2024 Annual Meeting of the IECEx System
Foz do Iguaçu Brazil

Electrical installations design, selection and installation of equipment, including initial inspection

Explosive Atmospheres

Electrical installation design, selection and installation of equipment, including initial inspection

Electrical installations inspection and maintenance

Equipment repair, overhaul and reclamation

IEC 60079-14

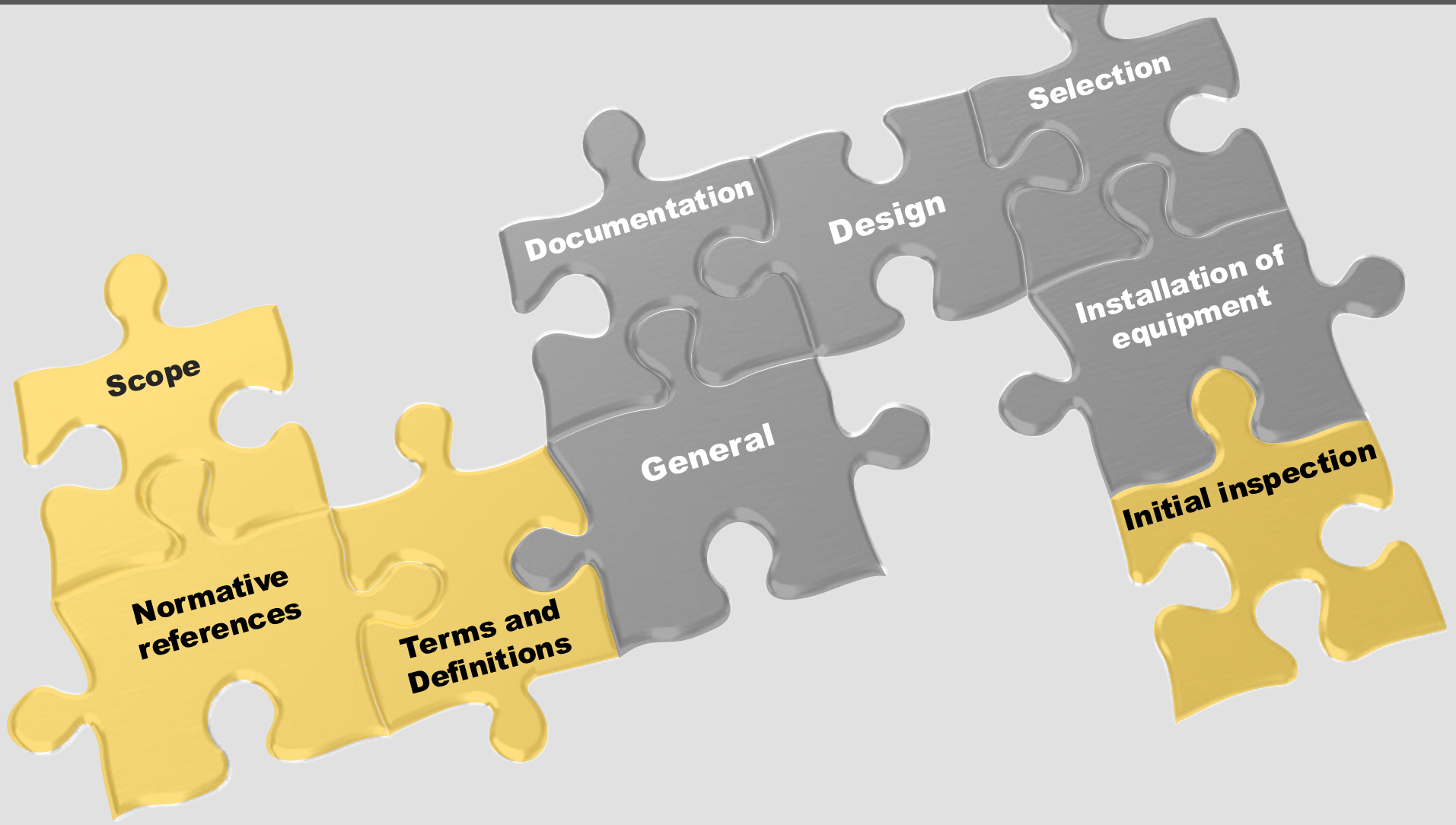
Edition 6.0 2024-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Explosive atmospheres –
Part 14: Electrical installation design, selection and installation of equipment, including initial inspection

Content IEC 60079-14:2024

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HYDROGEN
ENERGY
HYDROGEN
ENERGY

4. General

4.1.1 Zones and Equipment Protection Level

Zone	Equipment Protection Level (EPL)
0	Ga
1	Gb or Ga
2	Gc, Gb or Ga

4.1.2 Requirements for all Ex Equipment

Electrical installations in potentially explosive atmospheres must ***additionally*** comply with the corresponding requirements for ***electrical installations in non-hazardous atmospheres.***

If additional protection is required to meet other environmental conditions, such as protection against water ingress and corrosion resistance, the method used shall not compromise the integrity of the Ex Equipment.

4.2.2 Specific Conditions of Use

The symbol “X” is used to indicate the basic requirements for the installation, use, maintenance and repair of the Ex Equipment contained in the Ex Certificate, the so-called **“Specific Conditions of Use”**.

The “Specific Conditions of Use” listed in the Certificate must be complied with.

Task of the designer!

Nominal voltage:	6 V...230 V DC ±10 %; 60 V...230 V AC ±10 %
Rated current:	0.05 A...22.2 A DC; 0.2 A...1.06 A AC
Limiting power:	10.1 W...130 W
Ambient temperature:	-30 °C...+60 °C

These values are maximum values. See Annex for detailed information.

SPECIFIC CONDITIONS OF USE: YES as shown below:

A fuse corresponding to the device's rating current (max. 3 x I_N or, resp. I_B acc. to IEC/EN 60127-2) or, respectively, a motor protective switch with short circuit and thermal rapid release (corresponding to the rating current) has to be connected in series to each solenoid.

The solenoid is suitable for an extended temperature range. The user has to select appropriate cable glands and connection cables according to the specifications of the manufacturer.

The selected cable glands and / or blanking elements shall contain an additional seal or gasket to effectively seal threaded entries.

The terminal box with coating shall not be exposed to intense electrostatic charging processes.

Operation of the solenoid type GTCE 140 AGD… with 130 W in mode of operation S3 40 % 5 min is only permitted in conjunction with an adequate safety device for direct temperature control (e.g. a PTC thermistor relay), which has to be selected, provided and verified for Ex (hazardous location) application by the user.

Unused terminals inside the terminal box of the solenoid shall be tightened.

The interrupting transient overvoltage of solenoids without internal protective circuit shall be limited according to the specifications of the manufacturer by means of appropriate measures external to the solenoid.

5. Documentation

5.1 General

The installations must comply with the relevant certificates of the Ex Equipment, the present document and all requirements for the installation. **An installation dossier must be prepared for each installation to demonstrate compliance.**

The installation dossier must be kept up to date throughout the entire operating life of the installation. The dossier may be in paper or in electronic form.

5.2 Information about the location

- Documents for the classification of potentially explosive atmospheres including the temperature class or ignition temperature and the equipment group, where applicable;
- Assignment of the Equipment Protection Levels;
- Any identified external influences;
- **Ambient temperature ranges**, including solar radiation;
- Evidence of the competence of the persons who carried out the design, selection, installation of the equipment and initial inspection.

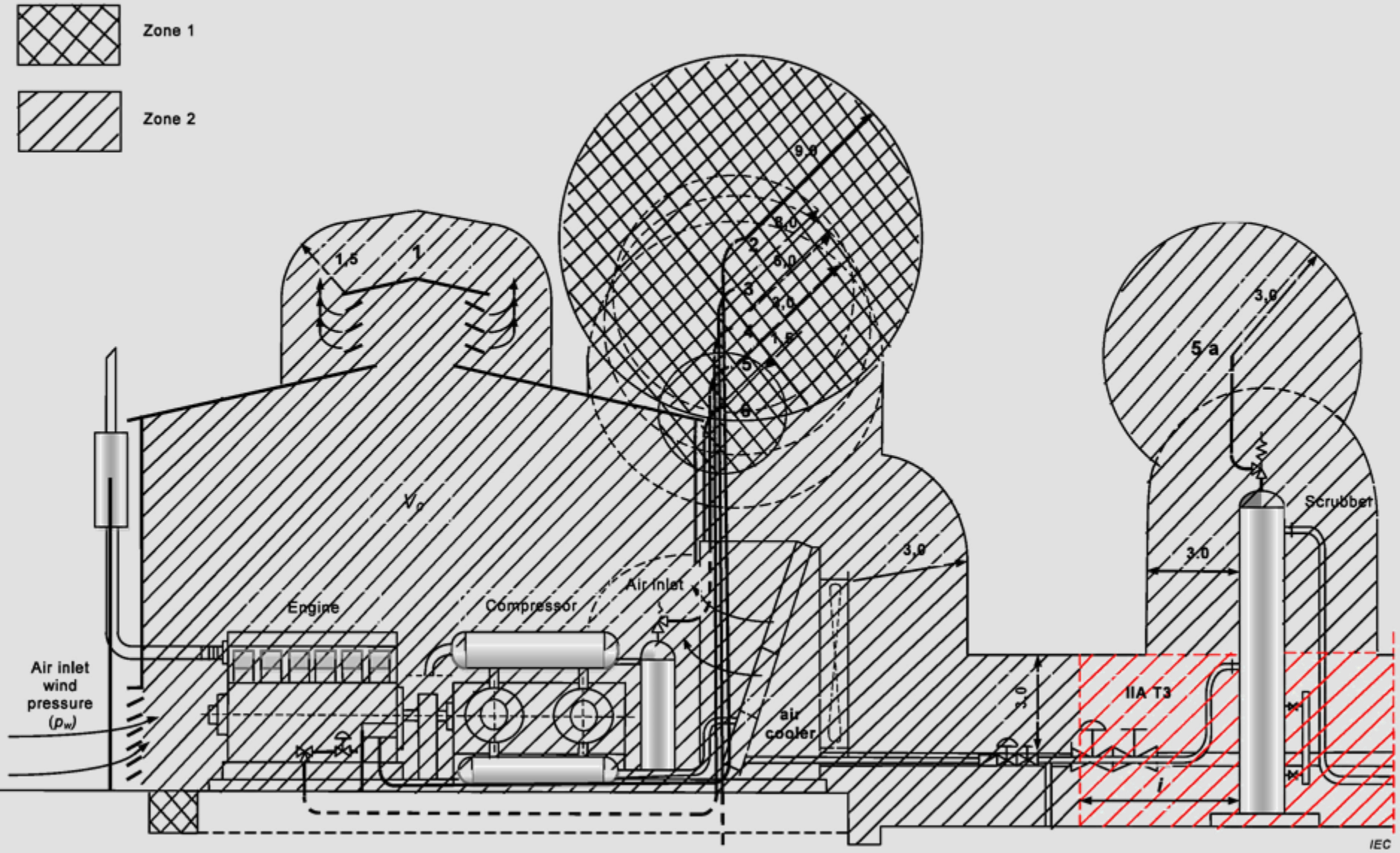
IEC 60079-10-1

Edition 2.0 2015-09

INTERNATIONAL STANDARD

Explosive atmospheres –
Part 10-1: Classification of areas – Explosive gas atmospheres

