APPLICATION GUIDE AG210
Power Isolators

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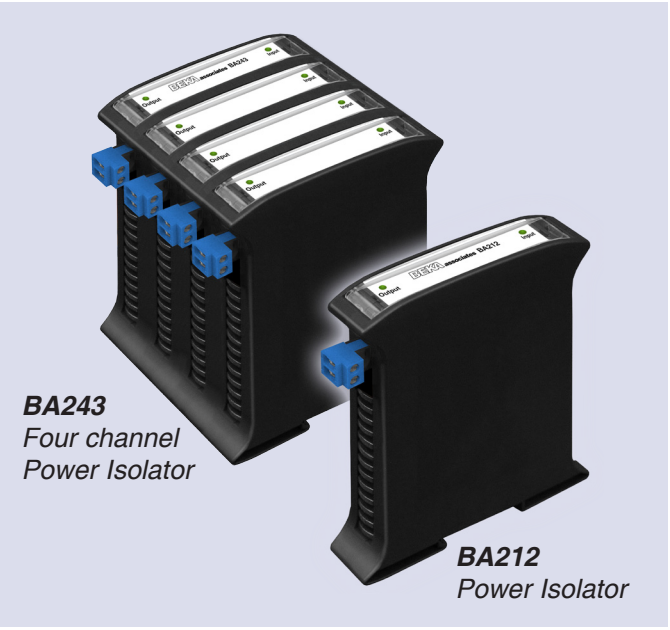
1. INTRODUCTION

This Application Guide describes the function of BEKA Power Isolators and how they may safely be used. They are primarily intended for powering BEKA intrinsically safe Pageant Operator Panels, but may also be used to power any intrinsically safe apparatus having compatible input safety parameters.



BA212 & BA243 Power Isolators

Detailed installation information is contained in the instruction manual for each model which can be viewed on the BEKA website at www.beka.co.uk.

2. DESCRIPTION

BEKA Power Isolators perform the same function as a diode safety barrier or a galvanic isolator, but have a higher usable power output than most barriers or isolators. The Power Isolators are powered by a 24V dc supply and are certified as associated apparatus.

BEKA Power Isolators clip onto a standard 35mm DIN rail and are usually installed in a safe area, but with additional mechanical protection may be installed in Zone 2, 21 or 22 - see section 7 and 8.

3. INTRINSIC SAFETY

Intrinsic safety protection is a technique for ensuring that the electrical energy in a circuit is too low to cause thermal or spark ignition of a flammable atmosphere. For the most incendive gas group IIC, represented by hydrogen, the minimum spark ignition energy is 20µJ.

For IIB ethylene it is 60µJ and for IIA propane it increases to 180µJ.

Wired intrinsically safe systems usually employ associated apparatus in the safe area, such as a Zener barrier or galvanic isolator, which limit the energy that can be transferred to wiring and apparatus in the hazardous area. Hazardous area apparatus is designed such that the energy transferred from the safe area can not be stored and released in a way that could cause spark ignition of the flammable atmosphere. The apparatus design also ensures that the transferred energy will not result in hot areas which could cause thermal ignition of the flammable atmosphere.

To simplify intrinsically safe system design, associated apparatus has output safety parameters which specify the maximum voltage, current and power output, plus the maximum capacitance and inductance that may be safely connected to the output.

Uo	Maximum output voltage
Io	Maximum output current
Po	Maximum output power
Co	Maximum permitted external capacitance
Lo	Maximum permitted external inductance
Lo/Ro	Maximum permitted L/R ratio of external apparatus or cables that may be connected.

Note: Lo/Ro is an alternative to the maximum permitted inductance Lo.

The level of protection of the intrinsically safe parts of the associated apparatus is also specified. All BEKA Power Isolators have ia level protection which means they remain safe with two countable faults and may be used to power apparatus located in Zone 0.

Similarly, intrinsically safe apparatus for installation in a hazardous area has input safety parameters. These define the maximum voltage, current and power input that may be safely applied.

Ui	Maximum input voltage
Ii	Maximum input current
Pi	Maximum input power
Ci	Maximum equivalent internal capacitance at input terminals.
Li	Maximum equivalent internal inductance at input terminals.

For a safe intrinsically safe system, the input voltage, current and power parameters of the hazardous area apparatus must be equal to, or greater than, the output voltage, current and power parameters of the barrier or isolator.

Also the equivalent input capacitance and inductance of the hazardous area apparatus, plus cable capacitance and inductance, must be equal to, or less than, the capacitance Co and inductance Lo that may be safely connected to the barrier or isolator.

Alternatively, the system will be safe if the L/R ratio of the connecting cables and load are less than the isolator's specified Lo/Ro.

