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

Approved 3 June 2013

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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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1 Purpose

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 not capable 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 vapour-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, Divisions 1 and 2 hazardous (classified) locations as defined in the National Electrical Code[®] (NEC[®]) ANSI/NFPA 70.

NOTE Some equipment designed for use in unclassified 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 unclassified location equipment specifically designed to directly connect to nonincandive field wiring in Class I and II, Division 2 and Class III, Divisions 1 and 2 hazardous (classified) locations as defined in the NEC[®].

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 and temperature class 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.

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 area 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 -25°C to 40°C
- b) an oxygen concentration of not greater than 21 percent by volume
- c) a pressure of 80 kPa (0.8 bar) to 110 kPa (1.1 bar)

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, Divisions 1 and 2 hazardous (classified) locations.

2.10 This standard does not cover electric luminaires for use in Division 2 hazardous (classified) locations.

2.11 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.

2.12 This standard does not cover AEx requirements for equipment for use in Class I, Zone 2 hazardous (classified) locations.

2.13 This standard does not cover the requirements for equipment for use in Zone 20, Zone 21 or Zone 22.

3 Definitions

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

3.1

associated nonincendive field wiring apparatus

apparatus in which the circuits are not necessarily nonincendive themselves, but that affect the energy in nonincendive field wiring circuits and are relied upon to maintain nonincendive energy levels. Associated nonincendive field wiring apparatus may be either of the following:

- a) Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location
- b) Electrical apparatus not so protected that shall not be used in a hazardous (classified) location

NOTE Associated nonincendive field wiring apparatus has designated associated nonincendive field wiring apparatus connections for nonincendive field wiring apparatus and may also have connections for other electrical apparatus.

3.2

control drawing

a drawing or other document provided by the manufacturer of the nonincendive field wiring apparatus or the associated nonincendive field wiring apparatus that details the allowed interconnections with other circuits or equipment. The control drawing includes the applicable electrical parameters to permit selection of equipment for interconnection.

3.3

dust-tight

enclosures constructed so that dust will not enter under specified test conditions.

3.4

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.

3.5

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.

3.6

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.

3.7

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.

3.8

maximum external capacitance (C_a)

maximum value of capacitance in a circuit that can be connected to the connection facilities of the associated nonincendive field wiring apparatus.

3.9

maximum external inductance (L_a)

maximum value of inductance in a circuit that can be connected to the connection facilities of the associated nonincendive field wiring apparatus.

3.10

maximum external inductance to resistance ratio (L_a/R_a)

ratio of inductance (L_a) to resistance (R_a) of any external circuit that can be connected to the connection facilities of the associated nonincendive field wiring apparatus.

3.11

maximum input power (P_i)

maximum power in an external circuit that can be applied to the connection facilities of the nonincendive field wiring apparatus.

3.12

maximum input voltage (V_{max})

maximum voltage (peak a.c. or d.c.) that can be applied to the connection facilities of the nonincendive field wiring apparatus.

3.13**maximum internal capacitance (C_i)**

total equivalent internal capacitance which is considered as appearing across the connection facilities of the nonincendive field wiring apparatus.

3.14**maximum internal inductance (L_i)**

total equivalent internal inductance which is considered as appearing at the connection facilities of the nonincendive field wiring apparatus.

3.15**maximum internal inductance to resistance ratio (L_i/R_i)**

ratio of inductance (L_i) to resistance (R_i) that is considered as appearing at the connection facilities of the nonincendive field wiring apparatus.

3.16**maximum output current (I_{sc})**

maximum output current (peak a.c. or d.c.) in a circuit that can be taken from the connection facilities of the associated nonincendive field wiring apparatus under normal operation.

3.17**maximum output voltage (V_{oc})**

maximum output voltage (peak a.c. or d.c.) in a circuit that can appear under open-circuit conditions at the connection facilities of the associated nonincendive field wiring apparatus under normal operation.

3.18**maximum output power (P_o)**

maximum electrical power in a circuit that can be taken from the connection facilities of the associated nonincendive field wiring apparatus under normal operation.

3.19**nonincendive circuit**

a circuit, other than nonincendive field wiring, in which any arc or thermal effect produced under normal operating conditions, is not capable of igniting the flammable gas-, vapor-, dust-air mixture, fibers or flyings. The circuit is evaluated under prescribed test conditions.

3.20**nonincendive component**

a component having contacts for making or breaking an incendive circuit and the contacting mechanism is constructed so that the component, under normal operating conditions, is not capable of igniting the flammable gas or vapor-air mixture. The housing of a nonincendive component is not intended to exclude the flammable atmosphere or contain an explosion. The component is evaluated under prescribed test conditions.

3.21**nonincendive equipment**

equipment having electrical/electronic circuitry that is not capable, under normal operating conditions, of causing ignition of a specified flammable gas-, vapor-, dust-air mixture fibers or flyings due to arcing or thermal means.

3.22

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 effects, of igniting the flammable gas-, vapor-, dust- air mixture, fibers or flyings. Normal operation includes opening, shorting, or grounding the field wiring.

3.23

nonincendive field wiring apparatus

nonincendive equipment intended to be connected to nonincendive field wiring.

3.24

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.

3.25

operator-accessible

readily accessible to the operator during normal use without use of a tool.

3.26

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.

3.27

service temperature

maximum or minimum temperature reached at specific points of the equipment when the equipment is operating at rated conditions, including ambient temperature and any external sources of heating or cooling.

NOTE 1 Equipment may reach different service temperatures in different parts.

NOTE 2 Rated conditions include enclosure orientation, the electrical supply and load, duty cycle or duty type, as assigned by the manufacturer, typically as shown in the marking.

3.28

unclassified locations

locations that have been evaluated by the classification process defined in ANSI/NFPA 70: and determined to be not Class I, Division 1; Class I, Division 2; Class I, Zone 0; Class I, Zone 1; Class I, Zone 2; Class II, Division 1; Class II, Division 2; Class III, Division 1; Class III, Division 2; Zone 20; Zone 21; Zone 22; or any combination thereof.

3.29

maximum input current (I_{max})

maximum current (peak a.c. or d.c.) that can be applied to the connection facilities of the nonincendive field wiring apparatus.

3.30**incendive circuit**

a circuit, in which any arc or thermal effect produced under normal operating conditions, is capable of igniting the flammable gas-, vapor-, dust-air mixture, fibers or flyings.

4 General requirements

Requirements for equipment intended to be used in Class I and Class II, Division 2 and Class III, Divisions 1 and 2 hazardous (classified) locations are established on the basis that the equipment in its normal operating condition is not capable 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 shall 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 unclassified location requirements for the particular category of equipment except as specifically amended herein (see Annex B).

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 Clause 8;
- b) used in a nonincendive circuit that meets the requirements of Clause 7;
- c) a nonincendive component that meets the requirements of Clause 12; or
- d) a sealed device that meets the requirements of Clause 13.

5.1.2 Equipment shall comply with the thermal ignition requirements of Clause 10.

5.2 Enclosures shall provide a suitable degree of protection against deterioration of the equipment that would adversely affect its suitability for use in Class I, Division 2 locations.

NOTE Although general-purpose enclosures normally will suffice, particular attention should be given to the possible need for weatherproofing, general protection from corrosion (for further information see ANSI/UL 50 or ANSI/NEMA 250, Enclosures for Electrical Equipment) and to preventive maintenance .

5.3 Fuses used in circuits that are subject to overloading in normal use shall be of a type suitable for use in Division 2 locations or housed in an enclosure suitable for Division 1 locations, unless:

- a) the operating element is immersed in oil;
- b) the operating element is enclosed within a chamber hermetically sealed against the entrance of gases and vapors; or
- c) the fuse is a nonindicating, filled, current-limiting type.

NOTE 1 Examples of circuits that are subject to overloading in normal use include This subclause 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. See 501.115(B)(3) of NFPA 70:2011 (NEC) for additional explanatory content.

NOTE 2 The material characteristics of the oil, and the depth to which the operating element of the fuse is immersed within the oil, is not controlled by this requirement.

5.4 If a ~~replaceable fuse is provided~~ fuse can be replaced from outside of the enclosure without the use of a tool, a switch suitable for the location where it is installed shall 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.

NOTE A typical construction to which this requirement applies is a fuseholder mounted through the wall of an enclosure with a threaded cap external to the enclosure and removable without the use of a tool. See 501.105(B)(5) of NFPA 70:2011 (NEC) for additional explanatory content.

5.5 A circuit breaker that may be used as a switch shall be of a type suitable for use in Division 2 locations or alternatively protected for use in Division 1 locations.

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

6.1 Equipment for Class II, Division 2 or Class III locations shall be protected by one of the following:

- a) the use of a sealed device that meets the requirements of Clause 13.
- b) the use of an enclosure that meets the requirements of Clause 14.
- c) the use of an enclosure that meets the dusttight requirements of ANSI/UL 50 and ANSI/UL 50E for equipment applications in which the gaskets and seals upon which the type of protection depends are not exposed to a service temperature greater than 60 °C.
- d) the use of an enclosure that meets the requirements of Type 4, Type 4X, Type 6 or Type 6P of ANSI/UL 50 and ANSI/UL 50E for equipment applications in which the gaskets and seals upon which the type of protection depends are not exposed to a service temperature greater than 60 °C.
- e) a nonincendive circuit meeting the requirements of Clause 7, with consideration for possible ignition in accordance with 7.2 including the shorting of any components and traces due to the entrance or accumulation of dust, and this entrance or accumulation of dust shall not result in ignition or charring of the dust due to the temperature of any part or parts that could be exposed to the dust due to the ingress of dust or by a combination of these methods.

EXCEPTION: Portable battery-powered equipment marked for use in Class II Group G or Class III only need not have all electrical components and wiring enclosed, nor have the shorting of any components and traces introduced, provided both the following conditions are met:

- a) Entrance or accumulation of dust does not result in ignition or charring of the dust due to the temperature of any part or parts that could be exposed to the dust.
- b) Circuits with make/break components shall be determined to be nonincendive with a propane-air mixture in accordance with the spark-ignition test (see 11.1 through 11.5, or 7.1).

NOTE When using an enclosure as noted above that meets the dusttight requirements of ANSI/UL 50 and ANSI/UL 50E, or that meets the Type 4, Type 4X, Type 6 or Type 6P requirements of ANSI/UL 50 and ANSI/UL 50E, the intent of the impact test in 15.3 is addressed by the impact testing required by ANSI/UL 50 and ANSI/UL 50E.

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 Clause 11
- 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 7.3; for Class II and III locations the curves for propane are to be used.