Area classification – Basic Example



5.3 Documentation – Ex Equipment

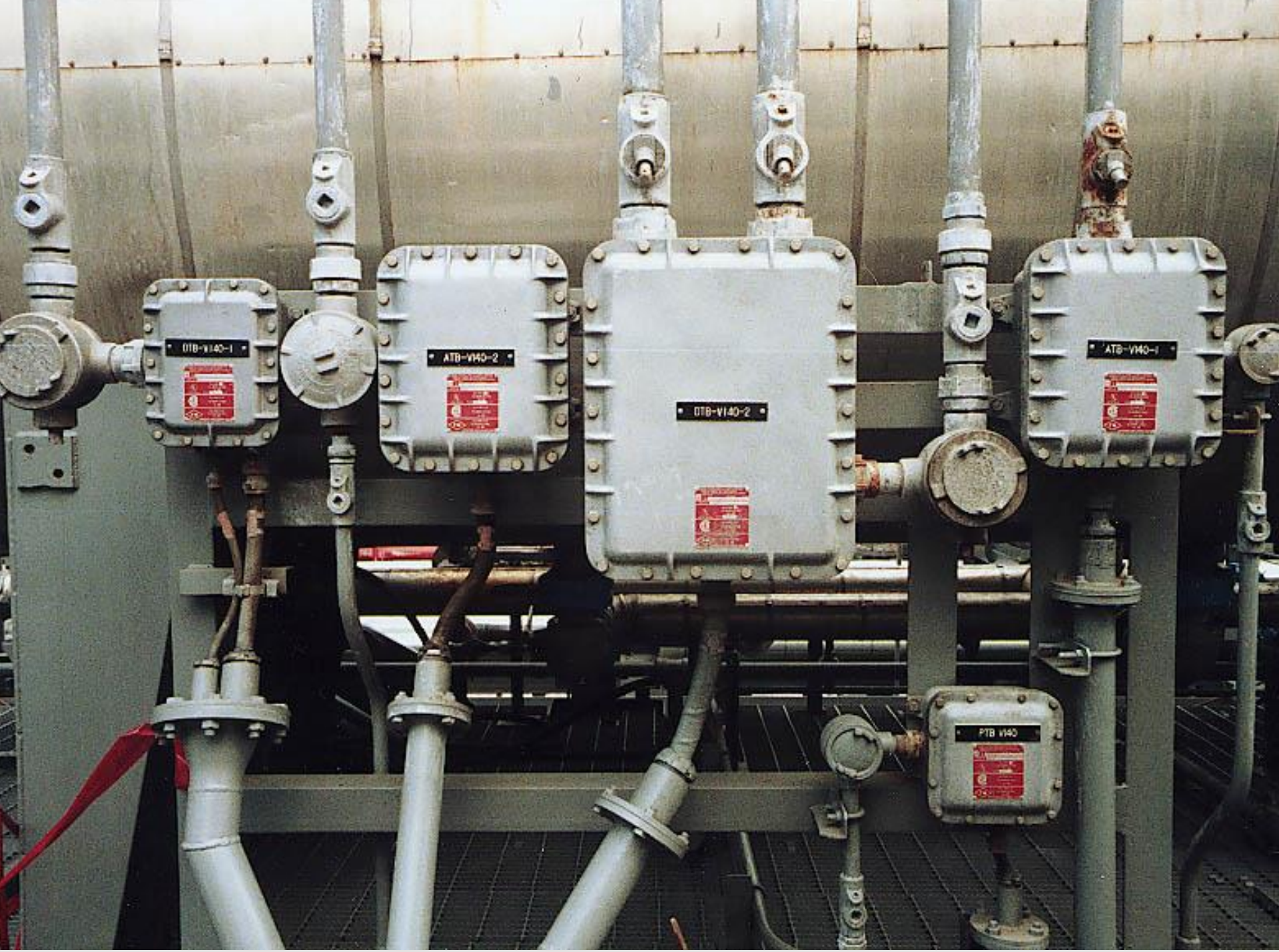
- Operating instructions of the Ex Equipment manufacturers with information on the intended use, for installation and initial testing, for maintenance and repair, if applicable
- Documents for Ex Equipment with **Specific Conditions of Use**
- Descriptive system documents for intrinsically safe systems
- Calculations or information , for example Ex “e” calculations and purging rates for pressurized equipment

5.4 Documentation - Installation (1)

- Manufacturer's instructions
- Documentation on the suitability of the Ex Equipment for the area and environment to which it is exposed, for example temperature ratings, Type of Protection, degree of protection (IP Code), corrosion resistance;
- **Plans showing types and details of wiring systems and cable routing;**
- Records of selection criteria for cables, cable entry systems and conduits for compliance with the requirements for the particular Type of Protection;

5.4 Documentation - Installation (2)

- **Drawings of the conduit installation and the location of the sealing fittings;**
- Drawings and schedules relating to circuit identification;
- Records of the initial inspection;
- Installer's/qualified person's declaration


DTB-V140-1
ATB-V140-2
DTB-V140-2
ATB-V140-1
PTB V140

5.5 Personnel competency

The design of installation, the selection of Ex Equipment and installation accessories, installation and initial inspection covered in this document shall only be carried out by persons whose training has included instruction on the various Types of Protection and installation practices, relevant rules and regulations and on the general principles of area classification.

The competence of the person(s) must be relevant to the type of work to be carried out.

The staff must continuously undergo appropriate further education or training.

6. Design

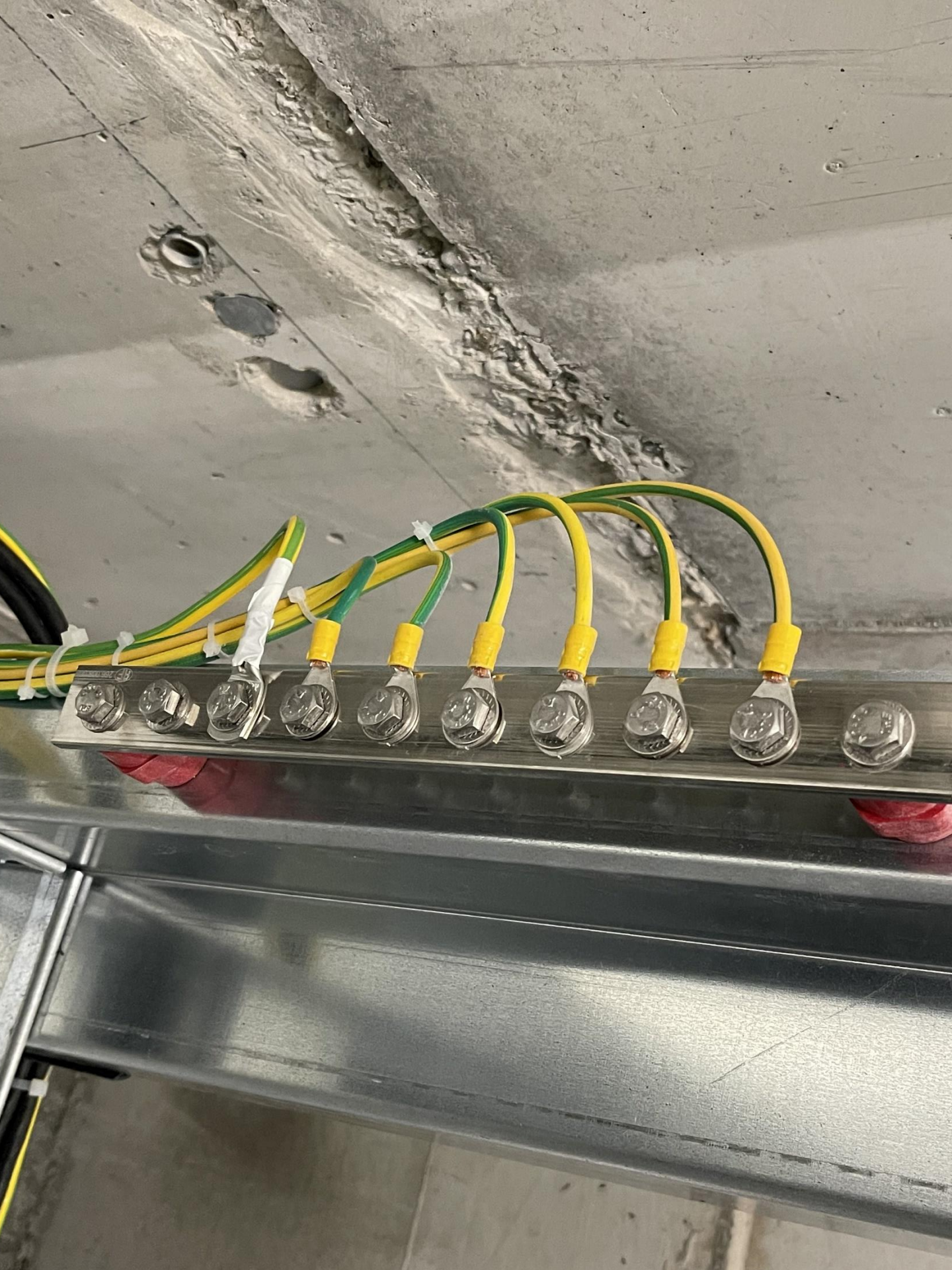
6.2.6 Protective equipotential bonding conductor

The cross-section for the protective equipotential bonding conductor is at least ***6 mm²*** (based on the conductance of copper) in accordance with IEC 60364-5-54 and at least ***4 mm² for the*** additional connections.

Mechanical strength must be taken into account for the connections, this may require cross-sections of 16 or 25 mm².

The connections must meet the following requirements:

- secured against self-loosening and
- be protected against corrosion.



Ratings and technical data

Provided the electrical and thermal exposure of the motors of this type does not differ from the tested sample in any significant way, this certificate applies to the following motor rating:

Star connection

Torque:	76	96	120	120	69	Nm
Output: **)	1.07	2.85	9.14	18.5	18.5	kW
Voltage: *)	45	80	200	400	400	V
Current:	27.5	29	34	34.5	34	A
Frequency:	5	10	25	50	87	Hz
Speed:	134	283	727	1475	2559	min^{-1}
Duty type:			S1			
Thermal class:			155 (F)			

Delta connection

Torque:	76	96	120	120	120	Nm
Output: **)	1.07	2.85	9.14	18.5	32.5	kW
Voltage: *)	26	46	115	230	400	V
Current:	48	50	59	60	60	A
Frequency:	5	10	25	50	87	Hz
Speed:	134	283	727	1475	2584	min^{-1}
Duty type:			S1			
Thermal class:			155 (F)			

6.7.3.4 Electrical machines with converter supply (2)

b. Electrical machines that have been tested for converter operation, but where the type and manufacturer of the converter is not specified. In this case, the characteristics of the selected converter, the maximum converter input voltage and the converter settings must match the specifications of the electrical machine manufacturer.

6.12 Flameproof enclosures “d”

Ex Equipment marked “IIB + H_2” and used in a hydrogen atmosphere shall be installed as Ex Equipment of Group IIC.

6.13.2 Maximum number of conductors

The manufacturer's operating instructions must contain the permissible number of terminals, the conductor cross-section and the maximum current for each terminal size.

If not, all terminals will be loaded simultaneously, then the load factor may be used for the calculation.

6.13.2 Maximum number of conductors

Current	Cross-section in [mm²]							
[A]	1,5	2,5	4	6	10	16	25	35
6	102							
10	68	102						
16	23	45	84					
20	9	26	51	64				
25		12	28	24	52			
35			8	5	52	44		
50					10	44		
63						16		
80								
100								
max. number of terminals	51	51	42	32	26	22		

6.13.2 Maximum number of conductors

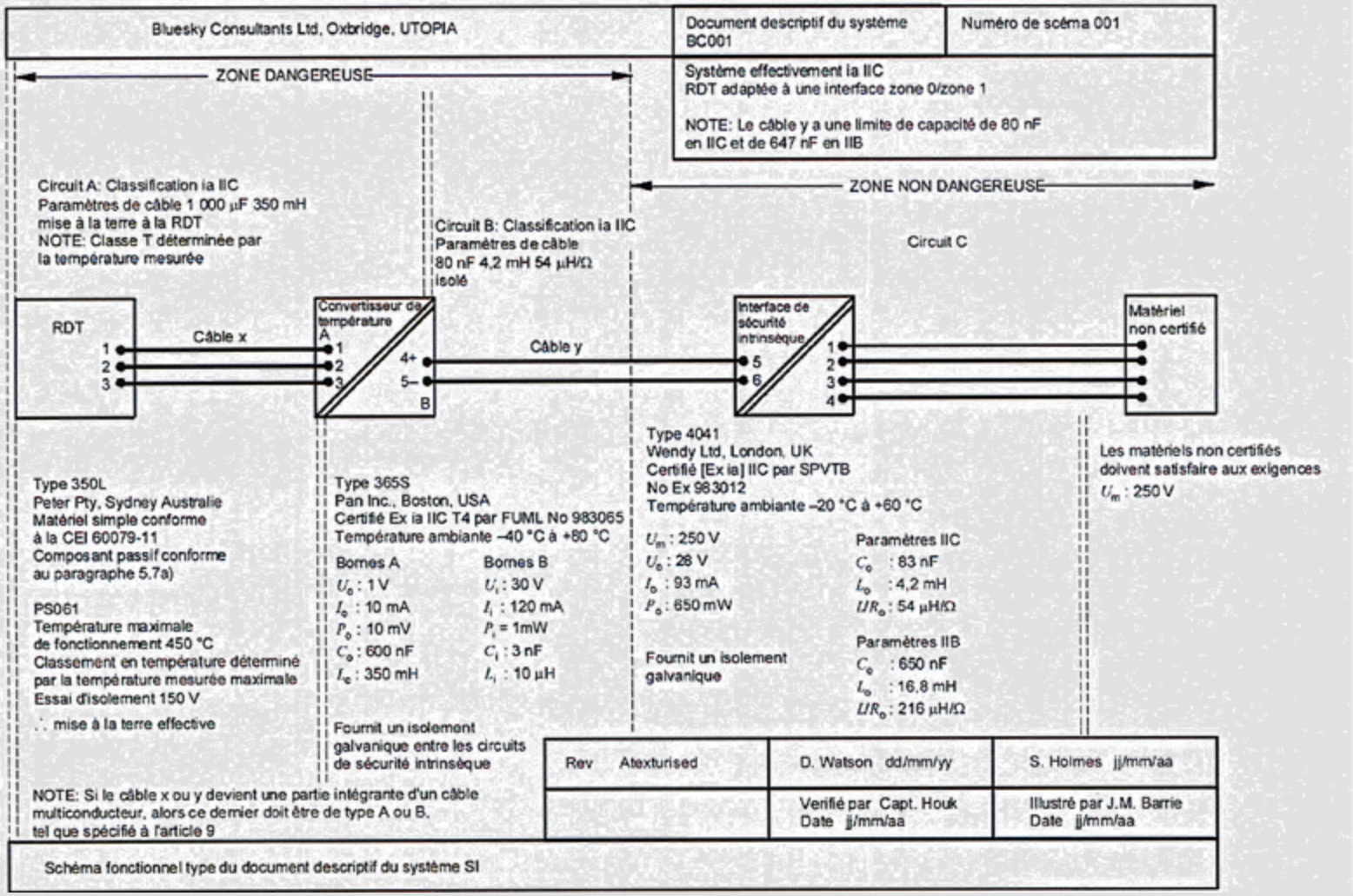
6.14.3.2 Descriptive system document

The designer must prepare a descriptive system document specifying the Ex equipment, including the simple equipment and the electrical parameters of the system, including the connecting cables.

The form of the required system description is not specified in the standard and could be covered, by drawings, diagrams, operating instructions or similar documents.

Sample of descriptive system document

Extract from IEC 60079-25



can lead into areas of Zone 1 (EPL Gb) or Zone 21 (EPL Db).

15.3 **Parameters**

15.3.1 Type SB0604-*-6.51-248

15.3.1.1 Input circuit 1: terminal 1 = In 1+, terminal 2 = In 1 GND, terminals 3,4 = PA
Input circuit 2: terminal 5 = In 2+, terminal 6 = In 2 GND, terminals 6,7,8 = PA

Nominal voltage		DC	12	V
Maximum voltage	Um			
for type SB0604-1-*-*		AC/DC	60	V
for type SB0604-2-*-*		AC/DC	253	V

15.3.1.2 Output circuits, intrinsically safe level of protection Ex ib
terminal 13 = Out 1+, terminals 14, 15, 16 = Out 1 - GND
terminal 9 = Out 2+, terminals 10, 11, 12 = Out 2 – GND

Channel 1 and 2 separated, values for each channel

Voltage	U_o	DC	6.51	V
Current	I_o		248	mA
Power	P_o		1.13	W

Trapezoid output characteristic

The values for external inductance and external capacitance connected in acc. with the following table:

	Group IIC				Groups IIB and IIIC		
L_o	1 µH	100 µH	500 µH	710 µH	1 µH	1 mH	3.1 mH
C_o	22 µF	3 µF	1.1 µF	0.73 µF	500 µF	7.4 µF	2.6 µF

15.3.2 Type SB0605-*-13-188

15.3.2.1 Input circuit 1: terminal 1 = In 1+, terminals 2,3 = GND, PA, terminal 4 = In 1-
Input circuit 2: terminal 5 = In 2+, terminals 6,7 = GND, PA, terminal 8 = In 2-

Nominal voltage		DC	12	V
Maximum voltage	Um			
for type SB0605-1-*-*		AC/DC	60	V
for type SB0605-2-*-*		AC/DC	253	V

6.14.3.3 Intrinsically safe circuits with only one current source

If values in permissible pairs for L_o and C_o are specified in the certificate for the associated equipment, these combined inductances and capacitances can be used for the verification.

