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Examination Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II and III, Division 1, Hazardous (Classified) Locations

Class Number 3610

July 2021

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Foreword

This standard is intended to verify that the products and services described will meet stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of this standard is to present the criteria for examination of various types of products and services.

Examination in accordance with this standard shall demonstrate compliance and verify that quality control in manufacturing shall ensure a consistent and reliable product.

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1 INTRODUCTION

1.1 Purpose

1.1.1 This standard states testing and certification requirements for intrinsically safe apparatus and associated apparatus.

1.1.2 Testing and certification criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance program.

1.2 Scope

1.2.1 This standard provides requirements for the construction and testing of electrical apparatus, or parts of such apparatus, whose circuits are incapable of causing ignition in:

Classes I, II & III, Division 1 hazardous (classified) locations as defined in Article 500 of the National Electrical Code®, ANSI/NFPA-70 (NEC®).

1.2.2 This standard is intended to be used in conjunction with FM Approvals Standard 3600, *Electrical Equipment for Use in Hazardous (Classified) Locations – General Requirements*, which includes the general requirements that apply to all types of classified location protection methods.

1.3 Basis for Requirements

See FM Approvals Standard 3600.

1.4 Basis for Certification

See FM Approvals Standard 3600.

1.5 Basis for Continued Certification

See FM Approvals Standard 3600.

1.6 Effective Date

The effective date of this certification standard mandates that all products tested for certification after the effective date shall satisfy the requirements of this standard.

The effective date of this standard is eighteen (18) months after the publication date of the standard for compliance with all requirements.

1.7 System of Units

Units of measurement used in this Standard are United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Conversion of U.S. customary units is in accordance with ANSI/IEEE/ASTM SI 10.

1.8 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies.

ANSI/UL 60079-11 *Explosive Atmospheres - Part 11: Equipment Protection by Intrinsic Safety "i"*

FM 3600, *Electrical Equipment for Use in Hazardous (Classified) Locations – General Requirements*

1.9 Terms and Definitions

For purposes of this standard, unless stated otherwise, the definitions given in ANSI/UL 60079-11 apply.

2 GENERAL INFORMATION

2.1 Product Information

This standard shall apply to the electrical circuits of Intrinsically Safe Apparatus intended for use in, and Associated Apparatus intended for connection to:

Classes I, II and III, Division 1, Groups A, B, C, D, E, F and G, Hazardous (Classified) Locations.

2.2 Certification Application Requirements

To apply for a certification examination the manufacturer, or its authorized representative, should submit a request to the certification agency.

2.3 Applicability of Other Standards

2.3.1 Except where modified by the requirements of this standard, intrinsically safe and associated apparatus shall comply with the applicable requirements for ordinary locations, in accordance with FM Approvals Standard 3600.

2.3.2 Associated apparatus and circuits shall conform to the requirements of the location in which they are installed.

2.4 Control Drawing

2.4.1 A control drawing shall be provided for all intrinsically safe apparatus or associated apparatus that requires interconnection to other circuits or apparatus resulting in an intrinsically safe system.

2.4.2 An intrinsically safe system could consist of the interconnection of intrinsically safe apparatus and associated apparatus investigated as a system, or the interconnection of such apparatus separately investigated under the entity evaluation concept.

3 GENERAL REQUIREMENTS

3.1 Apparatus For Class I Locations

Intrinsically Safe Equipment and/or circuits for use in Class I, Division 1, Groups A, B, C and/or D Hazardous (Classified) Locations shall comply with all applicable requirements in ANSI/UL 60079-11 for Category ‘‘ia’’, Group IIC, IIB and/or IIA as shown in Table 1.

Exception No. 1: Marking of the equipment shall meet the requirements contained in Clause 5.

Exception No. 2: At the customer’s request, equipment for Class I may be assessed against the requirements in the previous edition of ANSI/UL-60079-11

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Table 1- Class I, Division 1 Requirements

Certification Sought for Class I, Division 1, Group as follows	*Requirements from ANSI/UL 60079-11 to be applied for the group as follows*
A	IIC
B	IIC
C	IIB
D	IIA

3.2 Apparatus For Class II And Class III Locations

3.2.1 Apparatus and associated wiring that meet the requirements of Clauses 1 through 3 of this standard, as applicable, also shall be considered to meet the requirements for Class II and Class III locations, if they comply with 3.2.2 and meet the requirements of either 3.2.3 or 3.2.4.

