

**§ 20.6 General requirements.**

(a) The lamps shall be durable in construction, practical in operation, and suitable for the service for which they are designed and approved.

(b) The intensity of light, distribution of light, and battery capacity shall be adequate for the use for which the lamp is intended.

(c) Battery terminals and leads therefrom, as well as the battery gas vents, shall be designed to minimize corrosion of the electrical contacts.

(d) Bulbs and other replacement parts of the lamps shall be adequately marked as a means of identification.

**§ 20.7 Specific requirements.**

Two general classes of electric lamps are recognized in these requirements, namely: Class 1, those that are self-contained and easily carried by hand, and class 2, those that may or may not be self-contained and not so readily portable as the first class.

(a) *Class 1.* Class 1 includes hand lamps, signal lamps, inspection lamps, flashlights, and animal lamps which are operated by small storage batteries or dry cells.

(b) *Class 2.* Class 2 includes lamps such as the pneumatic-electric types and large battery lamps.

**§ 20.8 Class 1 lamps.**

(a) *Protection against explosion hazards.* Unless properly designed, class 1 lamps present two sources of probable explosion hazards: Ignition of an explosive atmosphere by the heated filament of the bulb in case the bulb glass is accidentally broken, and ignition by electric sparks or arcs from the battery or connections thereto. MSHA's therefore, requires the following safeguards:

(1) *Safety device or design.* The lighting unit shall have a safety device to prevent the ignition of explosive mixtures of methane and air if the bulb glass surrounding the filament is broken. Alternatively, if the lamp is designed and constructed of materials that will prevent the ignition of explosive mixtures of methane and air by protecting the bulb from breakage and preventing exposure of the hot filament, no separate safety device is required. Alternative designs will be evaluated by mechanical impact tests,

temperature tests and thermal shock tests to determine that the protection provided is no less effective than a safety device.

(2) *Safety device (protection).* The design of the safety device and the housing which protects it shall be such that the action of the safety device is positive; yet the lamp shall not be too readily extinguished during normal service by the unnecessary operation of the device.

(3) *Locks or seals.* For lamps other than flashlights, all parts, such as bulb housing and battery container, through which access may be had to live terminals or contacts shall be adequately sealed or equipped with magnetic or other equally reliable locks to prevent opening by unauthorized persons. For flashlights, provision shall be made for sealing the battery container.

(4) *Battery current restricted.* Unless all current-carrying parts including conductors, are adequately covered and protected by the sealed or locked compartments, the maximum possible current flow through that part shall be limited by battery design, or by an enclosed-type fuse inside the sealed or locked container, to values that will not produce sparks or arcs sufficient to ignite an explosive mixture of methane and air.

(b) *Protection against bodily hazard.* This hazard is chiefly due to the possible burning of the user by electrolyte spilled from the battery. MSHA, therefore, requires that:

(1) *Spilling of electrolyte.* The lamp shall be so designed and constructed that when properly filled the battery will neither leak nor spill electrolyte under conditions of normal use. Lamps passing a laboratory spilling test will be considered satisfactory in this respect, contingent upon satisfactory performance in service.

(2) *Corrosion of battery container.* The material of which the container is made shall resist corrosion under conditions of normal use.

[Sched. 10C, May 17, 1938, as amended at 5 FR 3467, Aug. 30, 1940; 54 FR 30513, July 20, 1989]

**§ 20.9 Class 2 lamps.**

(a) *Safety.* (1) Unless special features of the lamp prevent ignition of explosive mixtures of methane and air by

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the broken bulb or other igniting sources within the lamp, the bulb and all spark-producing parts must be enclosed in explosion-proof compartments.

(2) Explosion-proof compartments will be tested while filled and surrounded with explosive mixtures of Pittsburgh natural gas<sup>1</sup> and air. A sufficient number of tests of each compartment will be made to prove that there is no danger of ignition of the mixture surrounding the lamp by explosions within the compartment. The lamp will not pass the above tests, even though the surrounding explosive mixtures are not ignited, if external flame is observed, if excessive pressures are developed, or if excessive distortion of any part of the compartment takes place.

(3) Glass-enclosed parts of such compartments must be guarded and be of extra-heavy glass to withstand pick blows, and be adequately protected by shrouds or by an automatic cut-out that opens the lamp circuit if the enclosure is broken.

(4) When an explosion-proof enclosure consists of two or more parts that are held together securely by bolts or some suitable means to permit assembly, the flanges comprising the joints between parts shall have surfaces with metal-to-metal contact, except enclosures requiring glass, in which case glass-to-metal joints are permitted. Gaskets, if adequate, may be used to obtain a firm seat for the glass but not elsewhere. Rubber, putty, and plaster of paris are not acceptable as material for gaskets. For enclosures having an unoccupied volume (air space) of more than 60 cubic inches the width of the joint measured along the shortest flame path from the inside to the outside of the enclosure shall not be less than 1 inch. When the unoccupied volume (air space) is less than 60 cubic inches, this path shall not be less than three-fourths inch.

(b) *Locks and seals (lighting attachment)*. Explosion-proof compartments shall be equipped with seals or locks

<sup>1</sup>Investigation has shown that for practical purposes Pittsburgh natural gas (containing a high percentage of methane) is a satisfactory substitute for pure methane.

that prevent unauthorized and unsafe opening of the compartments in a mine.

(c) *Locks or seals (battery)*. The battery shall be enclosed in a locked or sealed container that will prevent exposure of live terminals.

(d) *Temperature of lamp*. The temperature of the lamp under conditions of use shall not be such that a person may be burned in handling it.

(e) *Cable and connection*. (1) The cable or cord connecting the lamp to its battery shall be of high-grade design and materials, comparable to the specially recommended trailing cables as listed by MSHA, and shall be not more than 15 feet in length.

(2) The cable (or cord) shall be adequately protected at the battery end by a fuse in the locked battery box or housing. The cable (or cord) and the fuse shall be considered parts of the lamp, and specifications for them shall be submitted by the lamp manufacturer.

(3) The method of terminating the cable (or cord) at the lamp and at the battery housing shall be adequate, but in no case shall the cable or cord be detachable.

MSHA reserves the right to make minor changes in the requirements outlined in paragraphs (e) (1), (2), and (3) of this section (No. 9, class 2 lamps), as experience and service prove to be necessary in the interests of safety.

### § 20.10 Tests (class 1 and 2 lamps).

Such tests will be made as are necessary to prove the adequacy of a lamp or any of its parts in fulfilling the purposes for which it was designed. These tests include the following:

(a) Safety tests, including tests of safety devices, electrical contacts, and explosion-proof features.

(b) Photometric tests.

(c) Tests to demonstrate adequacy of mechanical strength.

(d) Tests of nonspilling features (storage-battery lamps of class 1).

(e) Temperature tests.

### § 20.11 Material required for MSHA records.

In order that MSHA may know exactly what it has tested and approved, detailed records are kept covering each