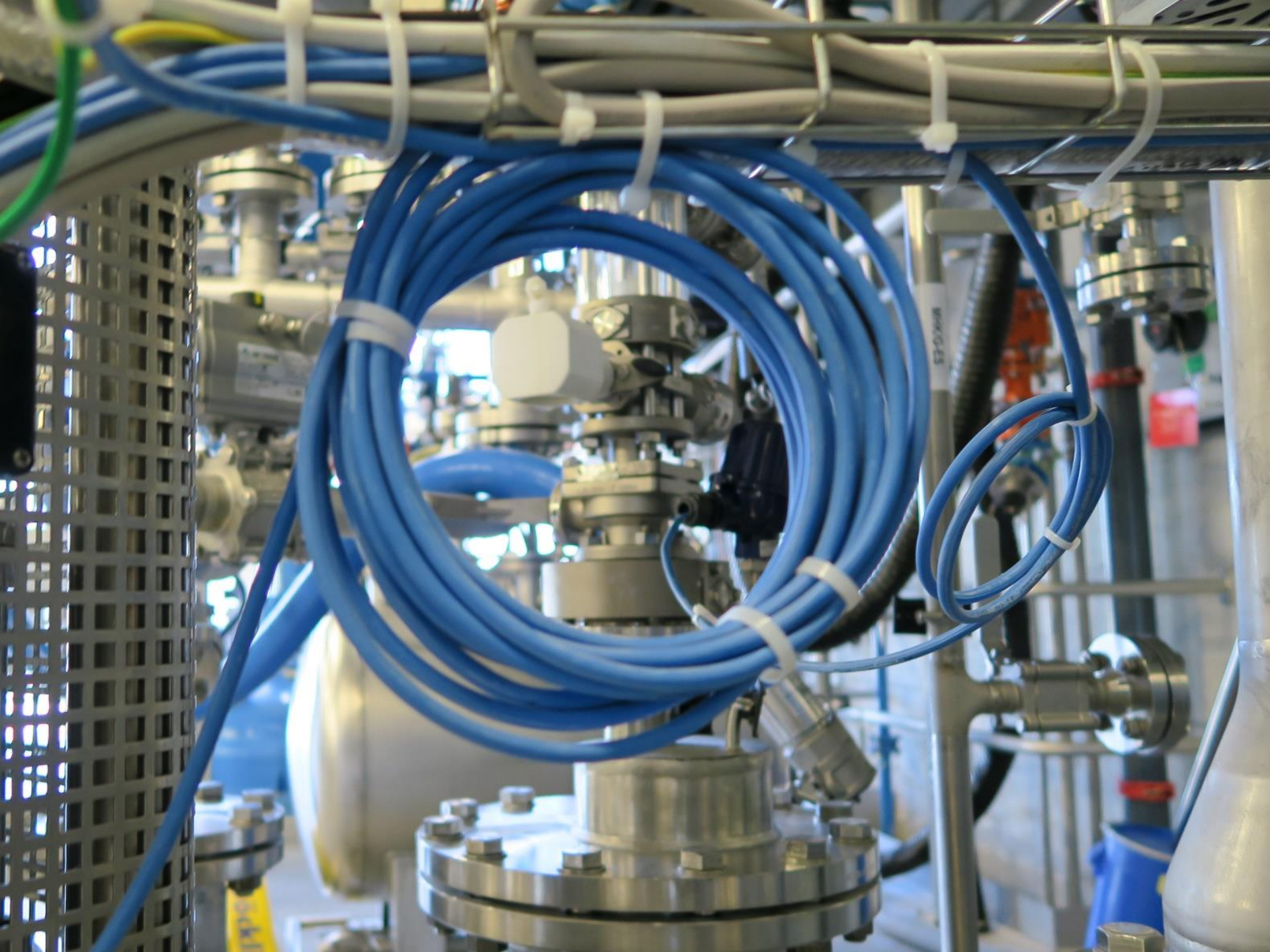
Remark:

Applies only to intrinsically safe circuits with only one current source and linear characteristic!

6.14.6 Marking of the cables

Cables containing intrinsically safe circuits shall be marked to identify them as part of an intrinsically safe circuit. If sheaths or enclosures are identified by a colour, the colour for cables containing intrinsically safe circuits shall be light blue.

For alternative possibilities see 8.9.3.2



7. Selection

7.3.1 Information requirements (1)

The following information is required for the selection of suitable Ex Equipment for potentially explosive atmospheres:

- the classification of the potentially explosive atmosphere including **Equipment Protection Level (EPL)**;
- the gas, vapour or dust classification in relation to the group or subgroup of Ex Equipment;
- Temperature class or ignition temperature of the gas or vapour concerned;
- Minimum ignition temperature of the dust cloud or dust layer;

7.3.1 Information requirements (2)

- the intended use of the Ex Equipment;
- the external influences;
- the ambient temperature.

7.3.7.2 Relation between EPL and Types of Protection

EPL	Type of protection	Code	Standard
Gb	Flameproof enclosure	d, db	IEC 60079-1
	Pressurization	p, pxb, pyb	IEC 60079-2
	Powder filling	q	IEC 60079-5
	Liquid immersion	o, ob	IEC 60079-6
	Increased safety	e, eb	IEC 60079-7

7.3.8 Selection according to the equipment group

Required gas/steam or dust subdivision	Permitted Equipment Group
IIA	II, IIA, IIB or IIC
IIB	II, IIB or IIC
IIC	II, IIC

7.3.9 Selection according to temperature class

Required temperature class	Ignition temperature of gases and vapours	Permissible temperature classes of the units
T1	> 450 °C	T1-T6
T2	> 300 °C	T2-T6
T3	> 200 °C	T3-T6
T4	> 135 °C	T4-T6
T5	> 100 °C	T5-T6
T6	> 85 °C	T6

7.3.10 Selection according to the ambient temperature

If no **ambient temperature range is** specified in the marking of the electrical appliance, then the appliance is **only intended** for use in the temperature range from
–20 °C to 40 °C.

Example
extended ambient temperature range T_{amb}

$-30\ °C \leq T_{amb} \leq 65\ °C$

Note
IEC 60079-0 Edition 8 requires a marking for the ambient temperature for all ranges including –20 °C to 40 °C!

7.4 Selection of cables

The cables must be suitable for the operating conditions used and must be selected and laid in such a way that they cannot be damaged during operation.

7.4 Selection of cables

The construction of the cable must either

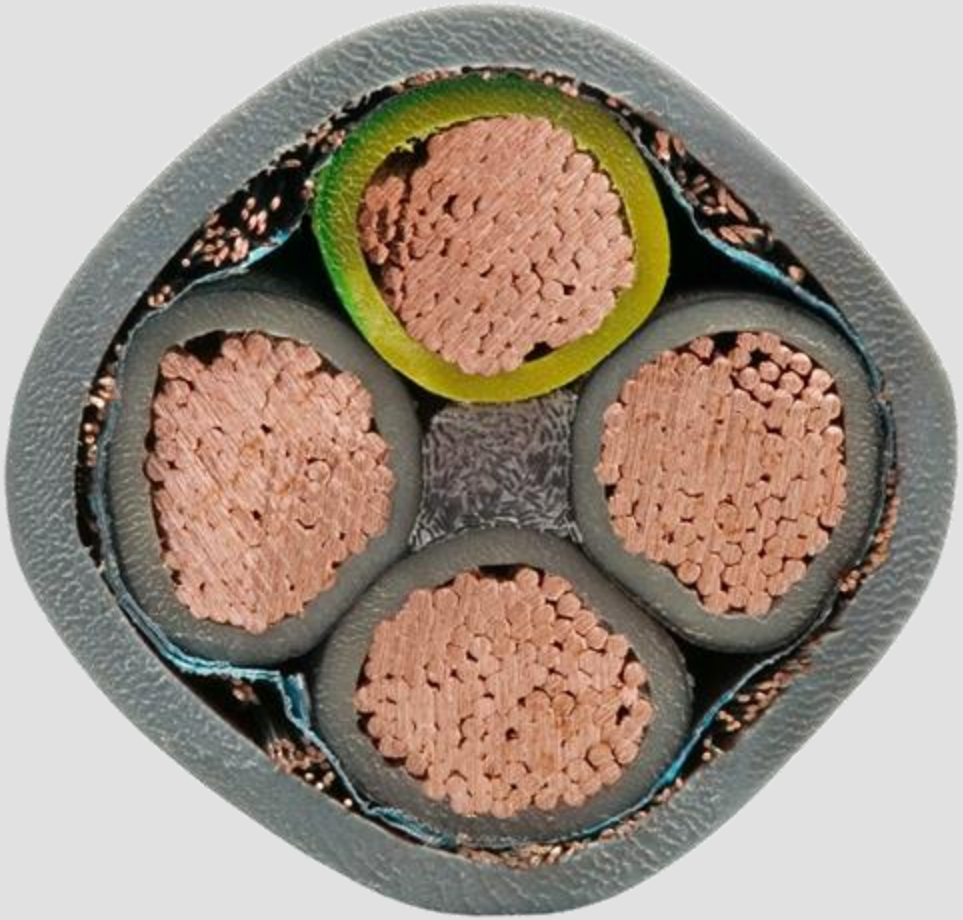
- nominally circular and installed with a cable entry selected in accordance with section 7.5 to maintain the degree of protection (IP Code) of the Ex Equipment; or
- non-circular (flat) cables selected together with the specific cable entry to maintain the degree of protection (IP Code) of the Ex Equipment.

7.4 Selection of cables

In cases where there may be gas migration through the cable due to the application and the cable enters a non-hazardous area or between different zones, the compactness of the cable must be considered.

Suitable cable entries can be, for example, barrier glands, which seal around the individual conductors.

7.4 Selection of cables

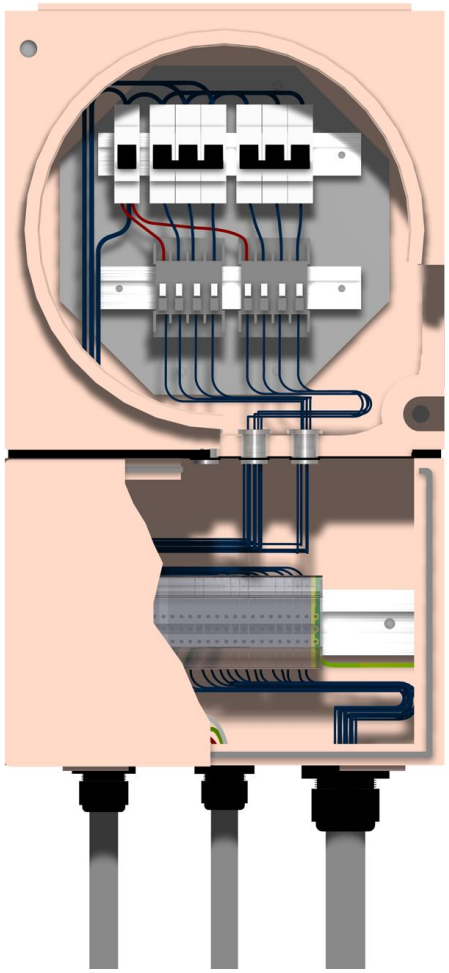


7.5.1 Selection of entry devices and other fittings

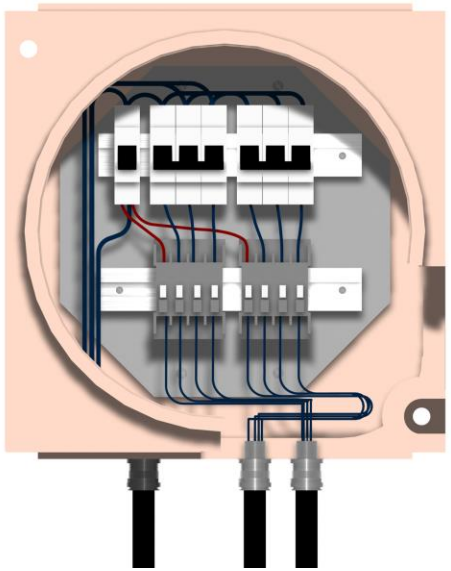
Extract from Table 15

Protection technique for the equipment	Glands, adapters and blanking element protection technique			
	Ex “d”	Ex “e”	Ex “n”	Ex “t”
Ex “d”	X			
Ex “e”	X (IP 54)	X		
Group II Ex “i” / Ex “nL”	X	X	X	
Group III Ex “i”				X

7.5.6 Cable entries for Type of Protection “d”



Indirect

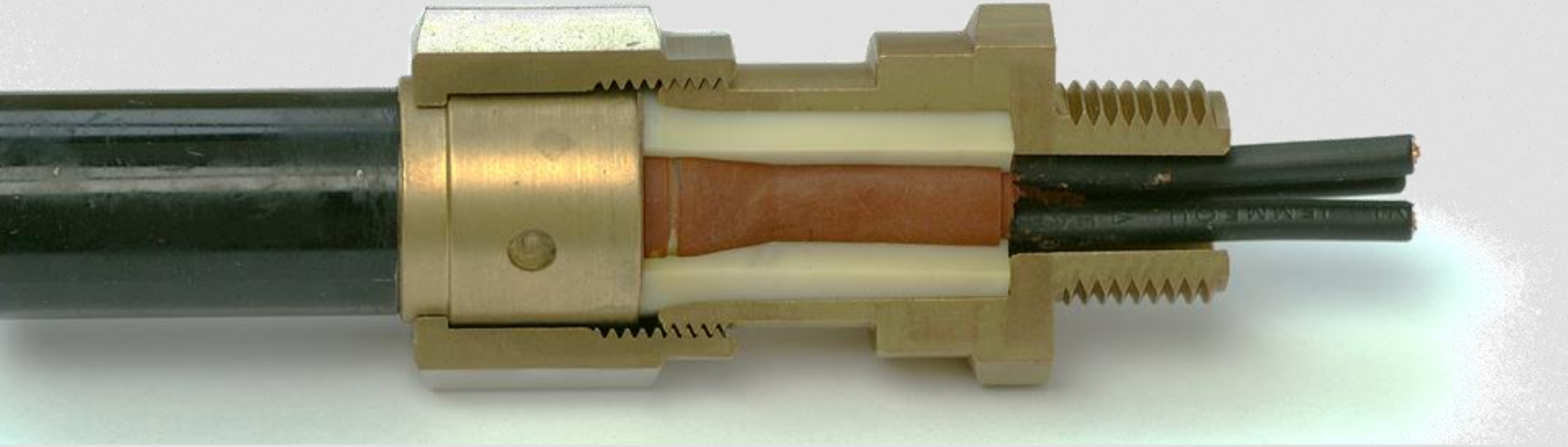


Direct

7.5.6 Cable entries for Type of Protection “d”

The cable entries must comply with one of the following requirements:

a. Barrier glands in accordance with IEC 60079-1 and certified as equipment; or

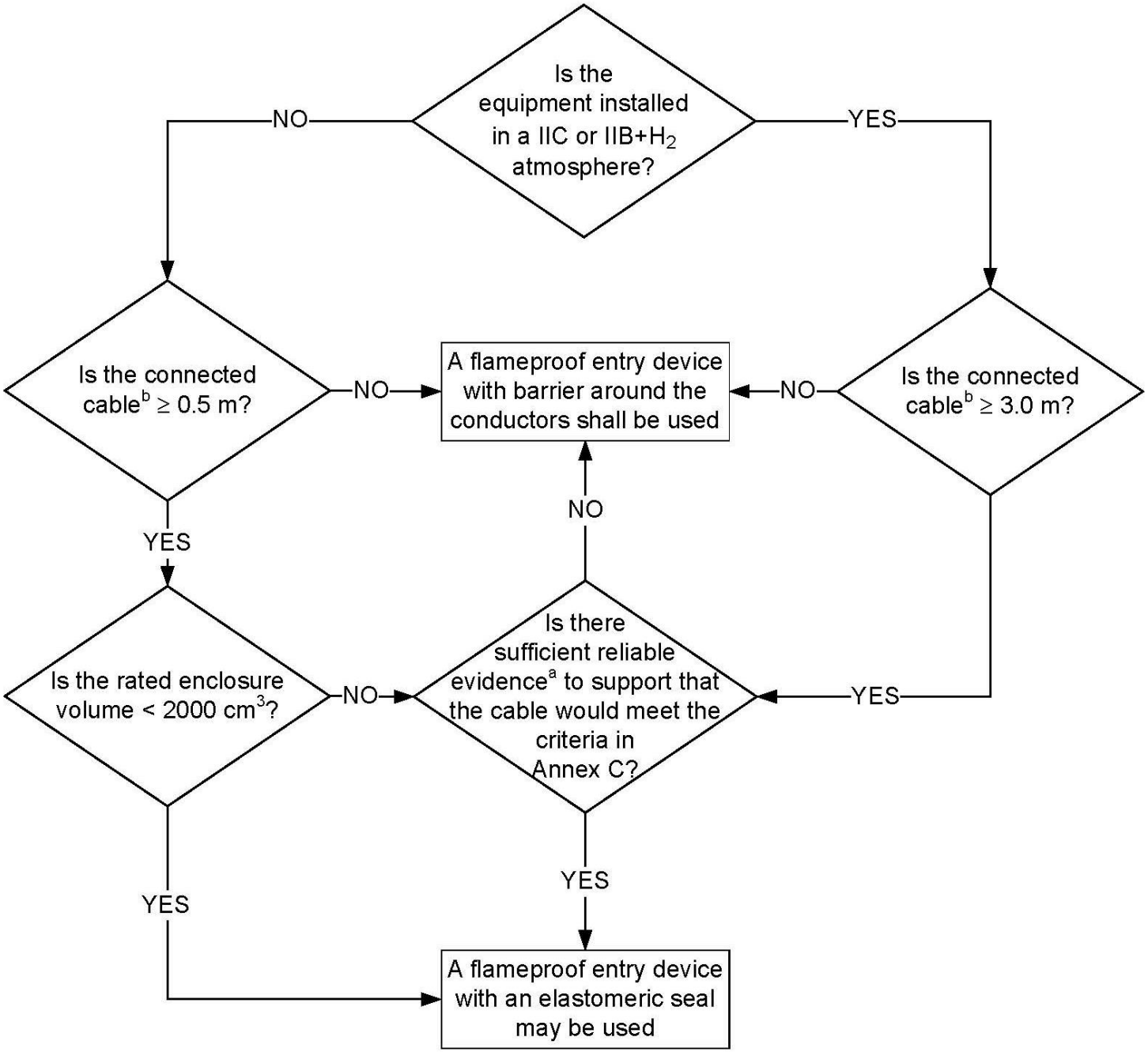


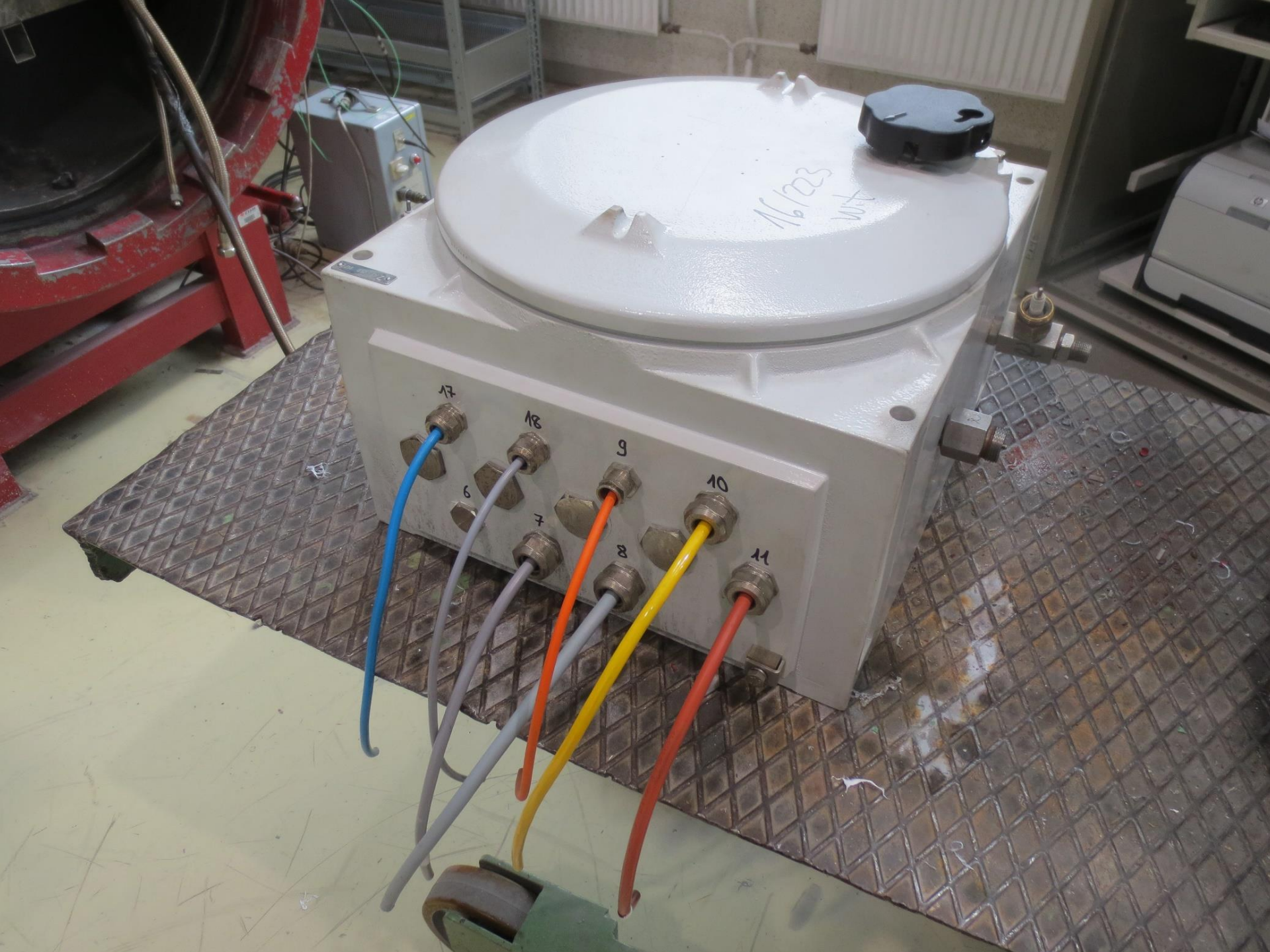

FLOWSERVE
APEX 8000

7.5.6 Cable entries for Type of Protection “d”

b. Cable entries in compliance with IEC 60079-1, certified as equipment and selected according to the new flow chart; or

c. Indirect cable entry through a combination of a flameproof enclosure with an Ex d bushing (Ex component) and a terminal box, for example in the increased safety “Ex eb” Type of Protection.


Is the equipment installed in a IIC or IIB+H_2 atmosphere?
NO
YES
Is the connected cable[b] ≥ 0.5 m?
NO
A flameproof entry device with barrier around the conductors shall be used
NO
Is the connected cable[b] ≥ 3.0 m?
YES
NO
YES
Is the rated enclosure volume < 2000 cm^3?
NO
Is there sufficient reliable evidence[a] to support that the cable would meet the criteria in Annex C?
YES
YES
YES
A flameproof entry device with an elastomeric seal may be used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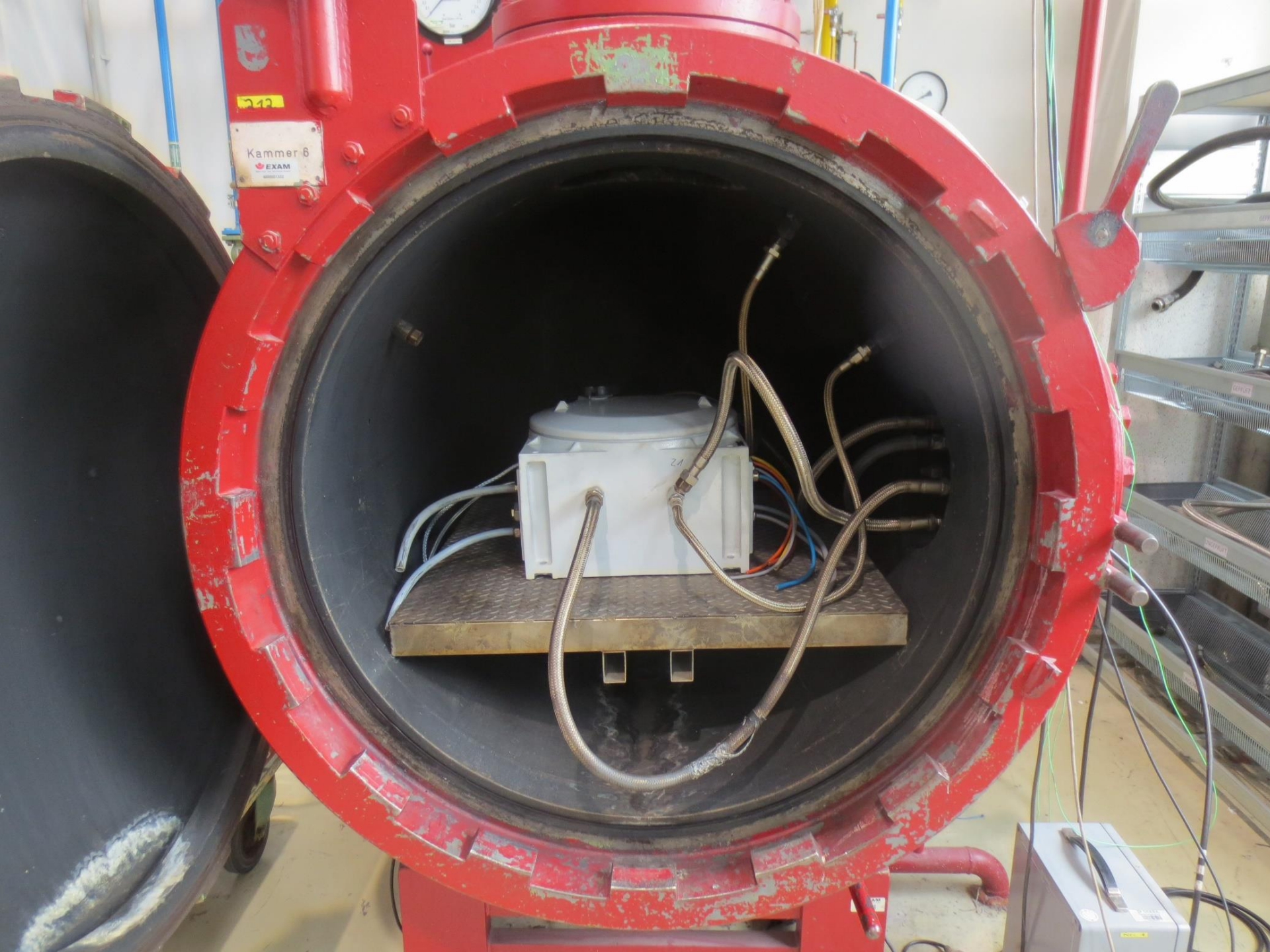
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EXAM

IEC SC 31J SD 001

Edition 1.0 2022-03

Background to flameproof cable gland requirements in IEC 60079-14

8. Installation of the equipment

8.2 Cable and wiring systems (1)

8.2.2 Equipotential bonding connections

The equipotential bonding connections should be arranged in such a way that the removal of a single connection does not lead to the loss of equipotential bonding of other parts.

The preferred arrangement for connecting multiple equipotential bonding wires is to provide a rail that allows each item to be provided with individual equipotential bonding as required.


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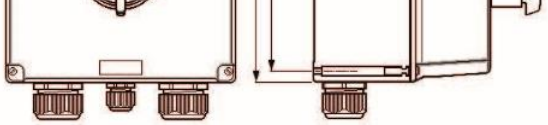
8.2 Cable and wiring systems (2)

8.2.3 Terminations

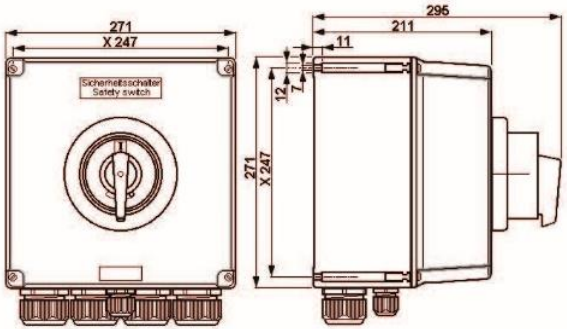
8.2.3.1 General

Connections must be made in accordance with the terminal type, degree of protection (IP Code) and the manufacturer's instructions to avoid undue voltages, hot spots and arcing at the terminals .

All screw and bolt connections must be *tightened to the torque specified by the manufacturer* of the Ex terminals.



GHG 264 .., 80 A 3-pole



GHG 264 .., 80 A 6-pole

Ex tb IIIC T80 °C Db

Rated voltage:		690 V, 50/60 Hz		
Rated current:		80 A		
		up to U_N 400 V	up to U_N 500 V	up to U_N 690 V
Perm. short circuit back-up fuse:		160 A/gG	160 A/gG	160 A/gG
Switching capacity AC 3:		80 A	80 A	63 A
Switching capacity DC 1 / DC 23:	U_e	120 V	60 V	
	I_e	80 A	80 A	
		2 contacts in series	1 contact	

Cable entries (standard version):	3-pole version	6-pole version
	2 x M50 + 1 x M25	4 x M50 + 1 x M25

suitable cables and test torques of the pressure screw				
Cabel entry:			M25	M50
Seal 1+2+3 (Ø mm / Nm)	1 2 3	min.	8.0 / 1.5	
		max. (1)	10.0 / 2.0	
Seal 1+2 (Ø mm / Nm)	1 2	min.	10.0 / 2.3	24.0 / 6.0
		max. (1)	13.0 / 2.6	28.0 / 7.0
Seal 1 (Ø mm / Nm)	1	min.	13.5 / 1.3	28.0 / 5.0
		max. (1)	17.5 / 2.3	35.0 / 7.0
Test torque for screw in thread cable entry (Nm)			3.0	7.5

(1) The tests of clamping ranges and torque values were performed with metal mandrel. The clamping range can vary by using cables with different manufacturing tolerances and material properties. Please use a suitable combination of seals in the intermediate area, so that the cap nut can be tightened in future maintenance work on the cable entry.

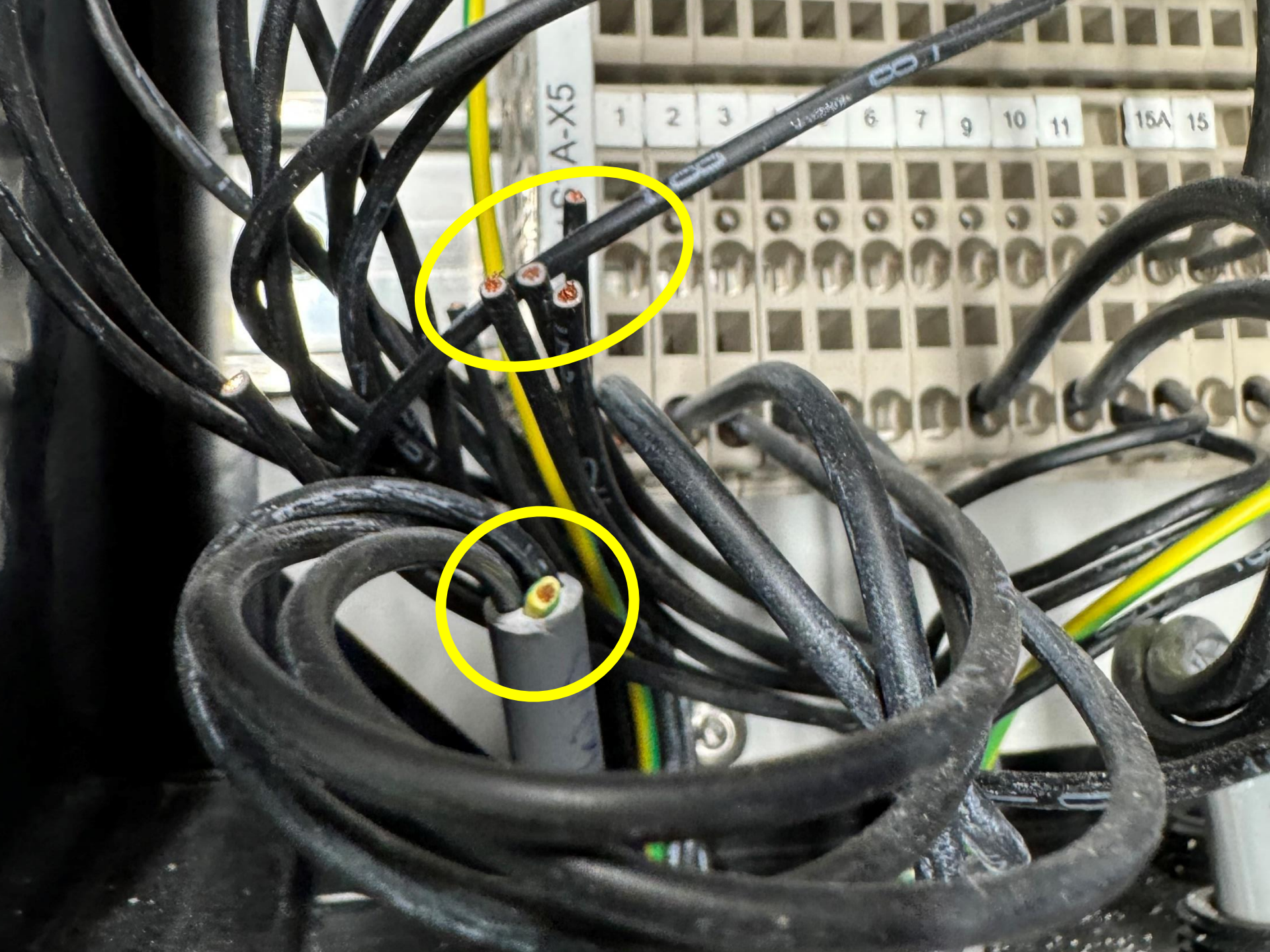
Main contact terminals:			1x / 2x 4.0- 25 mm² (with cable lug 1x 35 mm²)		
		Rated current:	Ambient temperature at T_{amb}: +40 °C	+50 °C	+55 °C
	16 mm²	≤ 63 A	T6	T6	T6
		≤ 80 A	T6	T5	–
	25 mm²	≤ 80 A	T6	T6	T6
	35 mm²	≤ 80 A	T6	T6	T6
Test torque terminals:			3.5 Nm		
Weight (standard version):			3-pole version approx. 6.50 kg		6-pole version approx. 9.00 kg

8.2 Cable and wiring systems (3)

8.2.3.2 Unused cores

The end of each unused core of cables shall either be adequately connected to terminals suitable for the Type of Protection or connected to earth.

Insulation by tape alone is not permitted for all Types of Protection. Insulation using shrink tube is not permitted inside Ex “e” and Ex “nA” enclosures.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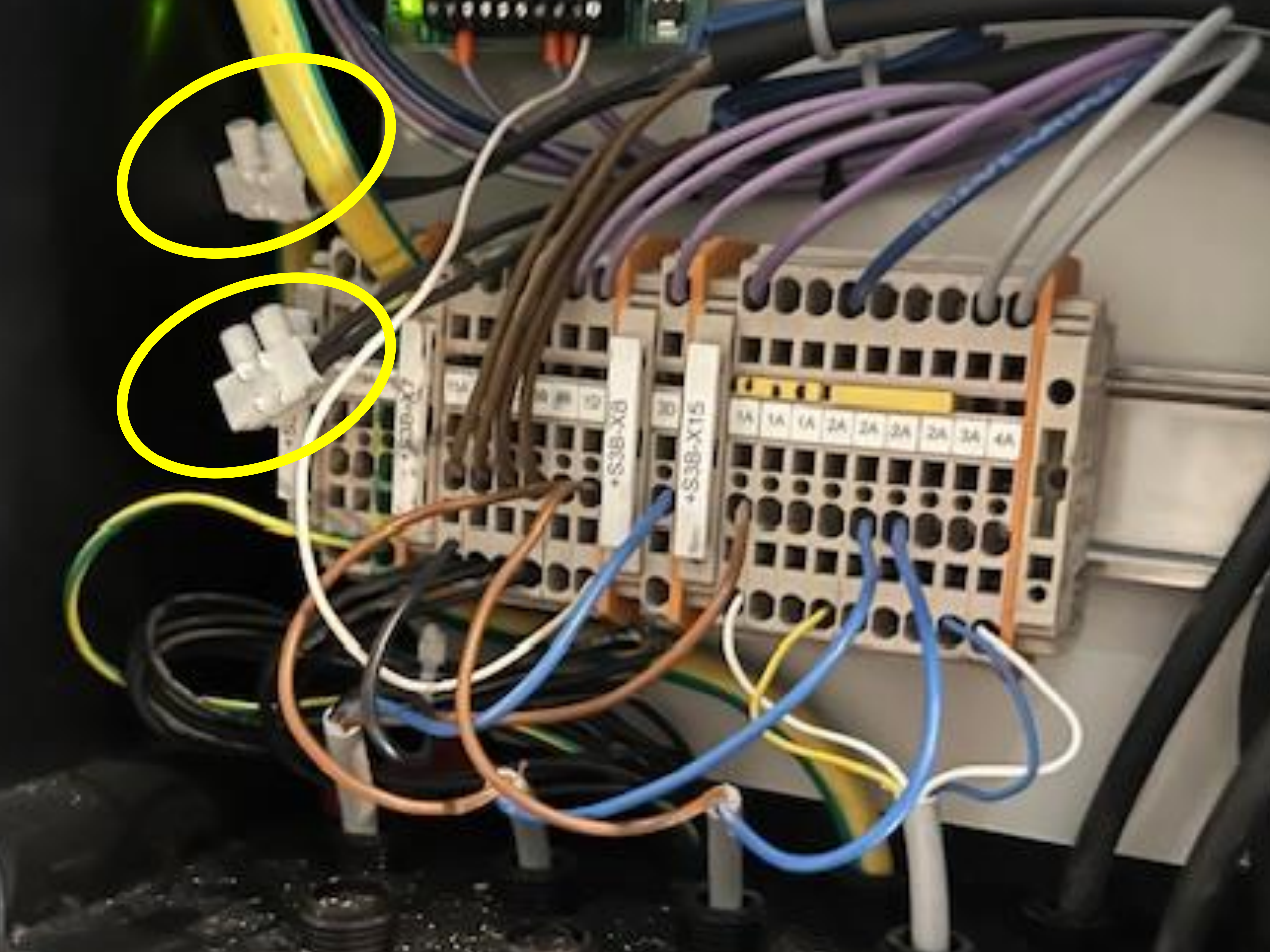
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IECEx Certificate of Conformity

Certificate No.: **IECEx PTB 14.0027X** Page 3 of 4

Date of issue: 2017-01-16 Issue No: 1

EQUIPMENT:
Equipment and systems covered by this Certificate are as follows:

Description
The cable gland, type GHG 960 **** * ****, made of polyamide serves to introduce permanently laid cables into electrical equipment of the type of protection Increased Safety "eb" and Protection by enclosure "tb".
The cable entry is composed of intermediate glands with two different widths of threaded joint, sealing rings of different designs and a cap nut.
Accessories are: blanking plug, reducing gland, multiple cable gland, flat cable gland and expansion gland.
They are installed in enclosures with through-holes or threaded holes, with or without lock nut.
The cap nut is optionally made in black resp. blue for the distinction of Ex-e and Ex-i circuits.

Technical Data and Nomenclature see Annex.

SPECIFIC CONDITIONS OF USE: YES as shown below:
Only permanently laid cables and conduits may be entered. The user must guarantee suitable clamping.

The degree of protection (IP66) will only be met if seals and cable glands are properly fitted. The manufacturer's instructions must be followed.

The cable entries with a low degree of mechanical hazard:may be used only in places where they are protected against the influence of mechanical danger.

The blanking plug type GHG 960 6107 P**** resp. GHG 960 1944 R**** shall only be used with the cable glands type GHG 960 92** P**** resp. GHG 960 19** R****.

8.3.2 Cable entry devices (3)

The cables must be laid straight from the cable entry to avoid lateral stresses that could affect the sealing of the cable or the degree of protection (IP Code).

Clamping of the cables should be done ***within 10 times the cable diameter or max. 300 mm***, whichever gives the shorter length, from the end of the cable entry.

WARNUNG ! WARNING ! AVERTISSEMENT !

+UH331.20

WARNUNG ! WARNING ! AVERTISSEMENT !

+UH333.20

A
B
IP66

8.3.4 Unused openings

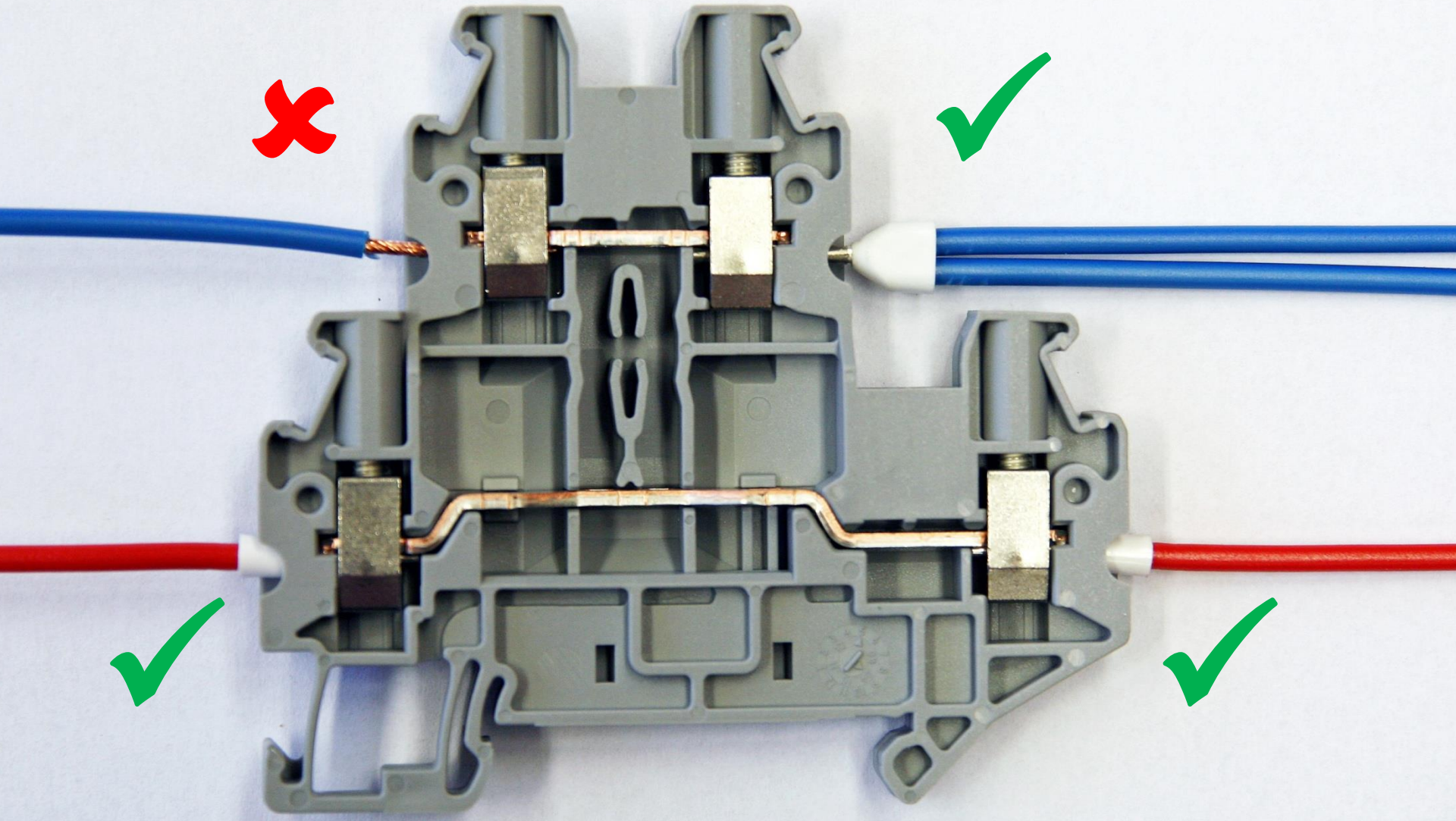
Unused openings in the enclosure must be closed off by means of blanking elements in accordance with the respective Type of Protection and degree of protection (IP Code).

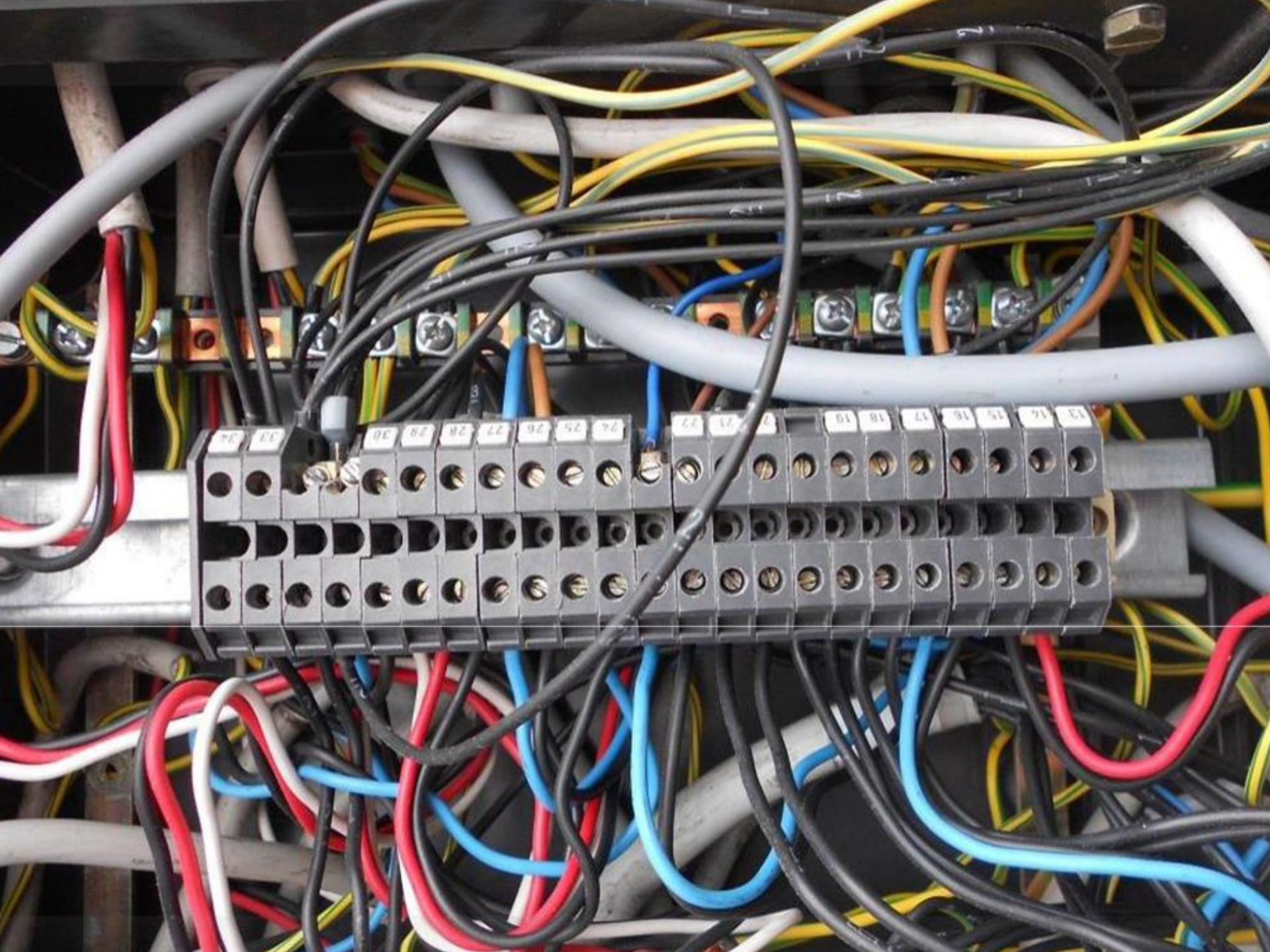
The blanking elements must comply with the requirements of **IEC 60079-0** and be such that they can only be removed with the aid of a tool.


ROSEMOUNT
WARNING
IN EXPLOSIVE ATMOSPHERE
KEEP COVER TIGHT WHEN CIRCUIT ALIVE
Rosemount
TAN
MON
FL

8.8.1 Conductor connections

Unless permitted in the manufacturer's operating instructions, two conductors with different cross-sections must not be connected to one terminal. Exception, the conductors are secured with a wire end sleeve (if permitted for 2 conductors) or another method specified by the manufacturer.





9. Initial inspection

Annex O
(informative)

Inspection tables for initial inspections (from IEC 60079-17)

Table O.1 shows the initial inspection schedule for Ex "d", Ex "e", Ex "n" and Ex "t"/"tD" installations.

Table O.1 – Initial inspection schedule for Ex "d", Ex "e", Ex "n" and Ex "t"/"tD" installations

Check that: X = required for all types, - = not required for initial inspection, n = type "n" only, t = type "t" and "tD" only		Ex "d"	Ex "e"	Ex "n" Ex"t/tD"
		Initial Inspection		
A	**GENERAL (ALL EQUIPMENT)**			
1	Equipment is appropriate to the EPL/Zone requirements of the location	X	X	X
2	Equipment group is correct	X	X	X
3	Equipment temperature class is correct (only for gas)	X	X	n
4	Equipment maximum surface temperature is correct			t
5	Degree of protection (IP grade) of equipment is appropriate for the level of protection/group/conductivity	X	X	X
6	Equipment circuit identification is correct	X	X	X
7	Equipment circuit identification is available	X	X	X
8	Enclosure, glass parts and glass-to-metal sealing gaskets and/or compounds are satisfactory	X	X	X
9	There is no damage or unauthorized modifications	X	X	X

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Foz do Iguaçu Brazil

Thank you for your attention!