STANDARDS UPDATE NOTICE (SUN)
ISSUED: August 10, 2023

STANDARD INFORMATION

Standard: CSA C22.2 No. 60079-11
Standard ID: Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i" [CSA C22.2#60079-11:2014 Ed.2}
Previous Standard ID: Explosive Atmospheres — Part 11: Equipment Protection by Intrinsic Safety "i" [CSA C22.2#60079-11:2011 Ed.1]

EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

Effective Date: **September 1, 2025**

IMPACT, OVERVIEW, AND ACTION REQUIRED

Impact Statement: Per our accreditation, Intertek is required to review reports against the standard revisions to confirm compliance. Once compliance is confirmed, the standard reference in the report is updated to show continued compliance to the technical requirements of the standard. Reports not updated to this version by the effective date above will be withdrawn.

Overview of Changes:

- The merging of the apparatus requirements for FISCO from IEC 60079-27
- The merging of the requirements for combustible dust atmospheres from IEC 61241-11
- Addition of new test requirements for opto-isolators
- Introduction of Annex H about ignition testing of semiconductor limiting power supply circuits

Specific details of new/revised requirements are found in table below.

Current Listings Not Active? – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records. We will do this at no charge as long as Intertek is notified in writing prior to the review of your reports.

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CLAUSE	VERDICT	COMMENT
		Additions to existing requirements are underlined and deletions are shown lined out below.
5	Info	**Levels of protection and ignition compliance requirements of electrical apparatus**
5.5		The circuit shall be assessed and/or tested for the successful limitation of the spark energy that may be capable of causing ignition of the explosive atmosphere, at each point where an interruption or interconnection may occur, in accordance with 10.1. <u>For Group III, the spark ignition tests to the requirements of Group IIB shall be applied to circuits exposed to dust.</u>
5.6	Info	**Temperature for small components <u>for Group I and Group II</u>**
5.6.2		~~Small components, for example transistors or resistors, whose temperature exceeds that permitted for the temperature classification, shall be acceptable providing that, when tested in accordance with 26.5.3 of IEC 60079-0, small components do not cause ignitions.~~ <u>Requirements for temperatures of small components used in Group I or Group II equipment are provided in the small component temperature for Group I or Group II electrical equipment requirements of IEC 60079-0 and the test requirements are provided in the small component ignition test of IEC 60079-0.</u> <u>The 5 K and 10 K margin of safety required by the maximum surface temperature requirements of IEC 60079-0 does not apply to the maximum surface temperature values, 200 °C, 275 °C and 950 °C shown in the table for the assessment of temperature classification according to component size at 40 °C ambient temperature in IEC 60079-0.</u>
5.6.5		***New clause added;*** **Intrinsically safe apparatus and component temperature for Group III** For determination of maximum surface temperature for intrinsically safe apparatus of Group III, refer to IEC 60079-0, temperature measurement. In particular, the measurement shall be made using the specified values of Ui and Ii for the intrinsically safe apparatus without a 10 % safety factor. The temperature shall be that of the surface of the intrinsically safe apparatus that is in contact with the dust. For example, for intrinsically safe apparatus protected by enclosure of at least IP5X, the surface temperature of the enclosure shall be measured.

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		Alternatively, intrinsically safe apparatus shall be considered suitable for total immersion, or an uncontrolled dust layer thickness, if the matched power dissipation in any component is in accordance with Table 4, and the continuous short-circuit current is less than 250 mA. The intrinsically safe apparatus shall be marked T135 °C.
6	Info	**Apparatus construction**
6.1	Info	**Enclosures**
6.1.2	Info	**Enclosures for Group I or Group II apparatus**
6.1.2.1		**General** Intrinsically safe and associated apparatus which rely on the spacings in Table 5 or Annex F shall be provided with an enclosure meeting the requirements of 6.1.2.2 or 6.1.2.3 as applicable.
6.1.3		***New clause added;*** **Enclosures for Group III apparatus** Where the intrinsic safety of intrinsically safe apparatus can be impaired by ingress of dust or by access to conducting parts, for example if the circuits contain infallible creepage distances, an enclosure is necessary by one of the following: a) Where separation is accomplished by meeting the requirements for clearance or creepage distances of Table 5 or Annex F, the enclosure shall provide a degree of protection of at least IP5X, according to IEC 60529. For such enclosures the 6.1.2.3 a) shall additionally apply. b) Where separation is accomplished by meeting the requirements for distances under coating, casting compound or separation distances through solid insulation of Table 5 or Annex F, the enclosure shall provide a degree of protection of at least IP2X, according to IEC 60529. The enclosure does not need to be subjected to the tests for enclosures in IEC 60079-0, however for portable apparatus, the drop test of IEC 60079-0 still applies. Enclosures for Group III associated apparatus shall meet the requirements of 6.1.2.
6.2	Info	**Facilities for connection of external circuits**
6.2.5		***New clause added;*** **Requirements for connections and accessories for IS apparatus when located in the non-hazardous area** Intrinsically safe apparatus may be provided with connection facilities that are restricted to use in a non-hazardous area e.g. data downloading and battery charging connections. Such facilities shall be provided with protection to ensure

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		the ratings of the safety components within the intrinsically safe equipment comply with 7.1. The use of a fuse protected shunt Zener assembly complying with 7.3 and 7.5.2 shall be considered sufficient protection for voltage limitation. Where these connections are provided for the connection of battery charger see also 7.4.9. Protection circuitry and components may reside either in the intrinsically safe apparatus or the non-hazardous area equipment. If any part of the protection circuit is located in the non-hazardous area accessory, it shall be assessed in accordance with this standard and the non-hazardous area accessory shall be stated in the documentation.
6.3	Info	**Separation distances**
6.3.2		**Separation of conductive parts** Separation of conductive parts between – intrinsically safe and non-intrinsically safe circuits, or – different intrinsically safe circuits, or – a circuit and earthed or isolated metal parts, shall conform to the following if the type of protection depends on the separation. Separation distances shall be measured or assessed taking into account any possible movement of the conductors or conductive parts. Manufacturing tolerances shall not reduce the distances by more than 10 % or 1 mm, whichever is the smaller. Separation distances that comply with the values of Table 5 or Annex F under the conditions of 6.1.2.2, 6.1.2.3 or 6.1.3 shall not be subject to a fault. The fault mode of failure of segregation shall only be a short-circuit. Separation requirements shall not apply where earthed metal, for example tracks of a printed circuit board or a partition, separates an intrinsically safe circuit from other circuits, provided that breakdown to earth does not adversely affect the type of protection and that the earthed conductive part can carry the maximum current that would flow under fault conditions. Creepage distance requirements shall not apply where earthed printed circuit board tracks separate conductive tracks requiring separation, but clearance requirements shall still be applied. Clearance requirements shall not apply where an earthed metallic partition of sufficient height does not allow a discharge between components requiring separation. An earthed metal partition shall have strength and rigidity so that it is unlikely to be damaged and shall be of sufficient thickness and of sufficient current-carrying

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		capacity to prevent burn-through or loss of earth under fault conditions. A partition either shall be at least 0,45 mm thick and attached to a rigid, earthed metal portion of the device, or shall conform to 10.6.3 if of lesser thickness. Where a non-metallic insulating partition having a thickness and appropriate CTI in accordance with Table 5 is placed between the conductive parts, the clearances, creepage distances and other separation distances shall be measured around the partition provided that either the partition has a thickness of at least 0,9 mm or conforms to 10.6.3 if of lesser thickness.
6.3.4		~~In measuring or assessing clearances between conductive parts, insulating partitions of less than 0,9 mm thickness, or which do not conform to 10.6.3, shall be ignored. Other insulating parts shall conform to column 4 of Table 5.~~ Insulating partitions that do not meet the requirements of 6.3.2 shall be ignored, other insulating parts shall conform to column 4 of Table 5. For voltages higher than 1 575 V peak, an interposing insulating partition or earthed metal partition shall be used. In either case, the partition shall conform to 6.3.2.
6.6	Info	**Encapsulation**
6.6.1		**General** For intrinsically safe apparatus, all circuits connected to the encapsulated conductive parts and/or components and/or bare parts protruding from the compound shall be intrinsically safe. Fault conditions within the compound shall be assessed but the possibility of spark ignition inside shall not be considered. For associated apparatus, fault conditions within the compound shall be assessed. If circuits connected to the encapsulated conductive parts and/or components and/or bare parts protruding from the compound are not intrinsically safe, they shall be protected by another type of protection listed in IEC 60079-0. Encapsulation may be applied by casting, moulding or pouring. Where encapsulation is used, it shall conform to the following and where appropriate it applies also to any potting box or parts of an enclosure used in the encapsulation process: a) have a temperature rating, specified by the manufacturer of the compound or apparatus, which is at least equal to the maximum temperature achieved by any component under encapsulated conditions;