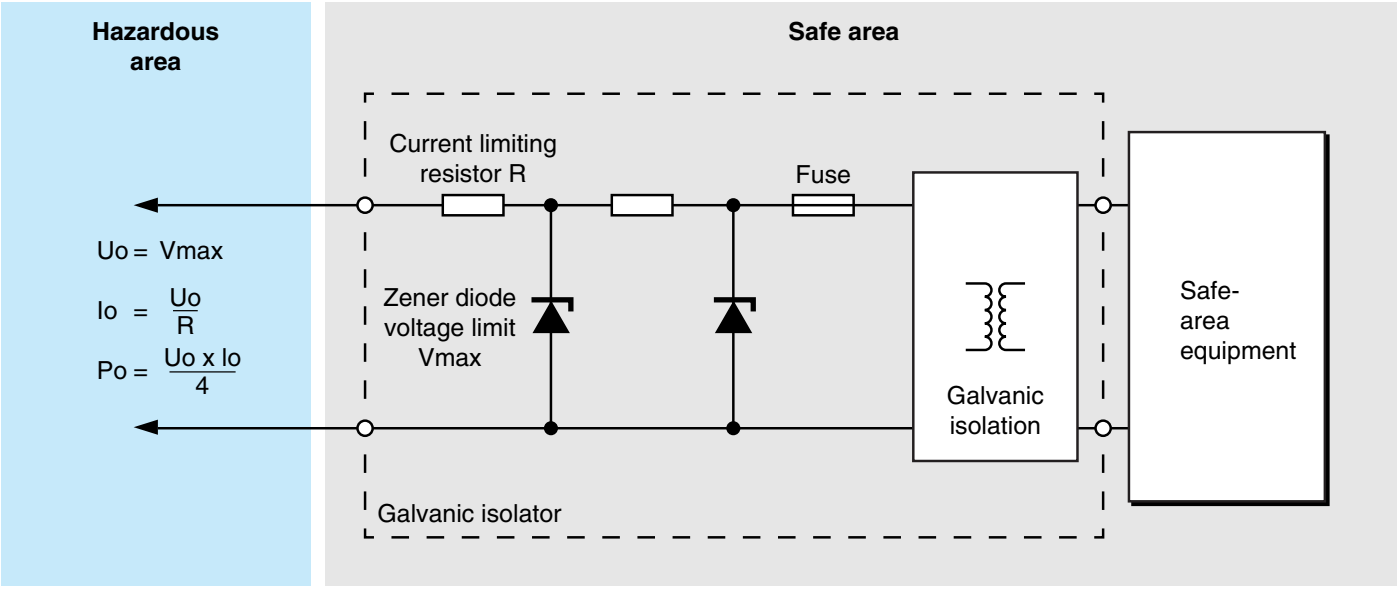


Fig 1 Galvanic isolator using passive voltage & current limits.

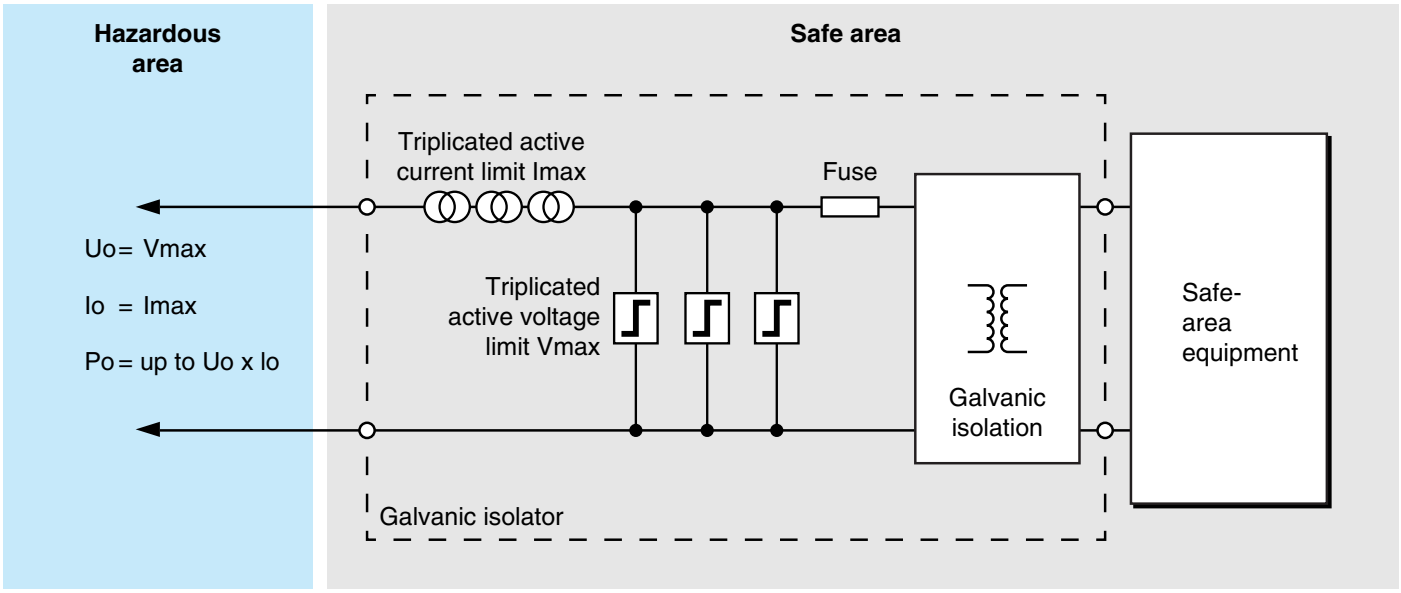


Fig 2 Galvanic isolator using active voltage & current limits.

3.1 Diode safety barriers and galvanic isolators

Diode safety barriers and galvanic isolators perform the same energy limitation function. Diode safety barriers require a high integrity earth connection, galvanic isolators have a floating output and do not require an earth connection.

The majority of diode safety barriers and galvanic isolators use passive components to limit their output and to define their output parameters as shown in Fig 1. Because of the resistive output, which determines the maximum output current, the maximum output power which can be transferred to the hazardous area Po, is the matched power which is only a quarter of the apparent power available considering Uo and Io.

Zener barriers and galvanic isolators employing passive components have typical output parameters of:

Uo	Io	Po	Application
15V	290mA	1W	12V power supply
28V	93mA	0.65W	4/20mA loop

3.2 Active barriers and galvanic isolators

Replacing the voltage limiting diodes and the current limiting resistor with multiple active devices as shown in Fig 2 significantly increases the usable power available in the hazardous area. However, this configuration makes it difficult to determine output safety parameters and edition 6 of EN 60079-11 *Equipment protection by intrinsic safety "i"* does not permit triplicated active current limits for Ex ia applications. This may change in edition 7.

Both of these difficulties can be overcome by employing a hybrid configuration using a combination of both passive and active limitation which is the technique employed in BEKA Power Isolators. Using both active and passive protection increases the usable power available in the hazardous area compared with that from a passive device and enables output safety parameters to be calculated. The hybrid configuration complies with Ex ia requirements and the Power Isolator may therefore be used for powering hazardous area apparatus in Zone 0.

The increased usable power from a low voltage isolator results in it having a relatively high output safety current parameter Io, which limits the inductance Lo that may be safely connected to the isolator's output. Whilst the equivalent internal inductance Li of hazardous area apparatus can be suppressed, it is not possible to suppress the inductance of the interconnecting cable. Hence the length of cable between the output of the Power Isolator and the hazardous area apparatus is restricted.

This cable length restriction can be overcome by using an interconnecting cable which complies with the Power Isolator's Lo/Ro safety parameter. This is the maximum value of ratio of inductance to resistance that may be safely connected to the Power Isolator's output and is an alternative to complying with just the allowable inductance Lo.

Cables with a low L/R ratio have a small conductor cross section resulting in a relatively high electrical resistance. When a cable with a low L/R ratio is installed the maximum cable length is often determined by the acceptable voltage drop.

4. BEKA POWER ISOLATORS

BEKA Power Isolators are primarily intended for powering a BEKA intrinsically safe Pageant Operator Panel. The isolators employ a combination of passive and active voltage and current limitation to maximise their output while retaining usable output safety parameters.