3.2.2 The temperature of exposed surfaces of apparatus shall be less than the marked temperature class when tested according to the procedures described in 4.2.3.

Note: See the latest edition of ANSI/NFPA 499 for the minimum ignition temperatures of specified dusts.

3.2.3 Circuits of intrinsically safe apparatus shall be enclosed in a dust-tight enclosure meeting the requirements of 3.2.5. The apparatus shall also meet spark ignition requirements for Class I, Group C and D locations.

3.2.4 Circuits of intrinsically safe apparatus not enclosed in a dust-tight enclosure meeting the requirements of 3.2.5 shall meet the spark ignition requirements specified in 3.2.3. In this case, it shall be assumed that all spacings do not meet the creepage and clearance distance requirements and that all connections between live or grounded parts and conductors are in the most unfavorable condition. The number of such connections is unlimited.*

3.2.5 Dust-Tight Enclosures*

For the purposes of this standard, an enclosure is considered dust-tight if it meets the requirements of 3.2.6 or 3.2.7or if it complies with the requirements of Clause 4.2 or if it is dust-ignitionproof. In addition, a portable apparatus shall be dust-tight after the drop test described in 4.1.

3.2.6 An enclosure is considered suitable if it conforms to applicable requirements for enclosures for ordinary locations and if it has no openings and if all joints are either threaded with a 3 full-thread minimum engagement or sealed by continuous welding, brazing, soldering or fusion of glass.

3.2.7 Parts of apparatus within an enclosure suitable for ordinary locations which are encapsulated to a depth of at least 1 mm (0.04 in.) shall be considered dust-tight.

4 TEST REQUIREMENTS

4.1 Drop Test

4.1.1 Portable apparatus shall be subjected to the following drop test. Intrinsic safety shall not be affected.

4.1.2 The apparatus shall be dropped at least six times, but not more than once on one surface, edge or corner, from a height of 1 meter (39.4 in.) on to a smooth horizontal concrete floor.

4.1.3 If appropriate, a nonrestrictive guide may be used to assure a free-fall drop on the surface to be tested.

4.2 Dust-Tight Enclosure Test

4.2.1 For the purpose of this standard, an enclosure is considered suitable for Class II and III locations if it meets the requirements of 4.2.

4.2.2 Dust Exclusion Test

4.2.2.1 The test is a circulating dust method conducted by using equipment in which talcum powder is maintained in suspension in a suitable closed chamber. The talcum powder used shall pass through a square-meshed sieve whose nominal wire diameter is 50 micrometers and whose nominal width between wires is 75 micrometers. The amount of talcum powder used is 2 kg per cubic meter of the test chamber volume and is not to be used for more than 20 tests.

4.2.2.2 The equipment under test is to be supported inside the test chamber, and the pressure inside the equipment is to be maintained below atmospheric pressure by a vacuum pump. If the enclosure has a single drain hole, the suction connection is to be made to a hole specially provided for the purpose of the test. If there is more than one drain hole, the other drain holes are to be left open for the test. The object of the test is to draw into the equipment, if possible, a minimum of 80 times the volume of air in the enclosure without exceeding an extraction rate of 60 volumes per hour with a suitable depression. In no event shall the depression exceed 200 mm of water. If an extraction rate of 40 to 60 volumes per hour is obtained, the test is to be stopped after two hours. If, with a maximum depression of 200 mm of water, the extraction rate is less than 40 volumes per hour, the test is to be continued until 80 volumes have been drawn through, or a period of eight hours has elapsed.

4.2.2.3 No visible dust shall be detected inside the enclosure at the end of the test.

4.2.3 Dust Blanketing Temperature Test

4.2.3.1 The apparatus shall be mounted in its normal position and shall be covered with the dust mixture specified in this clause until no more will stay on the enclosure or component (see 3.2.7 note) or to a depth of 12 mm (0.48 in.) whichever is less. The dust shall be fine enough to pass through a 100-mesh screen and shall be one of the following:

a) Wheat, flour or corn dust (or a mixture of both);

b) Aluminum oxide dust or magnesium dust for Group E only equipment.

4.2.3.2 The apparatus shall be operated under fault conditions appropriate to the device until all temperatures become constant (see 3.2).

4.2.3.3 Excursions of temperatures of small components above the temperature class are permitted as long as there is no evidence of charring or ignition of the test dust specified in 4.2.3.1.