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		b) alternatively, temperatures higher than the compound's rating shall be accepted provided that they do not cause damage to the compound. When the temperature of the compound exceeds its continuous operating temperature (COT), no visible damage of the compound that could impair the type of protection shall be evident, such as cracks in the compound, exposure of encapsulated parts, flaking, impermissible shrinkage, swelling, decomposition, or softening. In addition, the compound shall not show evidence of overheating that would adversely affect the protection; c) have at its free surface a CTI value of at least that specified in Table 5 or Annex F if any bare conductive parts protrude from the compound; d) only materials passing the test in 10.6.1 shall have its free surface exposed and unprotected, thus forming part of the enclosure; e) be adherent to all conductive parts, components and substrates except when they are totally enclosed by the compound; f) the compound shall be free of voids, except that encapsulation of components containing free space (transistors, relays, fuses etc) is allowed. g) be specified by its generic name and type designation given by the manufacturer of the compound.
6.6.2		***New clause added;*** Enc**apsulation used for the exclusion of explosive atmospheres** Where casting is used to exclude an explosive atmosphere from components and intrinsically safe circuits, it shall conform to 6.3.5. Where moulding is used to exclude an explosive atmosphere from components and Intrinsically safe circuits, the minimum thickness to the free surface shall comply with column 4 of Table 5, see Figures D.3a and D.3b. In intrinsically safe apparatus where a compound is used to reduce the ignition capability of hot components, for example diodes and resistors, the volume and thickness of the compound shall reduce the maximum surface temperature of the compound to the desired value.
7	Info	**Components on which intrinsic safety depends**
7.4	Info	**Primary and secondary cells and batteries**

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7.4.1		**General** Where batteries are intended to be replaced by the user, the apparatus shall be marked with a warning label as specified in item a) of 12.3. If the cells or batteries have to be recharged in hazardous areas, the charging circuits shall be fully specified as part of the apparatus. The charging system shall be such that, even when faults in accordance with 5.2, 5.3 or 5.4 are applied to the charging system, the charger voltage and current do not exceed the limits specified by the manufacturer.
8	Info	**Infallible components, infallible assemblies of components and infallible connections on which intrinsic safety depends**
8.6	Info	**Capacitors**
8.6.2		***New clause added;*** **Filter capacitors** Capacitors connected between the frame of the apparatus and an intrinsically safe circuit shall conform to 6.3.13. Where their failure by-passes a component on which the intrinsic safety of the circuit depends, they shall also maintain infallible separation or conform to the requirements for blocking capacitors in 8.6.1. A capacitor meeting the infallible separation requirements of 6.3, both externally and internally shall be considered to provide infallible separation and only one is required.
8.8		**Wiring, printed circuit board tracks, and connections** Wiring, printed circuit board tracks, including its connections which forms part of the apparatus, shall be considered as infallible against open circuit failure in the following cases: 2) where a single track is at least 2 mm wide or has a width of 1 % of its length, whichever is greater. In both the above cases, the printed circuit board track shall comply with either of the following: – each track is formed from copper cladding having a nominal thickness of not less than 33 µm; or – the current carrying capacity of a single track or a combination of tracks is tested ~~for 1 h with a current of 1,5 times the maximum continuous current which can flow in the track under normal and fault condition. The application of this test current should not cause the tested track to fail to open-circuit or to be separated from its substrate at any point;~~ in accordance with 10.12;
8.9	Info	**Galvanically separating components**

