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Standard

**Nonincendive Electrical
Equipment for Use in
Class I and II, Division 2
and Class III, Divisions 1
and 2 Hazardous
(Classified) Locations**



The International Society for Measurement and Control

ISA-S12.12 — Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations

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***NOTE:** An asterisk following a word or a section number signifies that explanatory material appears in the Appendix.

1 Purpose

1.1* The purpose of this standard is to provide minimum requirements for the design, construction, and marking of electrical equipment or parts of such equipment for use in Class I and Class II, Division 2 and Class III, Divisions 1 and 2 hazardous (classified) locations. This equipment, in normal operation, is incapable of causing ignition of the surrounding atmosphere under the conditions prescribed in this standard, although the equipment may contain electronic components that operate at incandive levels and may also have field wiring that is incandive. In addition, it is the intent of this document to establish uniformity in test methods for determining the suitability of the equipment and associated circuits and components as they relate to potential ignition of a specific flammable gas or vapor-in-air mixture, combustible dust, easily ignitable fibers, or flyings.

2 Scope

2.1 This standard applies only to equipment, circuits, and components designed specifically for use in Class I and II, Division 2 and Class III, Division 1 and 2 hazardous (classified) locations as defined in the National Electrical Code (NEC).

NOTE: Some equipment designed for use in ordinary locations is permitted by the NEC for installing in Division 2 locations. The judgment of acceptability for the installation would be determined by the authority having jurisdiction. Such equipment would not have the hazardous location marking or documentation described in this standard. It is anticipated that such equipment would comply with the other requirements in this standard and that the determination of compliance is elementary — e.g., a nonarcing instrument inside a NEMA Type 4 or 12 enclosure used in a Class II, Division 2 location.

2.2 This standard also applies to certain ordinary (unclassified) location equipment specifically designed to directly connect to nonincandive field wiring in Class I and II, Division 2 and Class III, Division 1 and 2 hazardous (classified) locations as defined in the National Electrical Code.

2.3 This standard is primarily intended to provide requirements for electrical and electronic test, measuring, and controlling equipment.

2.4 This standard is concerned only with equipment construction and test criteria related to electrical or thermal ignition of specified flammable gases, vapors, combustible dusts, fibers, and flyings in air.

2.5 This standard is not intended to cover equipment for use in Class I and Class II, Division 1 locations, such as equipment constructed to be intrinsically safe, dust ignition-proof, or explosion-proof. Such equipment is, however, suitable for use in Class I and Class II, Division 2 locations in the same group for which it is suitable in Division 1.

2.6 This standard does not cover mechanisms of ignition from external sources, such as static electricity or lightning, that are not related to the electrical characteristics of the equipment.

***NOTE:** An asterisk following a word or a section number signifies that explanatory material appears in the [Appendix](#).

2.7 This standard is not intended as an instructional manual for untrained persons. It is intended to promote uniformity of practice among those skilled in the art of design, construction and application of equipment suitable for Class I and Class II, Division 2 and Class III, Divisions 1 and 2 locations.

2.8* The requirements of this standard are based on consideration of ignition in locations made hazardous by the presence of flammable gases, vapors, combustible dusts, fibers, and flyings under the following ambient conditions:

- a) an ambient temperature of -13°F (-25°C) to 104°F (40°C);
- b) an oxygen concentration of not greater than 21 percent by volume; and
- c) a pressure of 12.5 to 15.7 psia (86 to 108 kPa).

NOTE: If equipment is specified to operate in conditions outside the ranges listed above, the requirements of this standard may not ensure the desired level of safety.

2.9 This standard covers portable battery-powered equipment other than flashlights and lanterns for Class I and Class II, Division 2, and Class III, Division 1 and 2 hazardous (classified) locations.