4.1 Certification – IS associated apparatus

Both the BA212 and BA243 Power Isolators have IECEx, ATEX and UKCA associated apparatus intrinsic safety Ex ia IIC certification:

IECEx	IECEx CML 20.0080X
ATEX	CML 20 ATEX 2122X
UKCA	CML 21 UKEX 2278X

Copies of these certificates may be downloaded from the BEKA associates website www.beka.co.uk.

The certificate numbers have an 'X' suffix indicating that the isolators have specific conditions relating to safe installation or use. The BEKA Power Isolators have a Um of 30V and must be powered from a 30V maximum dc supply which complies with one of the following:

- SELV (separated or safety extra low voltage)
- PELV (protected extra-low voltage supply)
- Employing a safety isolating transformer with double or reinforced insulation.
- Complying with IEC60950 series, IEC61010-1 or technically equivalent standard.
- Fed directly from cells or batteries

Most 24V instrument supplies satisfy this requirement. Compliance with the European or UK Low Voltage Directives confirms the supplies suitability.

5. BA212 SINGLE CHANNEL POWER ISOLATOR

The BA212 Power Isolator has IECEx, ATEX and UKCA [Ex ia Ga] IIC intrinsic safety associated apparatus certification for installation in a safe area. All the approvals specify the same certification code and output safety parameters.

Location

Safe area or Zone 2, 21 or 22 – see section 7 & 8

Certification code

IECEx	[Ex ia Ga] IIC	-40°C ≤ Ta ≤ +70°C
ATEX & UKCA	II (1) G [Ex ia Ga] IIC	-40°C ≤ Ta ≤ +70°C

Output parameters

		Gas group		
		IIC	**IIB**	**IIA**
Uo	=	12.4V	12.4V	12.4V
Io	=	2.66A	2.66A	2.66A
		Maximum output current 500mA		
Po	=	5.2W	5.2W	5.2W
Co	=	1.24µF	7.9µF	30.0µF
Lo	=	5µH	20µH	40µH
Lo/Ro	=	4.3µH/Ω	17µH/Ω	34µH/Ω

5.1 Applications

The BA212 isolator is primarily intended to power equipment in gas groups IIB (ethylene) and IIA (propane). It does have IIC (hydrogen) certification, but the output inductive parameters are restrictive and preclude use in many applications for which the BA243 has been designed.

Fig 3 shows the isolators output characteristic. When the output load exceeds the current limit the output voltage falls to zero. When the load is reduced the output voltage is automatically restored.

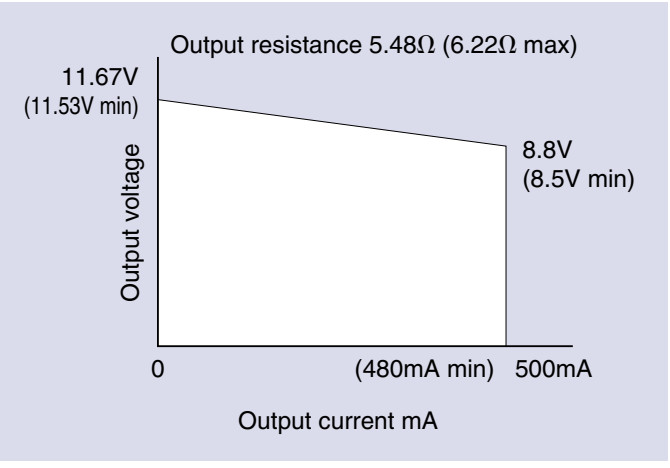


Fig 3 BA212 typical output characteristic

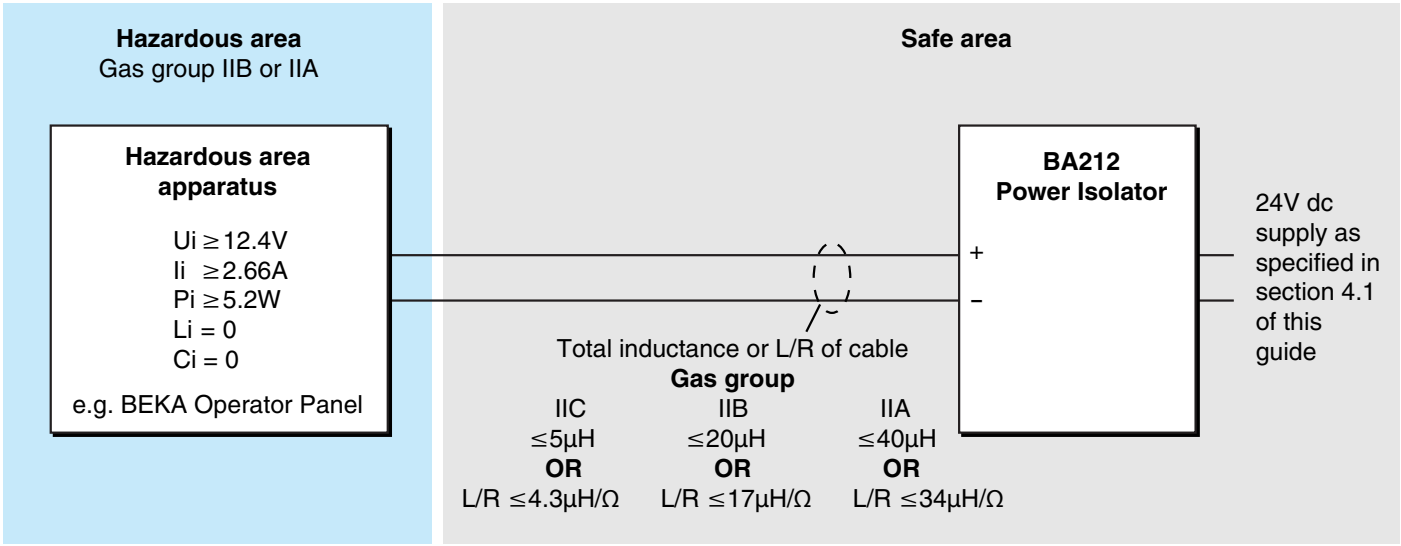


Fig 4 BA212 IIB or IIA system

The isolator may be used to power any certified intrinsically safe apparatus located in Zone 0, 1 or 2 providing the input voltage, current and power safetly parameters of the apparatus are equal to, or greater than, the output parameters of the BA212. The isolator has been designed to power a BEKA Pageant intrinsically safe Operator Panel, but is also ideal for powering intrinsically safe devices such as sounders, beacons and valves that require more power than is available from conventional barriers or isolators.

