

the diametrical clearance between the wire or cable insulation and the holes in the bushings shall not exceed $\frac{1}{16}$ -inch (based on the nominal specified diameter of the cable). The insulating bushings shall be secured in the metal wall.

(c) Insulated wires or cables conducted from one explosion-proof enclosure to another through conduit, tubing, piping, or other solid-wall passageways will be acceptable provided one end of the passageway is plugged, thus isolating one enclosure from the other. Glands of secured bushings with close-fitting holes through which the wires or cables are conducted will be acceptable for plugging. The tubing or duct specified for the passageway shall be brazed or welded into the walls of both explosion-proof enclosures with continuous gas-tight welds.

(d) If wires and cables are taken through openings closed with sealing compounds, the design of the opening and characteristics of the compounds shall be such as to hold the sealing material in place without tendency of the material to crack or flow out of its place. The material also must withstand explosion tests without cracking or loosening.

(e) Openings through common walls between explosion-proof enclosures not provided with bushings or sealing compound, shall be large enough to prevent pressure piling.

§ 18.39 Hose conduit.

Hose conduit shall be provided for mechanical protection of all machine cables that are exposed to damage. Hose conduit shall be flame resistant and have a minimum wall thickness of $\frac{3}{16}$ inch. The flame resistance of hose conduit will be determined in accordance with the requirements of § 18.65.

§ 18.40 Cable clamps and grips.

Insulated clamps shall be provided for all portable (trailing) cables to prevent strain on the cable terminals of a machine. Also insulated clamps shall be provided to prevent strain on both ends of each cable or cord leading from a machine to a detached or separately mounted component. Cable grips anchored to the cable may be used in lieu of insulated strain clamps. Supporting

clamps for cables used for wiring around machines shall be provided in a manner acceptable to MSHA.

§ 18.41 Plug and receptacle-type connectors.

(a) Plug and receptacle-type connectors for use in by the last open crosscut in a gassy mine shall be so designed that insertion or withdrawal of a plug cannot cause incendive arcing or sparking. Also, connectors shall be so designed that no live terminals, except as hereinafter provided, are exposed upon withdrawal of a plug. The following types will be acceptable:

(1) Connectors in which the mating or separation of the male and female electrodes is accomplished within an explosion-proof enclosure.

(2) Connectors that are mechanically or electrically interlocked with an automatic circuit-interrupting device.

(i) *Mechanically interlocked connectors.* If a mechanical interlock is provided the design shall be such that the plug cannot be withdrawn before the circuit has been interrupted and the circuit cannot be established with the plug partially withdrawn.

(ii) *Electrically interlocked connectors.* If an electrical interlock is provided, the total load shall be removed before the plug can be withdrawn and the electrical energy in the interlocking pilot circuit shall be intrinsically safe, unless the pilot circuit is opened within an explosion-proof enclosure.

(3) Single-pole connectors for individual conductors of a circuit used at terminal points shall be so designed that all plugs must be completely inserted before the control circuit of the machine can be energized.

(b) Plug and receptacle-type connectors used for sectionalizing the cables out by the last open crosscut in a gassy mine need not be explosion-proof or electrically interlocked provided such connectors are designed and constructed to prevent accidental separation.

(c) Conductors shall be securely attached to the electrodes in a plug or receptacle and the connections shall be totally enclosed.

(d) Molded-elastomer connectors will be acceptable provided:

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(1) Any free space within the plug or receptacle is isolated from the exterior of the plug.

(2) Joints between the elastomer and metal parts are not less than 1 inch wide and the elastomer is either bonded to or fits tightly with metal parts.

(e) The contacts of all line-side connectors shall be shielded or recessed adequately.

(f) For a mobile battery-powered machine, a plug and receptacle-type connector will be acceptable in lieu of an interlock provided:

(1) The plug is padlocked to the receptacle and is held in place by a threaded ring or equivalent mechanical fastening in addition to a padlock. A connector within a padlocked enclosure will be acceptable; or,

(2) The plug is held in place by a threaded ring or equivalent mechanical fastening, in addition to the use of a device that is captive and requires a special tool to disengage and allow for the separation of the connector. All connectors using this means of compliance shall have a clearly visible warning tag that states: "DO NOT DIS-ENGAGE UNDER LOAD," or an equivalent statement; or,

(3) The plug is held in place by a spring-loaded or other locking device, that maintains constant pressure against a threaded ring or equivalent mechanical fastening, to secure the plug from accidental separation. All connectors using this means of compliance shall have a clearly visible warning tag that states: "DO NOT DIS-ENGAGE UNDER LOAD," or an equivalent statement.

[33 FR 4660, Mar. 19, 1968, as amended at 68 FR 37082, June 23, 2003]

§ 18.42 Explosion-proof distribution boxes.

(a) A cable passing through an outside wall(s) of a distribution box shall be conducted either through a packing gland or an interlocked plug and receptacle.

(b) Short-circuit protection shall be provided for each branch circuit connected to a distribution box. The current-carrying capacity of the specified connector shall be compatible with the automatic circuit-interrupting device.

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(c) Each branch receptacle shall be plainly and permanently marked to indicate its current-carrying capacity and each receptacle shall be such that it will accommodate only an appropriate plug.

(d) Provision shall be made to relieve mechanical strain on all connectors to distribution boxes.

§ 18.43 Explosion-proof splice boxes.

Internal connections shall be rigidly held and adequately insulated. Strain clamps shall be provided for all cables entering a splice box.

§ 18.44 Non-intrinsically safe battery-powered equipment.

(a) Battery-powered equipment shall use battery assemblies approved under Part 7 of this chapter, or battery assemblies accepted or certified under this part prior to August 22, 1989.

(b) Battery box covers shall be secured in a closed position.

(c) Each wire or cable leaving a battery box on storage battery-operated equipment shall have short-circuit protection in an explosion-proof enclosure located as close as practicable to the battery terminals. A short-circuit protection device installed within a nearby explosion-proof enclosure will be acceptable. In no case shall the exposed portion of the cable from the battery box to the enclosure exceed 36 inches in length. Each wire or cable shall be protected from damage.

[53 FR 23500, June 22, 1988]

§ 18.45 Cable reels.

(a) A self-propelled machine, that receives electrical energy through a portable cable and is designed to travel at speeds exceeding 2.5 miles per hour, shall have a mechanically, hydraulically, or electrically driven reel upon which to wind the portable cable.

(b) The enclosure for moving contacts or slip rings of a cable reel shall be explosion-proof.

(c) Cable-reel bearings shall not constitute an integral part of a circuit for transmitting electrical energy.

(d) Cable reels for shuttle cars and locomotives shall maintain positive tension on the portable cable during reeling and unreeling. Such tension shall