Additional Information

- Hazardous Area Classifications
- Operation of the Intrinsically safe Valve

METHODS OF PROTECTION

The generic term for all methods of protection of electrical equipment used in Europe is 'explosion proof'. American practice is to use this term for flameproof equipment. The table lists the more usual methods of protection.

TECHNIQUES	SYMBOL (Ex)
Oil Immersion	o
Pressurisation	p
Powder Filling	q
Flameproof Enclosure	d
Increased Safety	e
Intrinsically Safe	ia
Intrinsically Safe	ib
Non-incendive	N
Encapsulation	m
Special Protection	s

SOLENOIDS VALVES IN HAZARDOUS AREAS

Not all of these methods are applicable to solenoid protection, the more commonly used are listed below.

1. Flameproof This form of protection entails enclosing the coils in a robust enclosure which will contain an internal explosion should it occur and prevent its transmission to the surrounding atmosphere.

2. N-Type Protection (Non-incendive) Generally applied to non-sparking electrical equipment such as a solenoid coil which will not get abnormally hot even if the armature is locked out.

3. Encapsulation This involves enclosing the coil and any associated electrical components in a compound so as to prevent the ignition of a surrounding explosive atmosphere.

4. Intrinsically Safe Intrinsic safety is a technique that achieves safety by limiting the electrical-spark energy (and surface temperature) that can arise in hazardous area circuits to levels that are insufficient to ignite an explosive atmosphere.

An intrinsically safe system consists of a certified Intrinsically safe interface which passes signals to and from the process (hazardous area) but limits the energy (that is voltage and current) that can reach the hazardous area under fault conditions.
The interface is usually mounted in the safe area and can be either a shunt diode safety barrier or a galvanic isolator.
In the hazardous area 'simple' or 'non-energy storing devices' (switches, thermocouples & LED's) can be used without certification but 'Energy-storing' equipment such as solenoid valves must be designed so as to prevent this energy escaping and of necessity need to be of sufficiently low power to operate within the constraints of the IS signal.

5.Special Protection Offers combination of one or more methods of protection and in the case of solenoids these are usually 'e' and 'm', where the coil is encapsulated, has over temperature protection and the terminals are approved under the increased safety requirement.

Classification of Hazardous Areas (IEC)

International Electrotechnical Commission

A Hazardous area is divided into zones according to the probability of the presence of a flammable mixture, but the zone (previously division), has no relationship with the actual nature of the hazard.

Gases

Zone 0: in which an explosive gas-air mixture is continuously present or present for long periods.

Zone 1: in which an explosive gas-air mixture is likely to occur in normal operation.

Zone 2: in which an explosive gas-air mixture is not likely to occur in normal operation and if it occurs, will exist only for a short time.

Dusts

Zone 20: in which a combustible dust, as a cloud, is continuously present or present for long periods.

Zone 21: in which a combustible dust, as a cloud, is likely to occur in normal operation.

Zone 22: in which a combustible dust, as a cloud, is not likely to occur in normal operation and if it occurs, will exist only for a short time.

Comparison of National Methods of Area Classification

	Continuous Hazard Gases (Dusts)	**Intermittent Hazard** Gases (Dusts)	**Hazard under Abnormal** Conditions Gases (Dusts)
IEC	Zone 0 (Zone 20)	Zone 1 (Zone 21)	Zone 2 (Zone 22)
USA & Canada	Division 1*		Division 2*

*Includes combustible dusts

Selection of type of protection according to zone of risk

Zone	Protection Concepts
0	ia s (specially certified for use in Zone 0)
1	Any type of protection suitable for Zone 0 and :- d ib p e s m
2	Any type of protection suitable for Zone 0 or 1 and :- N o q

Temperature Classification

Gas-air mixtures can be ignited by hot surfaces and consequently apparatus for hazardous area duty requires classification according to its maximum surface temperatures under fault conditions.