The BA212 output is galvanically isolated and should not be connected to any other intrinsically safe supply. If the output is connected to hazardous area apparatus via a multicore cable carrying other intrinsically safe circuits, the cable should be a Type A or a Type B multicore as defined in IEC 60079-14 to ensure that connection between intrinsically safe circuits is unlikely to occur.

If, for operational reasons, it is necessary to earth one side of the isolator's output, this should be a single point connection to a high integrity earth, such as the plant's equipotential bonding system.

5.2 Loop Design

A typical BA212 system is shown in Fig 4. It assumes that the inductance and capacitance of the hazardous area apparatus is suppressed and therefore Li and Ci of the apparatus are zero.

The cable between the BA212 Power Isolator output and the hazardous area apparatus should be selected to have inductance of less than Lo or an L/R ratio of less than Lo/Ro of the isolator.

Cable manufacturers usually specify the inductance per metre of a cable. Most twisted pair instrument cables have an inductance of less than 0.8µH per metre. The addition of a screen or armour makes little difference. Twisted pairs within multicore cables also have a similar inductance.

If the inductance of the hazardous area load is fully suppressed so that it has an Li of zero, the maximum permissible cable length between the BA212 Power Isolator and the load will be defined by the isolator's Lo or by its Lo/Ro. At 12.4V the allowable capacitance Co that may be connected to the isolator is relatively large and is therefore unlikely to cause any cable limitations.

Considering the limitation imposed by Lo:

If a typical twisted pair cable with an inductance of less than 0.8µH/m is used, the maximum cable length between the BA212 isolator and the hazardous area apparatus will be:

	Gas group		
	IIC	**IIB**	**IIA**
Cable length	6m	25m	50m

Alternatively, considering the limitation imposed by Lo/Ro:

Any length of cable with an L/R ratio equal to, or less than, the BA212 isolators Lo/Ro may be used. The maximum length being defined by the acceptable resistive voltage drop.

	Gas group		
	IIC	**IIB**	**IIA**
L/R of cable ≤	4.3µH/Ω	17µH/Ω	34µH/Ω

Instrumentation cables complying with the L/R ratio required for use in IIC gases are not generally available, but those for use in IIB and IIA gases are produced by a number of manufacturers. For example, the Draka Norsk Kabe FlexFlame RFOU(i) 150/250(300) cable has 0.75mm² conductors and is available with single and multi twisted pairs with and without screens and armour. Each single twisted pair has the following electrical parameters:

Inductance	Resistance	L/R ratio
0.67µH/m	26.3mΩ/m	12.7µH/Ω

Instrument cables with similar specifications are also manufactured by:

Tele-Fonika Kabel S.A. (TF Kabel).

Nexans Cabling Solutions.

5.3 Maximum cable length

If a Pageant Operator Panel is connected to a BA212 Power Isolator as shown in Fig 4 using the Draka Norsk Kabe cable described in the previous section, the maximum cable length limitation imposed by the Lo of the isolator will be:

Gas group	Lo	Maximum cable length
IIC	5µH	5 / 0.67 = 7m
IIB	20µH	20 / 0.67 = 29m
IIA	40µH	40 / 0.67 = 59m

Alternatively considering the limitation imposed by the Lo/Ro ratio of the isolator.

The Draka Norsk Kabe cable has an L/R ratio of 12.7µH/Ω which is below the Isolators Lo/Ro output safety parameter for gas groups IIA and IIB. Therefore, any length of this cable may be used between the Isolator and the Operator Panel in gas groups IIA and IIB, the maximum length being determined by the cable's acceptable voltage drop.

The current consumption of a Pageant Operator Panel depends upon the number and type of plug-in input and output modules that are fitted. The maximum percentage of the total available power from the Pageant Operator Panel that each module consumes is shown on the datasheet and the instructions for each module. The sum of the power consumption of all the modules fitted determines how much current the Pageant Operator Panel draws from the Power Isolator.

Total % module power consumption	Operator Panel maximum current
20%	300mA
100%	400mA

The maximum allowable cable length can be calculated as follows:

$$\text{Max cable length} = \left[\frac{(Vo\ min - VL\ min) - Ro\ max}{IL\ max}\right]\left[\frac{1}{2 \times Rcab}\right]$$

Where:

Vo min = Minimum isolator output voltage with no load.

VL min = Minimum operating voltage of load

IL max = Maximum current consumption A

Ro max = Maximum isolator output resistance Ω

R cab = Cable conductor resistance Ω/m

With 100% module power consumption

$$= \left[\frac{(11.53 - 7.5) - 6.22}{0.40}\right]\left[\frac{1}{2 \times 0.0263}\right]$$

Max cable length = 73m

With 20% module power consumptions

Max cable length = 137m

This method of determining the maximum permitted cable length allows significantly longer cables in gas groups IIA and IIB but can not be used for gas group IIC applications because cables with an L/R ratio of 4.3µH/ Ω are not generally available.

For most applications in a group IIC gas, the BEKA BA243 Power Isolator should be used, see section 6. This has four galvanically isolated outputs which can be remotely combined to provide 4.4W usable output power with much longer cables in gas group IIC atmospheres.

5.4 Selecting field wiring cable

Manufacturers do not always specify the L/R ratio of their cables, and when they do, some tend to quote very conservative maximum figures. If the cables inductance and the conductors resistance is known, the cables L/R ratio can be calculated.

$$L/R = \frac{\text{cable inductance per unit length}}{\text{cable loop resistance per unit length}}$$

$$= \frac{\text{cable inductance per unit length}}{2 \times \text{conductor resistance per unit length}}$$

The same unit of length should be used for both the resistance and inductance.

If cable parameters are not available, it is easy to measure the inductance and resistance of a short sample length of cable from which the cable's L/R ratio can be calculated. If a five metre long cable sample is provided, BEKA will perform this measurement for any customer free of charge.

6 BA243 FOUR CHANNEL POWER ISOLATOR

The BA243 has four isolated channels with IECEx, ATEX and UKCA [Ex ia Ga] IIC intrinsic safety associated apparatus certification. All the approvals specify the same certification code and output safety parameters.

Location

Safe area or Zone 2 or 22 – see section 7 & 8.