5 MARKING REQUIREMENTS

5.1 Intrinsically Safe Apparatus

The minimum marking of intrinsically safe apparatus shall be readily visible by the user and shall include the following:

a) Manufacturer's name or trademark, address, and type or model designation;

b) Where repair is possible, a warning label stating:

''WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY''.

c) Where the manufacturer does not specify live maintenance procedures, a warning label stating to the effect:

''WARNING'': followed by words stating to the effect **''TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING''.**

Where the manufacturer specifies and provides live maintenance procedures, the word **''WARNING'':** followed by words stating to the effect **''TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, READ, UNDERSTAND AND ADHERE TO THE MANUFACTURER'S LIVE MAINTENANCE PROCEDURES"**

d) Reference to a control drawing number, except for apparatus not intended to be connected to other apparatus or circuits.

e) The certification agency's mark of conformity shall be displayed visibly and permanently on the product and/or packaging as appropriate and in accordance with the requirements of the certification agency. The manufacturer shall exercise control of this mark as specified by the certification agency and the certification scheme.

f) The words Intrinsically Safe and the Class, Division and Group for which the equipment was approved. Exception: the Division marking is not required for equipment evaluated for Division 1.

g) Maximum operating temperature or temperature class as appropriate. Refer to the latest edition of the FM 3600.

h) The maximum input power, maximum input voltage, maximum input current, maximum unprotected internal capacitance and maximum unprotected internal inductance if evaluated under the entity concept, along with their designations, e.g. Vmax = 24 Vdc. Exception: when included in the control drawing.

5.2 Associated Apparatus

The minimum marking of associated apparatus shall be readily visible by the user and include the following:

a) Manufacturer's name or trademark, address, and type or model designation;

b) Connections for intrinsically safe circuits (e.g. terminals, plugs, receptacles) shall be identified. The color blue may be used to identify such connections;

c) Control drawing number, except for apparatus not intended to be connected to other apparatus or circuits;

d) Where repair is possible a warning label stating:

''WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY''

e) The certification agency's mark of conformity.

f) The words ''associated apparatus'' or ''provides intrinsically safe circuits'' or equivalent along with the Class, Division and Group for which the intrinsically safe circuits were approved. Exception: the Division marking is not required for equipment evaluated for Division 1.

Example:

Associated Apparatus providing Intrinsically Safe Circuits for Class I, Division 1, Groups C and D, Provides Intrinsically Safe Circuits for Class I, Division 1, Groups C and D.

g) The maximum voltage (U_m) and frequency which can be applied to the non-intrinsically safe terminals of the associated apparatus;

h) The maximum output power, maximum output voltage, maximum output current, maximum allowed capacitance and maximum allowed inductance if evaluated under the entity concept, along with their designations, e.g. Vmax = 24 Vdc. Exception: when included in the control drawing;

5.3 Marking Battery-Powered Apparatus

5.3.1 When the batteries used are not intrinsically safe, the apparatus shall be marked with a warning such as:

"**WARNING - BATTERIES MUST BE CHANGED IN AN UNCLASSIFIED LOCATION ONLY."**

The text following the word "WARNING" may be replaced by technically equivalent text.

5.3.1.1 If there are two or more replaceable batteries, where there are two or more replaceable batteries the warning marking shall also warn against mixing of different manufacturers' batteries and mixing of new with used batteries.

5.3.1.2 Apparatus or battery packs provided with external contacts for recharging the batteries shall be marked with the following or equivalent:

''WARNING: TO REDUCE THE RISK OF EXPLOSION, RECHARGE THE BATTERIES IN AN UNCLASSIFIED LOCATION''

5.4 Marking Abbreviations

The following are acceptable for marking brevity:

Class: CL
Division: DIV
Group: GP
Hazardous Location: HAZ. LOC.
Intrinsically Safe: INT. SAFE or IS

5.5 Marking Drawings

5.5.1 The manufacturer's drawing delineating marking shall be reviewed prior to apparatus certification and all subsequent revisions shall be reviewed by the certification agency.

5.5.2 A reference to accompanying literature, that provides special installation, maintenance, or operating instructions. If this information is not on the apparatus, it shall be included or referenced on the control drawing.

6 OPERATIONS REQUIREMENTS

See FM Approvals Standard 3600.

7 BIBLIOGRAPHY

ANSI/NFPA 70, *National Electrical Code*

ANSI/NFPA 499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*