2.10 This standard does not cover equipment that utilizes purged or pressurized enclosures. Such equipment is, however, considered suitable for use in Class I, Class II, Division 2 and Class III, Division 1 and 2 locations when designed to meet the requirements of ANSI/NFPA 496.¹

2.11 This standard does not cover electric lighting fixtures for use in Division 2 hazardous (classified) locations.

2.12 This standard does not cover electric motors, electric heaters, heat-tracing cables, and similar heat-producing devices, except where they are an integral part of the equipment under evaluation, for use in Division 2 locations.

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 dust-tight: So constructed that dust will not enter the enclosing case under specified test conditions.

3.2 hermetically sealed device: A device that is sealed against the entrance of an external atmosphere and in which the seal is made by fusion — e.g., soldering, brazing, welding, or the fusion of glass to metal.

3.3 maintenance, corrective: Any maintenance activity that is not normal in the operation of the equipment and requires access to the equipment's interior. Such activities are expected to be performed by qualified personnel who are aware of the hazards involved. Such activities typically include locating causes of faulty performance, replacing defective components, and adjusting service controls.

¹NFPA Standard 496-1993, Purged and Pressurized Enclosures for Electrical Equipment in Hazardous (Classified) Locations.

3.4 maintenance, operational: Any maintenance activity, excluding corrective maintenance, that is intended to be performed by the operator and is required for the equipment to serve its intended purpose. Such operational maintenance activities typically include the correcting of "zero" on a panel instrument, changing charts, keeping of records, and adding ink.

3.5 make/break components: Components having contacts that can interrupt a circuit (even if the interruption is transient in nature). Examples of make/break components are relays, circuit breakers, servo potentiometers, adjustable resistors, switches, and connectors.

3.6 nonincendive circuit*: A circuit in which any arc or thermal effect produced under normal operating conditions of the equipment is not capable, under the conditions prescribed in this standard, of igniting the specified flammable gas, vapor-in-air mixture, dust, fibers, or flyings.

3.7 nonincendive component: Component having contacts for making or breaking a specified incendive circuit in which the contacting mechanism is constructed so that the component is not capable of ignition of the specified flammable gas or vapor-in-air mixture, when tested according to Section 12. The housing of a nonincendive component is not intended to either (1) exclude the flammable atmosphere or (2) contain an explosion.

3.8 nonincendive equipment: Equipment having electrical/electronic circuitry that is incapable, under normal operating conditions, of causing ignition of a specified flammable gas or vapor-in-air mixture due to arcing or thermal means.

3.9 nonincendive field wiring*: Wiring that enters or leaves an equipment enclosure and, under normal operating conditions of the equipment, is not capable, due to arcing or thermal effect, of igniting a specified flammable gas, vapor-in-air mixture, dust, fibers, or flyings. Normal operating conditions include opening, shorting, or grounding the field wiring.

3.10 normal operating conditions: Conditions under which equipment conforms electrically and mechanically with its design specification and is used within the conditions specified by the manufacturer. These conditions include:

- a) supply voltage, current, and frequency;
- b) environmental conditions (including process interface);
- c) all tool-removable parts (e.g., covers) in place;
- d) all operator-accessible adjustments at their most unfavorable settings; and
- e) opening or grounding of any one or shorting of any two of the nonincendive field-wiring conductors.

3.11 sealed device: A device so constructed that it cannot be opened during normal operational conditions or operational maintenance; it is sealed to restrict entry of an external atmosphere. See Section 13 for detailed requirements for sealed devices.

4 General requirements

Requirements for equipment intended to be used in Class I and Class II, Division 2 and Class III, Division 1 and 2 hazardous (classified) locations are established on the basis that the equipment in its normal operating condition is incapable of causing ignition of a specified flammable gas, vapor-in-air mixture, dust, fibers, or flyings. The tolerances associated with the components of the equipment must be considered. Subsequent arcs or thermal effects within the equipment, resulting from opening, shorting, or grounding of nonincendive field wiring, shall be taken into consideration as they affect the suitability of the equipment for use in Division 2 locations. Equipment also shall comply with the ordinary location requirements for the particular category of equipment² except as specifically amended herein.