Certification code

IECEx	[Ex ia Ga] IIC	-40°C ≤ Ta ≤ +70°C
ATEX & UCKA	II (1) G [Ex ia Ga] IIC	-40°C ≤ Ta ≤ +70°C

Output parameters for each channel

		Gas group IIC	IIB	IIA
Uo	=	12.4V	12.4V	12.4V
Io	=	0.67A	0.67A	0.67A
		Maximum output current 130mA		
Po	=	1.36W	1.36W	1.36W
Co	=	1.24µF	7.9µF	30.0µF
Lo	=	79µH	317µH	634µH
Lo/Ro	=	17µH/Ω	68µH/Ω	137µH/Ω

The BA243 isolator is primarily intended to power apparatus in gas group IIC (hydrogen). It has four identical, independently isolated outputs which may be used alone, or remotely combined to transfer the maximum intrinsically safe power to IIC hazardous area apparatus.

Fig 5 shows the output characteristic of each channel. When the output load exceeds the current limit the output voltage falls to zero. When the load is reduced the output voltage is automatically restored.

6.1 Design of single channel IIC systems

Each of the four isolated outputs may be used as a separate intrinsically safe supply. If an output is connected to hazardous area apparatus via a multicore cable carrying other intrinsically safe circuits, the cable should be a Type A or a Type B multicore as defined in IEC 60079-14. This will ensure that connection between separate intrinsically safe circuits is unlikely to occur.

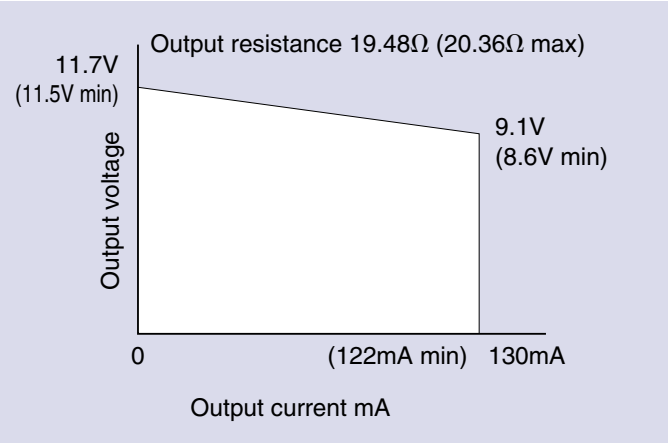


Fig 5 BA243 typical output characteristic of each channel

If, for operational reasons, it is necessary to earth one side of any of the isolator outputs, this should be a single point connection to a high integrity earth, such as the plant's equipotential bonding system. Earthing the output of one channel does not affect the other channels.

A typical single channel BA243 loop is shown in Fig 6. If the inductance and capacitance of the hazardous area load is fully suppressed so that it has an Li and Ci of zero, the maximum permissible cable length between the BA243 Power Isolator and the load will be defined by the isolator's Lo or by its Lo/Ro. At 12.4V the allowable capacitance Co that may be connected to the isolator is relatively large and is therefore unlikely to cause any cable limitations.

Considering the limitation imposed by Lo:

If a cable with an inductance of less than 0.8µH/m is used, the maximum cable length between the BA212 isolator and the hazardous area apparatus will be:

	Gas Group IIC	IIB	IIA
Cable length	98m	396m	792m

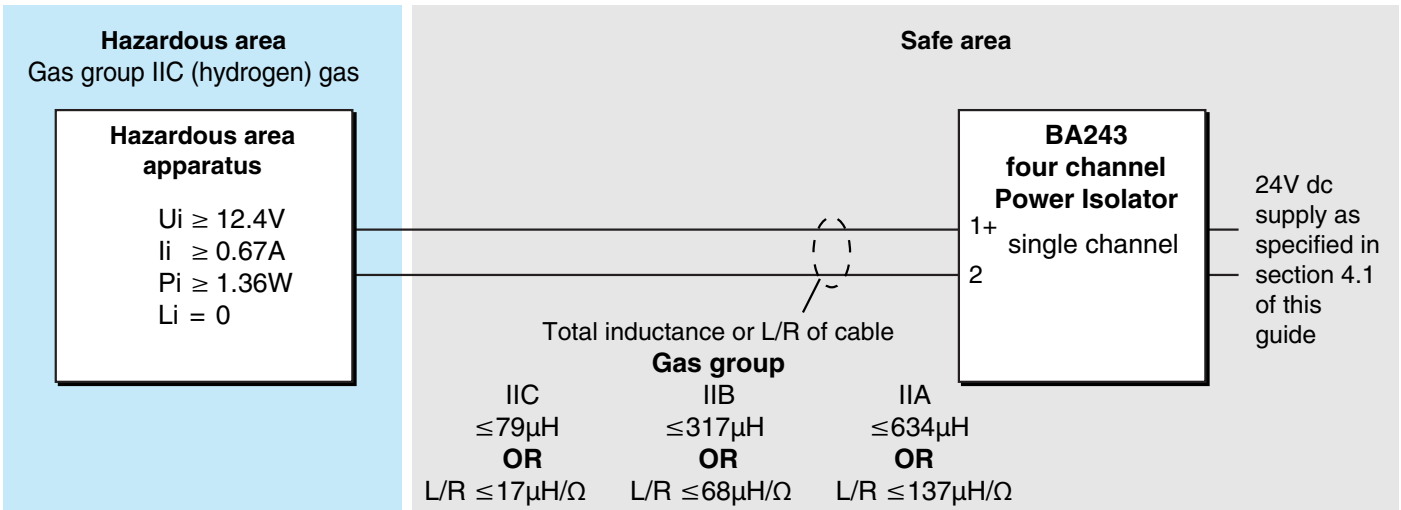


Fig 6 BA243 single channel system

Alternatively, considering the limitation imposed by Lo/Ro:
Any length of cable with an L/R ratio equal to, or less than, the BA212 isolators Lo/Ro may be used. The maximum length being defined by the acceptable resistive voltage drop of the cable.

	Gas Group		
	IIC	**IIB**	**IIA**
L/R of cable	≤17µH/Ω	68µH/Ω	137µH/Ω

6.2 Connecting four channels in parallel

The four galvanically isolated output channels of the BA243 Power Isolator have been designed such that they are spark ignition safe in a IIC (hydrogen) atmosphere when connected in parallel. However, when connected in parallel the combined Io of the four channels is 4 x 0.67A = 2.68A. This high current reduces the inductance Lo that may be safely connected to only 5µH. Even with the hazardous area apparatus inductance fully suppressed, this limits the length of cable between the isolator and the hazardous area apparatus to a few metres in a group IIC atmosphere.