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8.9.2		**Isolating components between intrinsically safe and non-intrinsically safe Circuits** Isolating components shall comply with the following. b) The non-intrinsically safe circuit connections shall be provided with protection to ensure that the ratings of the devices in accordance with 7.1 are not exceeded ~~unless it can be shown that the circuits connected to these terminals cannot invalidate the infallible separation of the devices~~. For example, the inclusion of a single shunt Zener diode protected by a suitably rated fuse according to 7.3, or a thermal device, shall be considered as sufficient protection. For this purpose, Table 5 shall not be applied to the fuse and Zener diode. The Zener diode power rating shall be at least 1,7 In times the diode maximum Zener voltage. General industrial standards for the construction of fuses and fuseholders shall be applied and their method of mounting including the connecting wiring shall not reduce the clearances, creepage distances and separations afforded by the fuse and its holder. In some applications the intrinsically safe circuit connections may require the application of similar protective techniques to avoid exceeding the rating of the isolating component. Alternatively optical isolators shall comply with the test requirements of 10.11.
9	Info	**Supplementary requirements for specific apparatus**
9.2		***New clause added;*** **FISCO apparatus** Apparatus that has been constructed in accordance with Annex G and is intended to be used within a FISCO system, shall be additionally marked as 'FISCO' followed by an indication of its function, i.e. power supply, field device or terminator. (See Clause 12).
9.3		***New clause added;*** **Handlights and caplights** Caplights for Group I shall comply with IEC 60079-35-1. Handlights and caplights for Groups II and III shall comply with the requirements of this standard.
10.1	Info	**Spark ignition test**
10.1.2		**Spark test apparatus** For Level of Protection "ic", the spark test apparatus shall be considered for the following situations: – at connection facilities,

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		– across separations less than the values specified in Table 5 or Annex F; – in place of normally sparking contacts such as plugs/sockets, switches, pushbuttons, potentiometers; – in place of components that are not suitably rated under normal operating conditions.
10.5	Info	**Tests for cells and batteries**
10.5.3		**Spark ignition and surface temperature of cells and batteries** Cells and batteries shall be tested or assessed as follows. ~~b) The maximum surface temperature shall be determined as follows. All current-limiting devices external to the cell or battery shall be short-circuited for the test. Any external sheath (of paper or metal, etc.) not forming part of the actual cell enclosure shall be removed for the test. The temperature shall be determined on the outer enclosure of each cell or battery and the maximum figure taken. The test shall be carried out both with internal current-limiting devices in circuit and with the devices short-circuited using 10 cells in each case. The 10 samples having the internal current-limiting devices short-circuited shall be obtained from the cell/battery manufacturer together with any special instructions or precautions necessary for safe use and testing of the samples.~~ b) Cells shall be tested at any temperature between laboratory ambient and the specified maximum ambient that gives the most onerous conditions and the values obtained shall be used directly in the temperature class assessment. The cells shall be arranged in a way as to simulate the thermal effects of their intended position in the complete apparatus. The temperature shall be determined on the hottest surface of the cell that may be exposed to the explosive atmosphere and the maximum figure taken. If an external sheath is fitted, then the temperature shall be measured at the interface of the sheath and the metal surface of the cell or battery. The maximum surface temperature shall be determined as follows: For 'ia' and 'ib' all current-limiting devices external to the cell or battery shall be shortcircuited for the test. The test shall be carried out both with internal current-limiting devices in circuit and with the devices short-circuited using 10 cells in each case. The 10 samples having the internal current-limiting devices short-circuited shall be obtained from the cell/battery manufacturer together with any special instructions or precautions necessary for safe use and testing of the samples. If the internal current limiting devices protect against internal shorts, then these devices need not be removed. However, such devices shall only be considered for Level of Protection 'ib'. c) For 'ic' the maximum surface temperature shall be determined by testing in normal operating conditions with all protection devices in place.