5 Requirements for Class I, Division 2 equipment

5.1 Protection shall be provided according to 5.1.1 and 5.1.2 to ensure that under normal operating conditions such equipment is not capable of igniting the specified flammable gas or vapor-in-air mixture.

5.1.1* Each make/break component shall be either:

- a) a normally nonarcing component that meets the requirements of [Section 8](#);
- b) used in a nonincendive circuit that meets the requirements of [Section 7](#);
- c) a nonincendive component that meets the requirements of [Section 12](#); or
- d) a sealed device that meets the requirements of [Section 13](#).

5.1.2 Equipment with a surface temperature in excess of 100°C (212°F) shall comply with the requirements of [Section 10](#).

5.2 Enclosures shall provide protection to prevent deterioration of the equipment that would adversely affect its suitability for use in Class I, Division 2 locations. Although general-purpose enclosures normally will suffice, particular attention should be given to the possible need for weatherproofing, general protection from corrosion, and preventive maintenance.

5.3 Equipment shall be capable of being installed according to the requirements of the National Electrical Code.

5.4* Fuses used in circuits that are subject to overloading in normal use must be of a type suitable for use in Division 2 locations or housed in an enclosure suitable for Division 1 locations.

NOTE: This subsection precludes a fuse housed in a general-purpose enclosure from being used in a motor circuit where a possibility of a stalled motor opening the fuse exists, or where there is the possibility of an overload not caused by a fault in the circuit.

² [ANSI/ISA-S82.01](#), [S82.02](#), and [S82.03-1988](#), Safety Standard for Electrical and Electronic Test, Measuring, Controlling and Related Equipment.

5.5* If a fuse is provided, a switch suitable for the location where it is installed must also be provided to remove power from the fuse. The switch need not be integral to the equipment if the equipment installation instructions indicate the need for such a switch.

5.6 A circuit breaker that may be used as a switch must be of a type suitable for use in Division 2 locations or housed in an enclosure suitable for Division 1 locations.

6 Requirements for Class II, Division 2, Class III, Division 1 and 2 equipment

6.1* For Class II, Division 2 equipment, protection shall be provided by the use of an enclosure that meets the requirements of Section 13 or 14 or shall be a nonincendive circuit meeting the requirements of Section 7, or by a combination of these methods. For Class III locations, protection shall be provided by a dust-tight enclosure that meets the requirements of Section 14.

NOTE: Consideration must be given to shorting or bypassing components by conductive dust.

EXCEPTION: Portable battery-powered equipment need not have all electrical components and wiring enclosed provided both the following conditions are met:

- a) Entrance of dust does not result in ignition or charring of the dust; and
- b) Circuits with make/break components shall be determined to be nonincendive by testing with a propane-air mixture in accordance with the spark-ignition test. See 11.1 through 11.5 or 7.1.

7 Nonincendive circuits and nonincendive field wiring

7.1* Either of the following two methods may be employed to determine that a circuit(s) or field wiring is nonincendive:

- a) Testing the circuit according to Section 11; or
- b) Comparing the maximum calculated or measured values of current, voltage, and associated inductances and capacitances to the appropriate values in Figures 1 through 8 to establish that the current and voltage levels are below those specified in 7.1.2. For Class II and III locations the curves for propane are to be used.³

7.1.1 When evaluating a circuit as nonincendive, the following ignition sources shall be considered as normal operating conditions:

³ Figures 1, 2, 3, 4, 7, and 8 are based on information in Certification Standard SFA 3012, 1972 Edition, Department of Trade and Industry, British Approval Service, for Electrical Equipment in Flammable Atmospheres. Figures 5 and 6 are based on information in "Some Aspects of the Design of Intrinsically Safe Circuits," Research Report 256, 1968, by D. W. Widginton, Safety in Mines Research Establishment; Sheffield, England. Figures 7 and 8 represent capacitor discharge only. They do not include the additional current that may be available from the power supply.