This limitation can be overcome by remotely interconnecting the four channels at the hazardous area apparatus and treating each channel and it's associated wiring as a separate intrinsically safe circuit. To ensure that even under fault conditions the loops remain separated and current can not flow from one into another loop, channel interconnection must be made via triplicated series diodes as shown in Fig 7. Because the system's safety depends upon this isolation being maintained even with countable faults applied, this diode assembly requires third party certification. The BEKA BA3901 Power Combiner mounts onto a Pageant plug-in CPU module and has IECEx, ATEX and UKCA intrinsic safety apparatus certification.

If the four outputs are connected via a multicore cable, the cable should be a Type A or a Type B multicore as defined in IEC 60079-14.

Using this configuration the single channel cable parameters defined in section 6.1 are retained. If a Pageant Operator Panel is connected to a BA243 Power Isolator as shown in Fig 7 using four Draka Norsk Kabe twisted pair cables:

The maximum cable length limitation imposed by the Lo of the isolator will be:

Gas group	**Lo**	**Maximum cable length**
IIC	79µH	79 / 0.67 = 117m

Alternatively considering the limitation imposed by the Lo/Ro ratio of the isolator:

The Draka Norsk Kabe cable has an L/R ratio of 12.7µH/Ω which is below the Isolators Lo/Ro output safety parameter for gas group IIC. Any length of this cable may be used between the Isolator and the Operator Panel the maximum length being determined by the cable's acceptable voltage drop.

The current consumption of a Pageant Operator Panel depends upon the number and type of plug-in input and output modules that are fitted. The maximum percentage of the total available power from the Pageant Operator Panel that each module consumes is shown on the datasheet and the instructions for each module. The sum of the power consumption of all the modules fitted determines how much current the Pageant Operator Panel draws from the Power Isolator.

Total % module power consumption	**Operator Panel maximum current**
20%	300mA
100%	400mA

The minimum operating voltage of a plug-in CPU module is 7.5V and the BA3901 Power Combiner introduces an additional 1.1V voltage drop. Therefore the minimum permissible voltage at the Operator Panel is 8.6V and each of the four BA243 channels supplies one quarter of the Operator Panels current consumption.

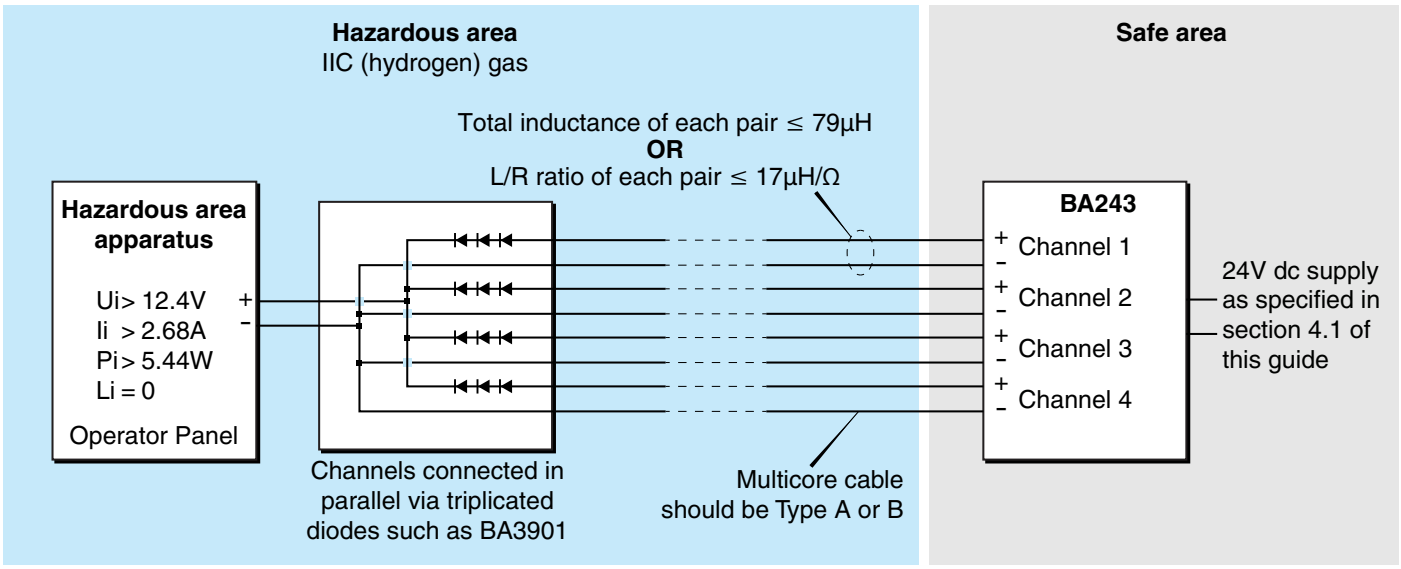


Fig 7 Combining 4 BA243 channels in hazardous area

The maximum allowable cable length can be calculated as follows:

$$\text{Max cable length} = \left[\frac{(Vo\ min - VL\ min) - Ro\ max}{IL\ max}\right]\left[\frac{1}{2 \times Rcab}\right]$$

Where:

Vo min	=	Minimum isolator output voltage with no load.
VL min	=	Minimum operating voltage of load
IL max	=	Maximum current supplied by each channel A.
Ro max	=	Maximum isolator output resistance Ω
R cab	=	Cable conductor resistance Ω/m

With 100% power consumption

$$= \left[\frac{(11.57 - 8.6) - 20.36}{0.10}\right]\left[\frac{1}{2 \times 0.0263}\right]$$

Max cable length = 177m

With 20% power consumption
Max cable length = 365m

This method of determining the maximum permitted cable length allows significantly longer cables than just considering the inductance of the cable.

6.3 Connecting two channels in parallel

If the required usable power in the hazardous area is greater than 1.05W but less than 2.1W, two channels of the BA243 may be remotely connected in parallel. This is spark ignition safe in a IIC atmosphere. Providing each channel and wiring is treated as a separate intrinsically safe circuit, single channel cable parameters are retained for each channel and no isolation diodes are required.

Fig 8 shows the required wiring and remote interconnection at the hazardous area apparatus.

Using the Draka Norsk Kabe cable and considering the inductance of the cable, lengths up to 117m in a IIC atmosphere may be used. The cable length achievable considering the cable L/R ratio depends upon the current consumed and the minimum acceptable operating voltage of the hazardous area apparatus.