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10.6	Info	**Mechanical tests**
10.6.1		**Casting compound** A force of 30 N shall be applied perpendicular to the exposed surface of casting compound with a 6 mm diameter flat ended metal rod for 10 s. No damage to or permanent deformation of the encapsulation or movement greater than 1 mm shall occur. Where a free surface of casting compound occurs and forms part of the enclosure, in order to ensure that the compound is rigid but not brittle, the impact tests shall be carried out on the surface of the casting compound in accordance with IEC 60079-0 using the drop height h in row a) of the tests for resistance to impact table of IEC 60079-0.
10.11		***New section added;*** **Optical isolators tests**
10.11.1		**General** The following tests shall be performed if optical isolators are used to provide isolation between intrinsically safe circuits and non-intrinsically safe circuits and are not adequately protected against overload by external protection components (see 8.9.2). The samples shall successfully comply with both the tests specified in 10.11.2 and 10.11.3.
10.11.2		**Thermal conditioning, dielectric and carbonisation test** The maximum temperature measured at the receiver side and at the transmitter side shall be determined by overloading the devices. These shall then be subjected to thermal conditioning and dielectric strength tests. A carbonisation test shall then be conducted to check for formation of internal creepage paths.
10.11.2.1		**Overload test at the receiver side** This test shall be conducted on five samples. The transmitter side of the optical isolator shall be operated with the rated load values (e.g. If = IN). The receiver side shall be operated with a specific power (e.g. between collector and emitter), which shall not damage the components. This value shall be determined either by preliminary tests or taken from the data sheet. After thermal equilibrium has been reached, the power shall be increased. After thermal equilibrium has been reached again, the power shall be increased further

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		in steps, until thermal equilibrium, and so on, until the receiver semiconductor is damaged. This will terminate or drastically reduce the power dissipation. The maximum surface temperature of the receiver side just before the damage of the receiver shall be recorded for each sample together with the ambient temperature.
10.11.2.2		**Overload test at the transmitter side** This test shall be conducted on five samples. The receiver side of the optical isolator is operated at the rated values of voltage and current (e.g. VC-E, IC). The transmitter side shall be operated with a specific power, which shall not damage the components. This value shall either be determined by preliminary tests or taken from the data sheet. After thermal equilibrium has been reached, the power shall be increased. After thermal equilibrium has been reached again, the power shall be increased further in steps, until thermal equilibrium, and so on, until the transmitter semiconductor is damaged. This will terminate or drastically reduce the power dissipation. The maximum surface temperature of the transmitter side just before the damage of the transmitter shall be recorded for each sample together with the ambient temperature.
10.11.2.3		**Thermal conditioning and dielectric strength test** All 10 samples used in 10.11.2.1 and 10.11.2.2 shall be placed in an oven for 6 0 +0.2 h at the maximum surface temperature recorded from 10.11.2.1 or 10.11.2.2 increased by at least 10 K but at most 15 K. After the optical isolators have cooled down to (25 ± 2) °C they shall be subjected to dielectric strength test with a voltage of 1,5 kV (a.c. 48 Hz to 62 Hz) applied between intrinsically safe and non-intrinsically safe terminals and within 10 s increased to 3 0 +5% kV. This voltage shall be applied for (65 ± 5) s. During this test, there shall be no breakdown of the insulation between the receiver and the transmitter and the leakage current shall not exceed 5 mA.
10.11.2.4		**Carbonisation test**

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10.11.2.4.1		**Receiver side** Using the five samples of 10.11.2.1, a d.c. voltage of 375 0 +10% V shall be applied for 30 0 +1 min across the terminals (e.g. collector and emitter) of the failed receiver semiconductor, to test the formation of an internal creepage path caused by the heated plastic material (carbonisation). During the last 5 min of this test, the current shall not exceed 5 mA.
10.11.2.4.2		**Transmitter side** Using the five samples of 10.11.2.2, a d.c. voltage of 375 0 +10% V shall be applied for 30 0 +1 min across the terminals of the failed transmitter (e.g. diode), to test the formation of an internal creepage path caused by the heated plastic material (carbonisation). During the last 5 min of this test the current shall not exceed 5 mA.
10.11.3		**Dielectric and short-circuit test**
10.11.3.1		**General** Optical isolators shall be subjected to a dielectric strength test, followed by a short-circuit current test and if applicable to the current limited short-circuit current test described below, followed by a dielectric strength test.
10.11.3.2		**Pre-test dielectric** Three new samples shall be used for this test, with an additional three samples if 10.11.3.4 applies. Prior to the short-circuit current tests, the samples of the optical isolator shall be capable of withstanding without breakdown a dielectric strength test of 4 0 +5% kV rms applied between the intrinsically safe side and the non-intrinsically safe side of the optical isolator.
10.11.3.3		**Short-circuit current test** Three samples of the optical isolator shall be subjected to a short-circuit current test. The open circuit voltage of the test circuit shall be Um. The available instantaneous short-circuit current capacity of the test circuit shall be at least 200 A. The test circuit shall be connected to the optical isolator so that the test current flows through the non-intrinsically safe side of the optical isolator. Protective components or assemblies that form part of the circuit are permitted to remain connected for the test.

