

§ 7.45

(b) All insulating material shall have a minimum resistance of 100 megohms at 500 volts d.c. and be accepted by MSHA as flame resistant under part 18 of this chapter.

(c) Battery box and cover insulating material shall meet the acceptable performance criteria for the acid resistance test in § 7.48.

(d) Covers shall be lined with insulating material permanently attached to the underside of the cover, unless the cover is constructed of insulating material.

(e) Covers, including those used over connector receptacle housings, shall be provided with a means of securing them in a closed position.

(f) Battery boxes shall be provided with vent openings to prevent the accumulation of flammable or toxic gases or vapors within the battery assembly. The size and location of openings shall prevent direct access to cell terminals and other uninsulated current carrying parts. The total minimum unobstructed cross-sectional area of the ventilation openings shall be no less than the value determined by the following formula:

$$\frac{(N)(R)}{950} = M$$

N = Number of cells in battery box.

R = Rated 6 hour battery capacity in ampere hours.

M = Total minimum ventilation area in square inches per battery box.

(g) Battery boxes shall have drainage holes to prevent accumulation of water or electrolyte.

(h) Battery cells shall be insulated from the battery box walls, partitions and bottom by insulating material, unless such part of the battery box is constructed of insulating material. Battery box wall insulating material shall extend to the top of the wall.

(i) Cell terminals shall be burned on, except that bolted connectors using two or more bolts may be used on end terminals.

(j) Battery connections shall be designed so that total battery potential is not available between adjacent cells.

(k) Cables within a battery box shall be accepted by MSHA as flame resistant under part 18 of this chapter or approved under subpart K of this part.

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The cables shall be protected against abrasion by insulation, location, clamping, or other effective means.

(l) When the battery plug and receptacle are not located on or within the battery box, strain on the battery terminals shall be prevented by a strain-relief device on the cable. Insulating material shall be placed between the strain-relief device and cable, unless the device is constructed of insulating material.

(m) At least a ½-inch air space shall be provided between the underside of the battery cover and the top of the battery, including the terminals and connectors.

[53 FR 23500, June 22, 1988, as amended at 57 FR 61220, Dec. 23, 1992]

§ 7.45 Critical characteristics

The following critical characteristics shall be inspected or tested on each battery assembly to which an approval marking is affixed:

- (a) Thickness of covers and boxes.
- (b) Application and resistance of insulating material.
- (c) Size and location of ventilation openings.
- (d) Method of cell terminations.
- (e) Strain relief devices for cables leaving boxes.
- (f) Type, location, and physical protection of cables.

§ 7.46 Impact test.

(a) *Test procedures.* (1) Prepare four covers for testing by conditioning two covers at -13 °F (-25 °C) and two covers at 122 °F (50 °C) for a period of 48 hours.

(2) Mount the covers on a battery box of the same design with which the covers are to be approved, including any support blocks, with the battery cells completely assembled. If used, support blocks must contact only the filler material or partitions between the individual cells. At the test temperature range of 65 °F -80 °F (18.3 °C-26.7 °C), apply a dynamic force of 200 ft. lbs. to the following areas using a hemispherical weight with a 6" maximum radius:

- (i) The center of the two largest unsupported areas;
- (ii) The areas above at least two support blocks, if used;

(iii) The areas above at least two intercell connectors, one cell, and one filler cap; and

(iv) Areas on at least two corners. If the design consists of both inside and outside corners, test one of each.

(3) Record the condition of the covers, supports, intercell connectors, filler caps, cell covers, and filler material.

(b) *Acceptable performance.* Impact tests of any of the four covers shall not result in any of the following:

(1) Bent intercell connectors.

(2) Cracked or broken filler caps, except plastic tabs which extend from the body of the filler caps.

(3) Cracks in the cell cover, cells, or filler material.

(4) Cracked or bent supports.

(5) Cracked or splintered battery covers.

[53 FR 23500, June 22, 1988, as amended at 60 FR 33723, June 29, 1995]

§ 7.47 Deflection temperature test.

(a) *Test procedures.* (1) Prepare two samples for testing that measure 5 inches by ½ inch, by the thickness of the material as it will be used. Prior to testing, condition the samples at 73.4 ± 3.6 °F (23 ± 2 °C) and 50 ±5% relative humidity for at least 40 hours.

(2) Place a sample on supports which are 4 inches apart and immersed in a heat transfer medium at a test temperature range of 65 °F–80 °F (18.3 °C–26.7 °C). The heat transfer medium must be a liquid which will not chemically affect the sample. The testing apparatus must be constructed so that expansion of any components during heating of the medium does not result in deflection of the sample.

(3) Place a temperature measuring device with an accuracy of 1% into the heat transfer medium within ⅛ inch of, but not touching, the sample.

(4) Apply a total load, in pounds, numerically equivalent to 11 times the thickness of the sample, in inches, to the sample midway between the supports using a ⅛ inch radius, rounded contact. The total load includes that weight used to apply the load and any force exerted by the deflection measurement device.

(5) Use a deflection measuring device with an accuracy of ±.001 inches to

measure the deflection of the sample at the point of loading as the temperature of the medium is increased at a uniform rate of $3.6 \pm .36$ °F/min. (2 ± 0.2 °C/min.). Apply the load to the sample for 5 minutes prior to heating, to allow compensation for creep in the sample due to the loading.

(6) Record the deflection of the sample due to heating at 180 °F (82 °C).

(7) Repeat steps 2 through 6 for the other sample.

(b) *Acceptable performance.* Neither sample shall have a deflection greater than .010 inch at 180 °F (82 °C).

[53 FR 23500, June 22, 1988; 53 FR 25569, July 7, 1988; 60 FR 33723, June 29, 1995]

§ 7.48 Acid resistance test.

(a) *Test procedures.* (1) Prepare one sample each of the insulated surfaces of the battery box and of the cover that measure at least 4 inches by 8 inches, by the thickness of the sample which includes the insulation plus the battery cover or box material. The insulation thickness shall be representative of that used on the battery box and cover. If the insulation material and thickness of material are identical for the battery box and cover, only one sample need be prepared and tested.

(2) Prepare a 30 percent solution of sulfuric acid (H₂ SO₄) by mixing 853 ml of water with 199 ml of sulfuric acid (H₂ SO₄) with a specific gravity of 1.84. Completely cover the samples with the acid solution at the test temperature range of 65 °F–80 °F (18.3 °C–26.7 °C) and maintain these conditions for 7 days.

(3) After 7 days, record the condition of the samples.

(b) *Acceptable performance.* At the end of the test, the insulation shall not exhibit any blistering, discoloration, cracking, swelling, tackiness, rubberiness, or loss of bond.

[53 FR 23500, June 22, 1988, as amended at 60 FR 33723, June 29, 1995]

§ 7.49 Approval marking.

Each approved battery assembly shall be identified by a legible and permanent approval plate inscribed with the assigned MSHA approval number and securely attached to the battery box.