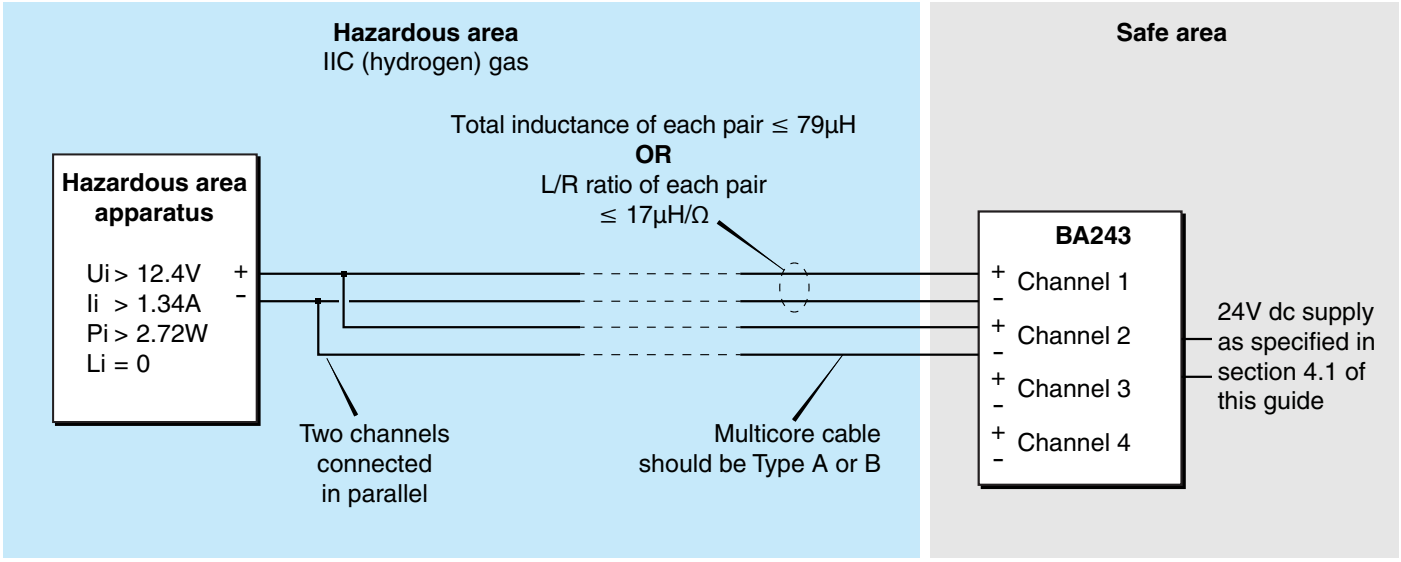


Fig 8 Combining 2 channels in hazardous area

7. POWER ISOLATOR INSTALLATION IN ZONE 2

In addition to intrinsic safety associated apparatus certification, BEKA Power Isolators also have IECEx, ATEX and UKCA increased safety Ex ec [iaGa] IIC Gc component certification:

IECEx	IECEx CML 20.0081U
ATEX	CML 20 ATEX 3123U
UKCA	CML 21 UKEX 3279U

This component certification permits the isolators to be installed in Zone 2 when provided with additional ingress protection. Copies of certificates may be downloaded from the BEKA associates website www.beka.co.uk.

7.1 Increased safety Ex e

Traditionally most barriers and galvanic isolators have used an Ex n protection technique for Zone 2 installations. Both the IEC and CENELEC are in the process of replacing Ex n Zone 2 protection techniques with variations of other methods of protection. Intrinsic safety without faults Ex ic has already replaced energy limiting Ex nL and non-sparking protection Ex nA is anticipated to be replaced by Ex ec for new equipment in 2022.

Increased Safety Ex e protection applies additional measures to provide increased security against the possibility of excessive temperatures and against the occurrence of arcs and sparks. The fifth edition of international standard IEC 60079-7:2015 Equipment Protection by Increased Safety 'e' defines two levels of protection:

Ex eb EPL Gb	Equipment may be installed in Zones 1 or 2. Electronic components may not be used.
Ex ec EPL Gc	Equipment may be installed in Zone 2. Electronic components maybe used. Intended to replace Ex nA protection.

7.2 Power Isolator Ex ec certificates

The Power isolator's Ex ec certificates classify the BEKA Power Isolators as Ex component equipment. EN IEC 60079-0, the general requirements for the explosive atmospheres standards, defines component equipment as:

> *Ex Component equipment is intended to be part of Ex Equipment, marked with the symbol "U", which is not intended to be used alone, and requires additional consideration when incorporated into Ex Equipment.*

