**Section 220.70 Grounding**

a) Grounding, metallic shielding, armors, conduit enclosing power conductors, metallic frames, casings, and other metallic enclosures of electric equipment and circuits.

 Metallic shieldings, armors, conduits enclosing power conductors, metallic frames, casings, and other metallic enclosures of electric equipment and circuits 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 Department.

b) Approved grounding methods; three (3)-phase systems.

1) Resistance Grounded Systems. A grounding circuit consisting of a grounding wire that meets the requirements of Section 220.70(f), originating at the grounded side of the grounding resistor, shall extend along with the power conductors and serve as the grounding conductor for all metallic shielding, armors, conduit enclosing power conductors, metallic frames, casings, and other metallic enclosures of electric equipment and circuits that receive power from the circuit. The grounding resistor shall be located at the power source. The grounded side of the grounding resistor shall be connected to a low resistance ground field.

2) Solidly Grounded Systems. The grounded point of three (3)-phase systems shall be grounded to a low resistance ground field and to the cases of the source transformers. A grounding circuit that meets the requirements of Section 220.70(b)(1) shall originate at the grounded point of the circuit and extend along with the power conductors and serve as a grounding circuit for the frames, casings, and other metallic enclosures of all circuits and equipment receiving power from that circuit. The grounded point shall be located at the power source. In three (3)-phase, four (4)-wire systems in which the neutral is a power conductor, the neutral shall also be grounded to a low resistance ground field at the service entrance to building or at the utilization locations.

3) Ungrounded Systems. A grounding circuit, consisting of a grounding conductor that meets the requirements of Section 220.70(i) and originating at the grounded case or frame of the power source, shall extend along with the power conductors and serve as the grounding conductor for all metallic casings and other metallic enclosures of electrical equipment and circuits receiving power from that circuit. The grounded case or frame of the power source shall be connected to a low resistance ground field.

c) Grounding method; single-phase system.

 Single phase systems shall be grounded in such manner so that the minimum amount of voltage will exist between the ungrounded conductors and earth. A conductor that meets the requirements of Section 220.70(i) shall originate at the grounded point in the circuit and extend along with the power conductors and serve as a grounding medium for the frames of all equipment receiving power from that circuit and such conductor shall also be grounded to a low resistance ground field at the service entrance or utilization points.

d) Grounding methods; direct-current systems.

1) Direct-current systems having one (1) grounded polarity. In direct-current systems having one polarity grounded to a low resistance ground field the grounded feeder wire or track rail shall be approved grounding medium. A grounding circuit meeting the requirements of Section 220.70(f) shall originate at the grounded feeder wire or tract rail and extend along with the power conductors and serve as a grounding conductor for the frames, casing, and metallic enclosures of all circuits and equipment receiving power from that credit.

2) Direct current systems having a grounded neutral point. The grounded neutral point shall be the approved grounding medium. A grounding circuit meeting the requirements of Section 220.70(f) originate at the grounded neutral point and extend along with the power conductors and serve as a grounding conductor for the frames, casings, and metallic enclosures of all circuits and equipment receiving power from that circuit.

3) Ungrounded direct-current circuits. In ungrounded direct-current circuits the grounded frame or casing of the power source shall be the approved grounding medium. In the event the power source is a direct-current generator, the frame of the generator power source is a direct-current generator, the frame of the generator shall be connected to a low resistance ground field. A grounding circuit meeting the requirements of Section 220.70(f) shall originate at the grounded frame or casing of the power source and extend along with the power conductors and serve as a grounding conductor for the frames, casings, and metallic enclosures of all circuits and equipment receiving power from that circuit.

e) Low resistance ground field; interpretation.

1) A low resistance ground field as referred to in Section 220.90 of this Part is interpreted to mean: made electrodes, buried metallic piping system, metal building framework, well or borehole casing, steel piling, and other underground metal structures installed for purpose other than grounding which have a resistance to ground of not more than five (5) OHMS. Grounding fields shall be measured at the time of installation and at least annually thereafter to insure a sufficiently low resistance ground field has been established and is being maintained and such measurements shall be recorded and kept at the installation.

2) An authorized representative of the Department may allow higher resistance to ground values if an investigation has revealed that such greater values of resistance will not pose a hazard to the miners.

f) Grounding wires; capacity.

 Where grounding wires are used to ground metallic shielding, armors, conduits, frames, casings, and other metallic enclosures, such grounding wires will be approved if:

1) Where the power conductor used is No. 6 A.W.G., or larger, the cross-sectional area of the grounding wire is at least one-half (½) the cross-sectional area of the power conductor; or

2) Where the power conductor used is less than No. 6 A.W.G., the cross-sectional area of the grounding wire is equal to the cross-sectional area of the power conductor.

g) Protection other than grounding.

 Methods other than grounding which provide no less effective protection may be permitted by the Department or its authorized representative. Such methods shall not be used unless so approved.

h) Grounding circuit; criteria.

 The grounding circuit for equipment and conductor enclosures shall:

1) Be permanent and continuous;

2) Have ample current-carrying capacity to conduct safely any currents liable to be imposed on it; and

3) Have impedance sufficiently low to facilitate the operation of the ground overcurrent devices in the circuit during fault conditions.

i) Approved grounding conductors.

 Any of the following conductors when properly installed shall be acceptable for grounding equipment to the ground field:

1) A properly-sized copper or other corrosion-resistant conductor which meets the requirements of Section 220.70(f);

2) Rigid metal conduit;

3) Electrical metallic tubing; and

4) The structural metal frame of buildings.

j) Use of grounding connectors.

 If ground wires are attached to grounded power conductors, separate clamps, suitable for such purpose, shall be used and installed to provide a solid connection.

k) Guy wire; grounding.

 Guy wires from poles supporting power lines shall be securely connected to the system ground or be provided with insulators installed near the pole end.