IECEx International Conference 2018
Split, Croatia

Electrical installations design, selection and erection

IECEx International Conference 2018
Split, Croatia

Peter Thurnherr
thuba Ltd., Switzerland

Convenor MT 60079-14
Chairman IECEx ExPCC

IEC 60079-14

Edition 5.0 2013-11

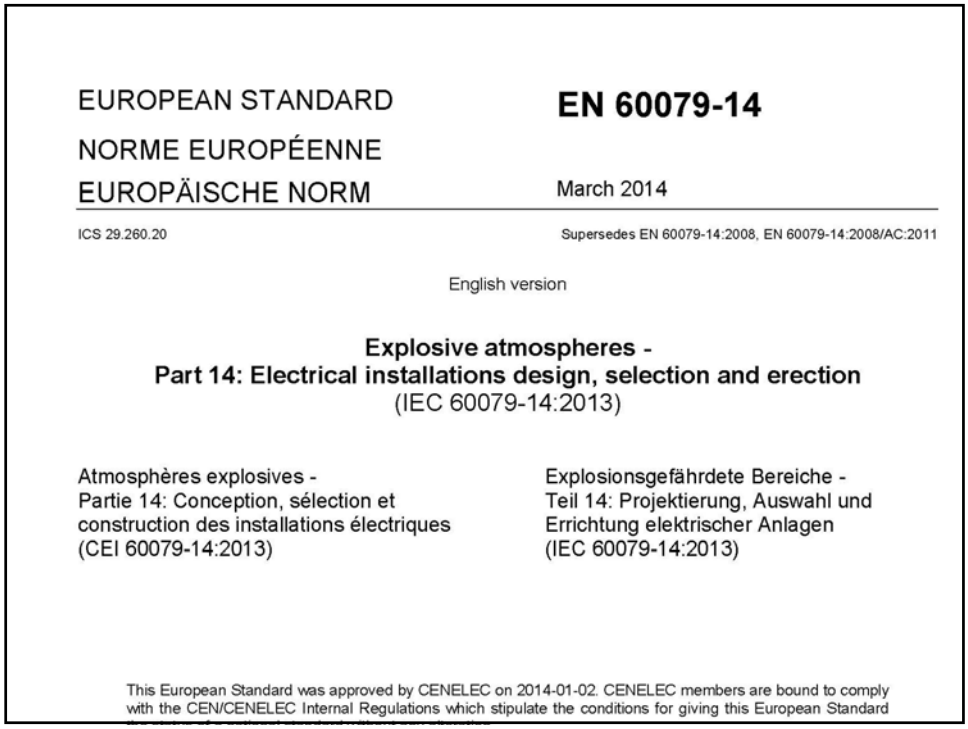
INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Explosive atmospheres –
Part 14: Electrical installations design, selection and erection

Atmosphères explosives –
Partie 14: Conception, sélection et construction des installations électriques



EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60079-14

March 2014

ICS 29.260.20

Supersedes EN 60079-14:2008, EN 60079-14:2008/AC:2011

English version

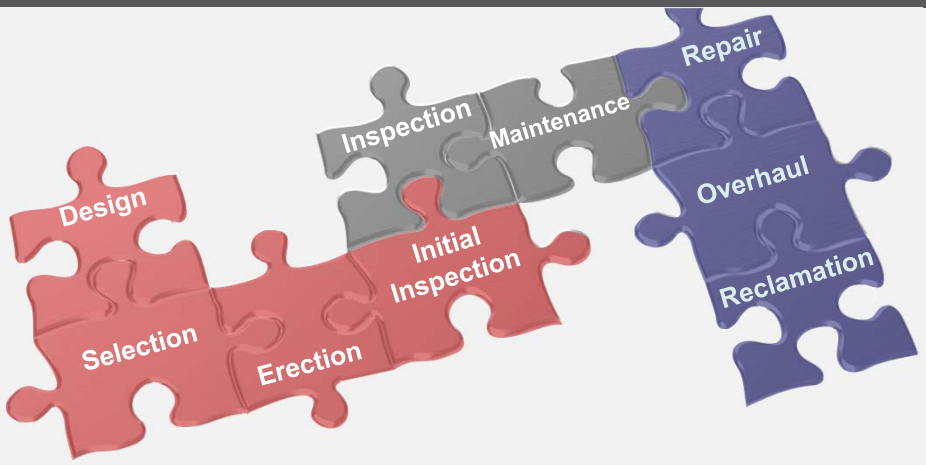
Explosive atmospheres -
Part 14: Electrical installations design, selection and erection
(IEC 60079-14:2013)

