

## § 18.36

(d) Suitable provisions shall be made to facilitate disconnection of portable cable quickly and conveniently for replacement.

[33 FR 4660, Mar. 19, 1968; 33 FR 6343, Apr. 26, 1968, as amended at 57 FR 61223, Dec. 23, 1992]

### § 18.36 Cables between machine components.

(a) Cables between machine components shall have: (1) Adequate current-carrying capacity for the loads involved, (2) short-circuit protection, (3) insulation compatible with the impressed voltage, and (4) flame-resistant properties unless totally enclosed within a flame-resistant hose conduit or other flame-resistant material.

(b) Cables between machine components shall be: (1) Clamped in place to prevent undue movement, (2) protected from mechanical damage by position, flame-resistant hose conduit, metal tubing, or troughs (flexible or threaded rigid metal conduit will not be acceptable), (3) isolated from hydraulic lines, and (4) protected from abrasion by removing all sharp edges which they might contact.

(c) Cables (cords) for remote-control circuits extending from permissible equipment will be exempted from the requirements of conduit enclosure provided the total electrical energy carried is intrinsically safe or that the cables are constructed with heavy jackets, the sizes of which are stated in Table 6 of Appendix I. Cables (cords) provided with hose-conduit protection shall have a tensile strength not less than No. 16 (AWG) three-conductor, type SO cord. (Reference: 7.7.7 IPCEA Pub. No. S-19-81, Fourth Edition.) Cables (cords) constructed with heavy jackets shall consist of conductors not smaller than No. 14 (AWG) regardless of the number of conductors.

### § 18.37 Lead entrances.

(a) Insulated cable(s), which must extend through an outside wall of an explosion-proof enclosure, shall pass through a stuffing-box lead entrance. All sharp edges that might damage insulation shall be removed from stuffing boxes and packing nuts.

(b) Stuffing boxes shall be so designed, and the amount of packing used shall be such, that with the packing

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properly compressed, the gland nut still has a clearance distance of  $\frac{1}{8}$  inch or more to travel without meeting interference by parts other than packing. In addition, the gland nut shall have a minimum of three effective threads engaged. (See figures 8, 9 and 10 in appendix II.)

(c) Packing nuts and stuffing boxes shall be secured against loosening.

(d) Compressed packing material shall be in contact with the cable jacket for a length of not less than  $\frac{1}{2}$  inch.

(e) Special requirements for glands in which asbestos-packing material is specified are:

(1) Asbestos-packing material shall be untreated, not less than  $\frac{3}{16}$ -inch diameter if round, or not less than  $\frac{3}{16}$  by  $\frac{3}{16}$  inch if square. The width of the space for packing material shall not exceed by more than 50 percent the diameter or width of the uncompressed packing material.

(2) The allowable diametrical clearance between the cable and the holes in the stuffing box and packing nut shall not exceed 75 percent of the nominal diameter or width of the packing material.

(f) Special requirements for glands in which a compressible material (example—synthetic elastomers) other than asbestos is specified, are:

(1) The packing material shall be flame resistant.

(2) The radial clearance between the cable jacket and the nominal inside diameter of the packing material shall not exceed  $\frac{1}{32}$ -inch, based on the nominal specified diameter of the cable.

(3) The radial clearance between the nominal outside diameter of the packing material and the inside wall of the stuffing box (that portion into which the packing material fits) shall not exceed  $\frac{1}{32}$ -inch.

[33 FR 4660, Mar. 19, 1968, as amended at 57 FR 61210, Dec. 23, 1992]

### § 18.38 Leads through common walls.

(a) Insulated studs will be acceptable for use in a common wall between two explosion-proof enclosures.

(b) When insulated wires or cables are extended through a common wall between two explosion-proof enclosures in insulating bushings, such bushings shall be not less than 1-inch long and

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 inby 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 outby 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: