Installation and Maintenance of Intrinsically Safe Field Wiring in Gassy Mines

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III. RECOMMENDED PRACTICE

INSTALLATION AND MAINTENANCE OF INTRINSICALLY SAFE FIELD WIRING IN GASSY MINES

A. Installation of Intrinsically Safe Field Cables and Wires

1.1 Copper conductors shall be used and sized such that their maximum surface temperature shall not exceed 150°C when carrying the maximum current that could flow in the circuit under fault conditions. Table I lists the maximum current versus conductor size to ensure meeting this requirement.

Table I
Maximum Current/Cross Sectional Area Relationship

Max. Current (amps)	Cross Sectional Area (mm)	Equivalent AWG No.
1.0	0.017	34
1.65	0.03	32
3.3	0.09	27
5.0	0.19	24
6.6	0.28	22
8.3	0.44	20

The cross sectional area for stranded conductors is the total cross sectional area of all the strands of the conductor.

1.2 Conductors shall be covered with an insulation thickness of 0.25 mm, minimum.

1.2.1 The insulation shall be capable of withstanding an rms AC test voltage of twice the nominal voltage of the intrinsically safe circuit with a minimum of 500 V.

1.3 Multiconductor cables shall contain all conductors within an insulative outer jacket having a minimum thickness of 0.25 mm.

1.4 Cables between machine components shall have flame-resistant properties and MSHA acceptance markings indicating they meet the flame resistance test requirements of Title 30, Code of Federal Regulations, Section 18.64 (30 CFR 18.64), or be enclosed within flame-resistant hose conduit having a minimum wall thickness of 3/16 inch and MSHA acceptance markings indicating it meets the flame test requirements of 30 CFR 18.65.

1.4.1 Cables and wires containing intrinsically safe circuits where conductor size is smaller than AWG No. 14 shall be accepted as meeting MSHA flame-resistant requirements if they pass the MSHA flame test for fiber optic cables, MSHA Program Policy Letter No. 88-II-1.

1.5 Cables and wires containing intrinsically safe circuits shall be so identified. The use of a bright blue color on the outer jacket is the preferred method for identification. Alternative methods of identification are the use of a bright blue band around the cable or wire, 0.5 inch minimum width, at intervals not exceeding 3 feet, or the marking "IS" impressed or durably printed on the cable jacket at intervals not exceeding 3 feet. The means of identification shall be visible after installation.

1.6 Intrinsically safe circuits from different intrinsically safe systems shall not be run in the same multiconductor cable. Multiple intrinsically safe circuits from a single intrinsically safe system or apparatus shall not be run in the same multiconductor cable unless allowed in the MSHA acceptance drawings for that system or apparatus. When allowed, each intrinsically safe circuit will be required to be shielded with the shields connected to ground at one end unless combinations of cable faults have been found to not create a safety hazard.

1.7 Cables and wires containing intrinsically safe circuits shall not be positioned close to intense magnetic fields, power distribution lines, heavy current carrying single conductor cables or wires, or high voltage uninsulated conductors to avoid electro-magnetic induction effects that might allow the energy level of intrinsically safe circuits to become capable of producing an ignition. When physical separation is not possible, attention should be given to twisting or shielding of the intrinsically safe conductors.

1.8 Intrinsically safe cables and wires between machine components shall be clamped in place to prevent undue movement, protected from mechanical damage, isolated from hydraulic lines and protected from abrasion by removing all sharp edges which they might contact.

1.8.1 Protection from mechanical damage may be by position, flame-resistant hose conduit, armoring, metal tubing, or troughs and trays. The armoring of armored cables shall be grounded at both ends of the cables.

1.8.2 Intrinsically safe machine remote control cables are not required to be protected by conduit.

1.9 Since the intrinsic safety of apparatus and systems may be dependent on cable length; distributed capacitance, inductance and resistance; or inductance to resistance ratio (L/R), cables and wires containing intrinsically safe circuits must be selected and installed in accordance with the MSHA acceptance drawings and conditions in regard to these parameters.

1.10 Intrinsically safe cables and wires interconnecting intrinsically safe apparatus, associated apparatus, or systems may be intermingled and routed together in the same bundle, conduit, or wiring tray when the likelihood of mechanical damage is low and the insulation integrity of all cables and wiring is assured through regular maintenance.

1.10.1 Where the likelihood of mechanical damage cannot be ignored, some form of additional mechanical protection shall be provided for each cable or wire, such as the use of flame-resistant hose conduit or armoring.

1.11 Cables and wires containing intrinsically safe circuits shall not be intermingled with cables and wires containing non-intrinsically safe circuits.

1.11.1 Intrinsically safe circuits and non-intrinsically safe circuits should not be included within the same cable.

1.11.2 Intrinsically safe wires and cables shall not be included in the same bundle as non-intrinsically safe wires and cables.

1.11.3 Intrinsically safe wires and cables shall not be included within the same conduit with non-intrinsically safe wires and cables.

1.11.4 Intrinsically safe wires and cables shall be positively separated from non-intrinsically safe wires and cables by at least 50 mm spacing with the wiring separately tied down. Where machine design precludes maintaining a 50 mm spacing, intrinsically safe wires and cables may be routed together with non-intrinsically safe wires and cables if each are enclosed in MSHA accepted flame-resistant hose conduit having a minimum wall thickness of 3/16 inch.

1.11.5 The installation of wires and cables shall preclude excessive slack that might permit intrinsically safe wires and cables to contact non-intrinsically safe wires and cables.

1.11.6 Intrinsically safe wires and cables shall not be included within the same wiring tray with non-intrinsically safe wires and cables unless separated by a non-combustible physical barrier.

B. Maintenance of Intrinsically Safe Field Cables and Wires

2.1 All intrinsically safe cables and wires shall be periodically examined by qualified personnel to ensure that no damage, change, or deterioration has occurred that may degrade intrinsic safety. Replacement or repair is to be accomplished in a timely fashion.

2.1.1 Each cable and wire shall be examined to ensure its outer insulation or insulating jacket is intact with no exposed conductors, burns, cracks, or splits.

2.1.2 An examination shall be made that each cable is adequately supported and unstressed.

2.1.3 An examination shall be made that segregation is maintained between all intrinsically safe and non-intrinsically safe cables and wires and that all cables and wires are installed according to the recommended installation practice.

2.1.4 An examination shall be made that all replacement cables and wires are in accordance with the recommended installation practice and the applicable requirements of the MSHA acceptance drawings and conditions included in the equipment manufacturer's installation instructions.

2.1.5 An examination shall be made that the interconnection of all intrinsically safe apparatus and systems is in accordance with the applicable requirements of the MSHA acceptance drawings and conditions included in the equipment manufacturer's installation instructions, and that no connectors or connections have been interchanged.

2.1.6 When necessary for maintenance, cables shall be disconnected from intrinsically safe equipment in such a way that live terminals or conductors are not left exposed. Cables shall not be left unconnected and repairs shall be made in a timely fashion.

2.2 Since some intrinsically safe circuits operate at voltage and current levels sufficient to constitute a shock hazard, the same safe precautions against shock hazard shall be observed when installing or servicing intrinsically safe circuits as are observed with non-intrinsically safe circuits.

2.3 When troubleshooting tests are conducted on intrinsically safe cables, wires and connectors, installed in hazardous locations, only MSHA approved test instruments shall be used. The instruments shall be used in accordance with all MSHA approval conditions.

2.3.1 Before a test instrument is taken into a hazardous area, it shall be checked to ensure that it is working properly and is not physically damaged.

2.3.2 When troubleshooting multiconductor cables containing energized multiple intrinsically safe circuits or separate cables carrying energized intrinsically safe circuits, the test instrument shall not be connected simultaneously to separate energized intrinsically safe circuits. Connection shall be restricted to one circuit at a time.