Class	Maximum Surface Temperature °C
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

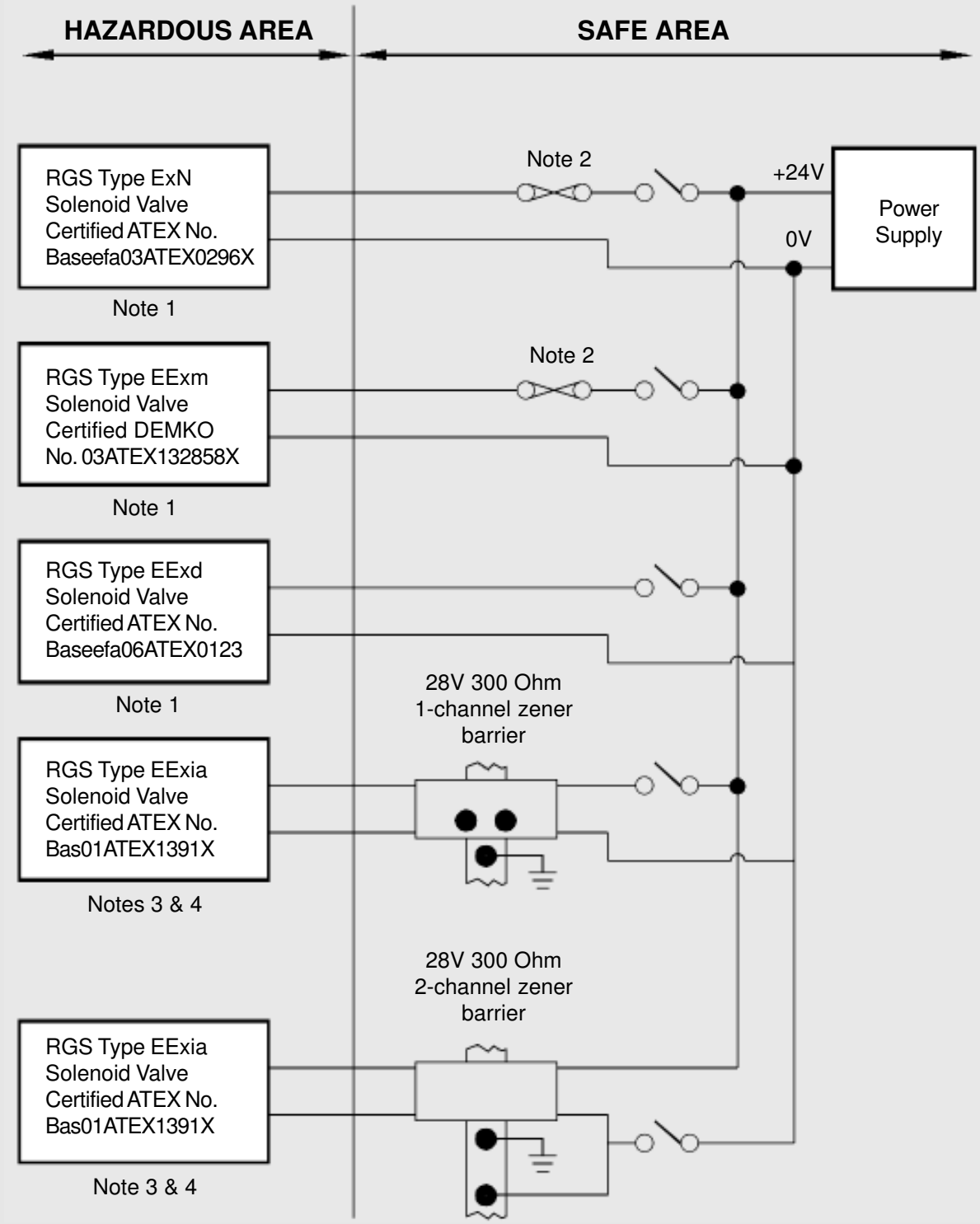
BS 5345 Part 1 1989 gives the temperature classification of the more common industrial gases. It should be noted that there is no correlation between the classification of gases for intrinsic safety (ignition energy) and ignition temperature. For example, hydrogen classification IIC is easily ignited by sparking, but will not ignite at surface temperatures below 560°C, hence only T1 classification is required.

Gas Classification

Flammable gases, vapours and mists are classified according to the spark energy required to ignite the most easily-ignitable mixture with air. Equipment is specified for the gases with which it may be used.

IEC	USA & Canada
Surface Industries	**Surface Industries**
Group IIA - Propane	**Class I Group D: Propane**
IIB - Ethylene	**Class I Group C: Ethylene**
IIC - Hydrogen/Acetylene	**Class I Group B: Hydrogen**
	Class I Group A: Acetylene
Dusts Under Consideration	**Class II Group G: Flour and Starch Grain**
	Class II Group F: Carbon Dust
	Class II Group E: Metal Dust
	Class III Fibres and Flyings
Mining Industry	**Mining Industry**
Group I: Methane (firedamp)	**Unclassified: Methane (firedamp)**

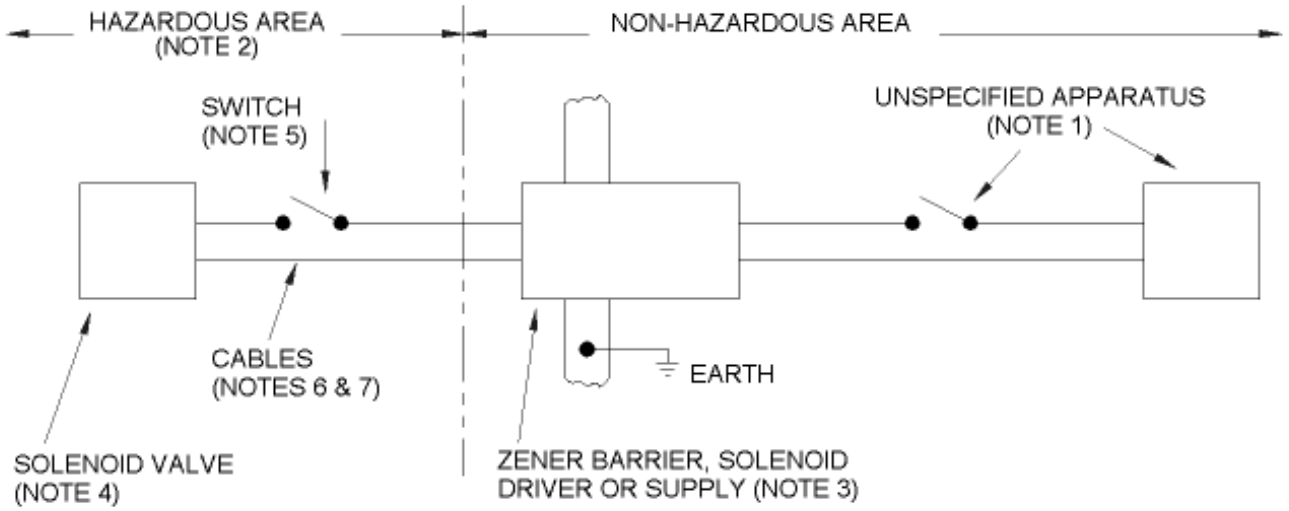
Classification of Hazardous Areas (IEC)



Notes:
1) Type EExnA, EExm and EExd valves not restricted to DC operation.
2) For recommended fuse ratings see relevant coil data sheet.
3) Alternative 240V and 120V AC mains and 24V DC isolating interface units are also available for operating intrinsically safe solenoids.
4) System approval Certificate of Conformity BAS No. Ex01E2392.

Intrinsic Safety Information

Solenoid Valve Control System



NOTE 1
This apparatus is unspecified except that it must not contain under normal or abnormal conditions a source of potential with respect to earth in excess of 250V R.M.S. or 250V DC.

NOTE 2
The electrical circuit in the Hazardous area must be capable of withstanding an AC test voltage of 500V R.M.S. to earth of frame of the apparatus for one minute.

NOTE 3
Any single channel or single channel of a multiple channel shunt zener diode safety barrier, solenoid driver or supply certified by any EU notified certification body to [EExia] IIC, whose output voltage (Uz, U max. : out OR Uo) does not exceed 28V and whose output current (I max. : out OR Io) is limited by resistance 'R' such that the output voltage (Uz, U max. : out OR Uo) does not exceed 25.5V and whose output current (I max. : out OR Io) is limited by resistance 'R' such that the output voltage divided by 'R' does not exceed 147mA.

NOTE 4
R.G.S. solenoid valve covered by Certificate of Conformity Bas01ATEX1391X to category EExia IIC T6.

NOTE 5
Switch must be selected and installed to meet the requirements of clauses 4.1 and 5 of EN60079-11:2007.

