cables, other than trailing cables, shall not be moved or handled at any time while energized, except that, when such centers and transformers are moved while energized as permitted under this subsection, energized high-voltage cables attached to such centers and transformers may be moved only by a qualified person and the operator of such mine shall require that such person wear approved and tested insulated wireman's gloves.

(Pub. L. 91-173, title III, §308, Dec. 30, 1969, 83 Stat. 780.)

REFERENCES IN TEXT

For the operative date of this subchapter, referred to in subsec. (d), see section 509 of Pub. L. 91-173, set out as an Effective Date note under section 801 of this title.

§ 869. Underground low- and medium-voltage alternating current circuits

(a) Circuits providing power for three-phase equipment; circuit breakers

Low- and medium-voltage power circuits serving three-phase alternating current equipment shall be protected by suitable circuit breakers of adequate interrupting capacity which are properly tested and maintained as prescribed by the Secretary. Such breakers shall be equipped with devices to provide protection against under-voltage, grounded phase, short circuit, and over-current.

(b) Circuits used underground; direct neutral grounds; ground conductors for frames; exceptions; grounding resistors

Low- and medium-voltage three-phase alternating-current circuits used underground shall contain either a direct or derived neutral which shall be grounded through a suitable resistor at the power center, and a grounding circuit, originating at the grounded side of the grounding resistor, shall extend along with the power conductors and serve as a grounding conductor for the frames of all the electrical equipment supplied power from that circuit, except that the Secretary or his authorized representative may

permit ungrounded low- and medium-voltage circuits to be used underground to feed such stationary electrical equipment if such circuits are either steel armored or installed in grounded rigid steel conduit throughout their entire length. The grounding resistor, where required, shall be of the proper ohmic value to limit the ground fault current to 25 amperes. The grounding resistor shall be rated for maximum fault current continuously and insulated from ground for a voltage equal to the phase-to-phase voltage of the system.

(c) Inclusion of fail safe ground check circuits in resistance ground systems; operative functions; time extension; couplers for power circuits; guidelines for construction

Six months after the operative date of this subchapter, low- and medium-voltage resistance grounded systems shall include a fail safe ground check circuit to monitor continuously the grounding circuit to assure continuity which ground check circuit shall cause the circuit breaker to open when either the ground or pilot check wire is broken, or other no less effective device approved by the Secretary or his authorized representative to assure such continuity, except that an extension of time, not in excess of twelve months, may be permitted by the Secretary on a mine-by-mine basis if he determines that such equipment is not available. Cable couplers shall be constructed so that the ground check continuity conductor shall be broken first and the ground conductors shall be broken last when the coupler is being uncoupled.

(d) Disconnecting devices installed in conjunction with circuit breakers; purpose; trailing cables for mobile equipment; guidelines for construction; time extension; splices

Disconnecting devices shall be installed in conjunction with the circuit breaker to provide visual evidence that the power is disconnected. Trailing cables for mobile equipment shall contain one or more ground conductors having a cross sectional area of not less than one-half the power conductor, and, six months after the operative date of this subchapter, an insulated conductor for the ground continuity check circuit or other no less effective device approved by the Secretary or his authorized representative to assure such continuity, except that an extension of time, not in excess of twelve months may be permitted by the Secretary on a mine-by-mine basis if he determines that such equipment is not available. Splices made in the cables shall provide continuity of all components.

(e) Connections of single phase loads

Single phase loads shall be connected phase to phase.

(f) Circuit breakers; markings

Circuit breakers shall be marked for identification.

(g) Trailing cables for medium voltage circuits; guidelines for construction

Trailing cables for medium voltage circuits shall include grounding conductors, a ground check conductor, and ground metallic shields around each power conductor or a grounded metallic shield over the assembly, except that on