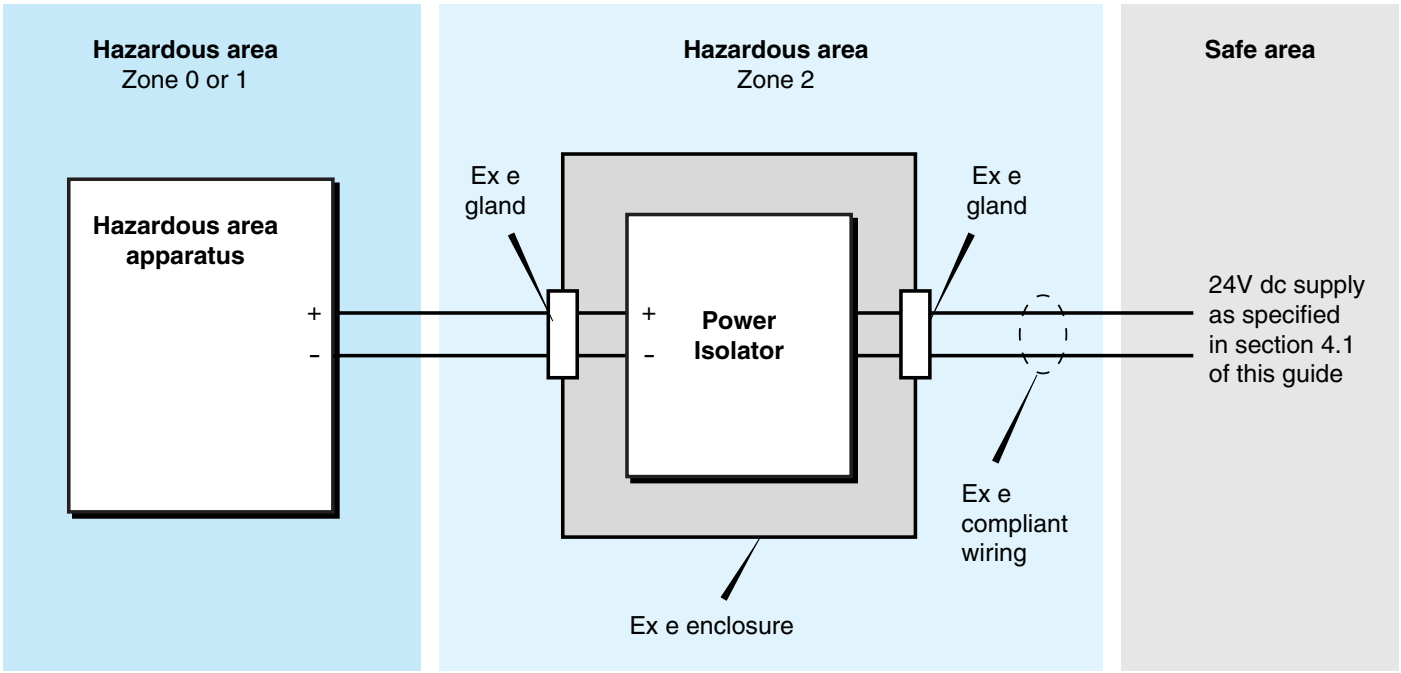


Fig 9 Mounting a BEKA Power Isolator in Zone 2

The Power Isolator component certificates have a schedule of limitations which contain the following clauses:

ii *The isolator shall be installed in an enclosure that meets the requirements of a type of protection as specified in EN / IEC 60079-0 clause 1, with a degree of protection at least as required for Ex e.*

iii *The equipment manufacturer shall ensure that the isolator is used within its rated operating temperature range, with due regard to other heat sources which may be present within the equipment enclosure. The service temperature range is the same as the ambient temperature range of -40°C to +70°C.*

iv *Where necessary, the equipment manufacturer shall take into account the following maximum temperature rises:*

Item	Rise (°K)
Isolator case	28
Input terminals	20
Output terminals	25
Small components	85

The equipment manufacturer referred to in this certificate schedule is the person responsible for the selection of the enclosure and the design of the isolator mounting and wiring. It is not the designer and manufacturer of the Power Isolator BEKA associates.

7.3 Zone 2 installation requirements

To comply with the Zone 2 component certificate requirements the Power Isolator must be installed in an enclosure providing a minimum of protection required for Ex ec increased safety equipment which is specified in EN IEC 60079-7. Enclosures can be metallic or non-metallic and exact protection requirements vary depending upon the contents.

Although any compliant enclosure may be used, the simplest solution is to use a proprietary enclosure with third party Ex ec component approval. Fig 9 illustrates the required configuration. To preserve the integrity of the enclosure all cable entries should be made via certified Ex e cable glands. The intrinsically safe Power Isolator output wiring should be segregated from the incoming Ex e power supply wiring and it should not pass through the same cable gland.

The wiring for all types of electrical circuits in hazardous areas, except intrinsically safe circuits, should comply with the Cable and Wiring Systems requirements specified in section 9 of IEC 60079-14 *Electrical installations design, selection and erection.*

The Ex e cable supplying power from the safe area to the Power Isolator in Zone 2 should have an adequate current and voltage rating, be mechanically robust with a toughened outer sheath, or it should be armoured. It should also be suitable for the expected operating temperature and be compatible with the glands used to seal the Ex e enclosure.

All hazardous area circuits, except intrinsically safe systems, should satisfy the requirements of IEC 60079-14 section 8 *Switch-off and isolation* and be protected from accidental electrical overloads. When using an instrument power supply complying with the European or UK Low Voltage Directive, overload protection is provided by the power supply and isolation may be achieved by switching off the power supply. The need for a specific means of isolation is not essential. since the risk is not as great as it is for higher power installations. The application diagrams in this guide therefore do not show separate fuses and a means of individually de-energising each loop, this accords with current practice in most extra low voltage instrument systems.

If site practice requires all loops to be protected by individual fuses and a means of isolating each loop, this can be readily achieved by using distribution cabinet terminals which incorporate a fuse and a means of isolation. However, this does marginally reduce the system operational reliability. Other methods of isolation, de-energising, and fault current limiting such as an mcb are equally acceptable.

7.4 Ex ec equipment assessment

Like the Ex ec component certificate for the BEKA Power Isolator, the Ex e certificate for the enclosure will almost certainly be a component certificate. These certificates confirm that when used alone in accordance with specific requirements each component complies with Ex e requirements. The certificates do not confirm that when the components are used together the resulting system is safe.

This requires additional consideration such as a third party Ex ec Equipment assessment and certificate for the isolator mounted within the enclosure. For ATEX & UKCA systems this can be a self-assessment.

7.5 Temperature classification

Ex ec component certificates such as those for the BEKA Power Isolators do not specify a surface temperature T rating. Components certificates for Ex ec enclosures may be allocated a T rating with specified contents such as the number of terminals they may contain, or a maximum internal power dissipation.

Temperature classification of Ex e equipment is performed in normal operation. The maximum operating temperature of the apparatus is usually the predominant factor in determining the temperature classification.

When housing BEKA Power Isolators the surface temperature of the Ex e equipment assembly comprising the enclosure and Power Isolator(s) should be assessed.

Most metallic Ex ec enclosures able to accommodate one BEKA Power Isolator can achieve a T4 (Maximum surface temperature 135°C). The maximum temperature within the enclosure should not exceed the maximum operating temperature of the BEKA Power Isolator which is 70°C. The Power Isolator's Ex ec certificate states that the maximum power dissipation is 8W, therefore the enclosure requires a thermal resistance of less than 8.2°C per watt.

8. POWER ISOLATOR INSTALLATION IN ZONE 22 OR 21

The BEKA Power Isolators do not have dust certification, but both the IECEx and ATEX increased safety Ex ec IIC Gc component certificates state in their schedule of limitations:

> The isolators are suitable for use in Ex tb applications when installed inside a suitable enclosure. The power consumption is 8.0W (BA212 and BA243).

IEC 60079-31 *Equipment dust ignition protection 't'* defines the requirements for a type of protection for explosive dust atmospheres where electrical equipment is mounted within an enclosure. The enclosure provides dust ingress protection and a means to limit surface temperatures.

Modifications

Issue 1a 13/10/2020	
Issue 1b 16/10/2020	Index added, minor changes made.
Issue 1c 21/10/2020	Minor changes made.
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Issue 1e 24/11/2021	Changes after circulation.
Issue 1f 10/02/2022	CJB mark ups.
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