NOTE 6
The cable maybe twin pair, or a pair contained in a type A, or type B multicore cable (as defined in clause 5.3 of EN60079-25:2004), provided that the peak voltage of any circuit contained within the multicore does not exceed 60 volts.

NOTE 7
The capacitance and inductance to resistance ratio of the hazardous area cables must not exceed the values shown below.

GROUP	CAPACITANCE (µF)	INDUCTANCE (mH)	L/R RATIO (µH/ohm)
IIC	0.13	1.32	40
IIB	0.39	3.96	120
IIA	1.04	10.56	320

Certificate of Conformity BAS No. Ex 01E2392

Intrinsic Safety Information

RGS's Intrinsically safe coil EP000/ia (and variants) must be operated from an intrinsically safe barrier/isolator which must conform and be installed within the criteria stipulated on system approval No. BAS Ex822148/1.

Typical devices include, but are not limited, to those listed below.
Full technical specification and installation advice is available from the relevant manufacturer.

MTL	Transformer Isolated Barriers	Zener Barriers
Tel: 01582 23633	MTL2241	MTL708
	MTL3021	MTL728
	MTL4021	
	MTL5021	

Pepperl & Fuchs GB Ltd.	Transformer Isolated Barriers	Zener Barriers
Tel: 0161 633 6431	KFD2-SD-EX148	Z428/EX
	KFD2-SL-EX148	Z728/EX

Elcon Intrinsic Safety Ltd.	Transformer Isolated Barriers
Tel: 01325 314 455	2871
	2872
	µD471DC
	µD472DC
	1871
	1872

Stahl	Transformer Isolated Barriers	Zener Barriers
Tel: 0121 767 6400	9351/10-16-10	9002/13/280/093/00

OPERATING NOTES

Zener Barriers

1. Cheaper unit price.
2. Require an intrinsically safe high integrity earth.
3. Require a well regulated supply.

Isolating Transformers

1. More expensive unit.
2. Does not require an earth.
3. Will tolerate a wide variation in input voltage without affecting output.
4. 120V and 240V DC supply versions available.
5. Can have switch circuit built in.

A full list of approved barriers is available from sales on request

Intrinsically Safe Solenoid Coil Specification – 10mA & 33mA

Coil Operating Characteristics

Construction	Diode protected encapsulated assembly
2,100 ohms. Nominal operating voltage	24V DC (10mA, 0.27W)
370 ohms	12V DC (33mA, 0.40W)

Temperature rating T6
Maximum permitted ambient temperature 65°C
Maximum operating pressure 10 Bar (Air or inert gases)
Cv Factor 0.02

Coil Approval Reference Labels

The following are the approval references for the coil only, which should not be confused with the full Product Codes.
Note. The relevant Product Code can be found on the appropriate coil or valve data sheet.
BASEEFA ATEX and IECEx Approval Ref. - EP000/ia
FM US Approval Reference - EP000/ia/aFM
FM Canadian Approval Reference - EP000/ia/aFM

IMPORTANT

Coils must be installed in accordance with the appropriate approval details.

Approvals

Intrinsically Safe in accordance with the following approvals:

BASEEFA (ATEX) - Certificate No. BAS01ATEX1391X EExia IIC T6
FM US (Entity Concept)- Report 3020332 Class I, II, III Division 1 Groups A, B, C, D, E, F & G
FM Canadian Report 3028180 Class I, II, III Division 1 Groups A, B, C, D, E, F & G
IECEx – Certificate No BAS 05.0040X Ex ia IIC T6

Intrinsically Safe Systems

BASEEFA ATEX and IECEx – Ex 01E2392 Solenoid Valve Control System
Ui = 31V, Ii = 0.67A, Pi = 2.98W, Ci = 0, Li = 0.*

FM (America and Canada) - Under 'Entity' requirements, the concept allows interconnection of intrinsically safe apparatus to safe area apparatus, provided that the criteria for intrinsic safety are met (Maximum voltage, current and maximum unprotected capacitance and inductance).
- Maximum input parameters to coil 35V / 300mA Ci = 0, Li = O.*

* Note. These figures do not represent the operating voltage or current of the coil. An IS interface in circuit with the coil gives operating characteristics as shown above, i.e. approximately 10mA, 0.27W and 33mA, 0.4W power consumption.

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