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10.11.3.4		**Current limited short-circuit current test** Where optical isolators have protective series fuses or current-limiting resistors, three additional samples of the optical isolator shall be subjected to 1,7 times the nominal current rating of the fuse or 1,5 times the calculated short-circuit current through the resistor under fault conditions, until temperatures reach equilibrium.
10.11.3.5		**Dielectric strength test** Each sample shall withstand without breakdown a dielectric strength test of 2 U + 1 000 V or 1 500 V rms, whichever is greater, applied between the intrinsically safe side and the non-intrinsically safe side of the optical isolator for (65 ± 5) s. During these tests the optical isolators shall not explode or catch fire throughout the short-circuit current tests, and the current shall not exceed 1 mA during the dielectric strength tests.
10.12		***New clause added;*** **Current carrying capacity of infallible printed circuit board connections** The current carrying capacity of the connection shall be tested for at least 1 h with a current of 1,5 times the maximum continuous current which can flow in the connection under normal and fault condition. The application of this test current should not cause the connection to fail to open-circuit or to be separated from its substrate at any point.
12	Info	**Marking**
12.1		**General** Apparatus meeting the requirements of 5.4 shall be marked with the symbol “ic”. Where it is necessary to include marking from one of the other methods of protection listed in IEC 60079-0, the symbol “ic” shall occur first. For associated apparatus the symbol Ex ia, Ex ib or Ex ic (or ia or ib or ic, if Ex is already marked) shall be enclosed in square brackets. For apparatus complying with the requirements of Annex G, each piece of apparatus shall additionally be marked with the word “FISCO” followed by an indication of its function, i.e. power supply, field device or terminator. Where apparatus is dual marked so that it can be used in both a FISCO system and a conventional intrinsically safe system, care shall be taken to differentiate between the FISCO marking and the marking for the conventional intrinsically safe system.

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		In the case of FISCO power supplies, output parameters Uo, Io, Co, Lo, Po and Lo/Ro and FISCO field devices or terminators, input and internal parameters Ui, Ii, Ci, Li, Pi and Li/Ri need not be marked.
Annex F	Info	**Alternative separation distances for assembled printed circuit boards and separation of components**
F.3	Info	**Distances for printed circuit boards and separation of components**
F.3.2		**Level of protection "ic"** For Level of Protection "ic", reduced segregation distances according to Table F.2 may be used, provided that the following conditions apply. ~~– Provision shall be made, either in the apparatus or external to the apparatus, to provide transient protection at the power supply terminals of the apparatus. The transient protection shall limit transients up to a maximum of 140 % of the peak value of 60 V, 90 V, 190 V or 375 V depending on the nominal voltage of the apparatus. Where the means is to be provided externally, the apparatus shall be marked with the symbol "X" (see Clause 29 of IEC 60079-0) and the information shall be given in the documentation (see Clause 13).~~ – Provision shall be made, either in the apparatus or external to the apparatus, to provide that the circuits are limited to overvoltage category II as defined in IEC 60664-1.
Annex G		***New annex added;*** **Fieldbus intrinsically safe concept (FISCO) – Apparatus requirements** This annex contains the details of the construction of apparatus for use with the Fieldbus Intrinsically Safe Concept (FISCO). It is based on the concepts of Manchester encoded, bus powered systems designed in accordance with IEC 61158-2 which is the physical layer standard for Fieldbus installations (see standard for details).
Annex H		***New annex added;*** **Intrinsically safe and associated equipment for use in Class I, II, and III, Division 1 hazardous locations** This annex contains requirements for intrinsically safe and associated equipment marked for Class I, II, and III (see standard for details).