Atmosphères explosives -
Partie 14: Conception, sélection et construction des installations électriques
(CEI 60079-14:2013)

Explosionsgefährdete Bereiche -
Teil 14: Projektierung, Auswahl und Errichtung elektrischer Anlagen
(IEC 60079-14:2013)

This European Standard was approved by CENELEC on 2014-01-02. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard

Standards

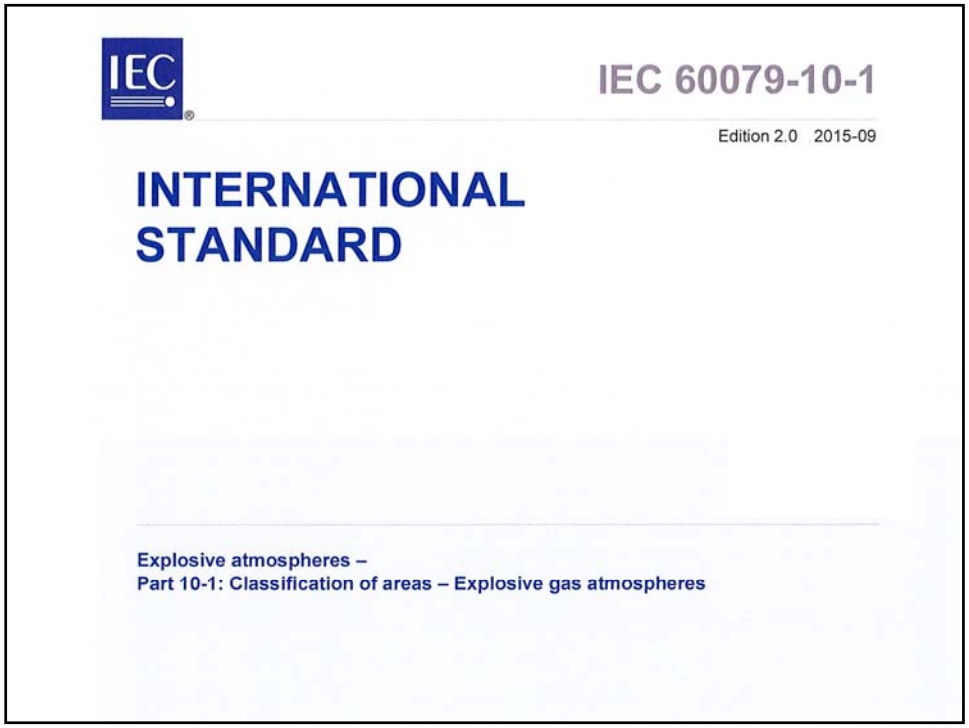


IEC 60079-14	IEC 60079-17	IEC 60079-19
EN 60079-14	EN 60079-17	EN 60079-19

General requirements

Documentation – Site

- area classification documents (IEC 60079-10-1 and IEC 60079-10-2)
- where applicable, gas, vapour or dust classification in relation to the group or sub-group of the electrical Ex Equipment
- temperature class or ignition temperature of the gas or vapour involved;
- any use of conditions of control for exceptional circumstances
- ***external influences and ambient temperature***



IEC 60079-10-2

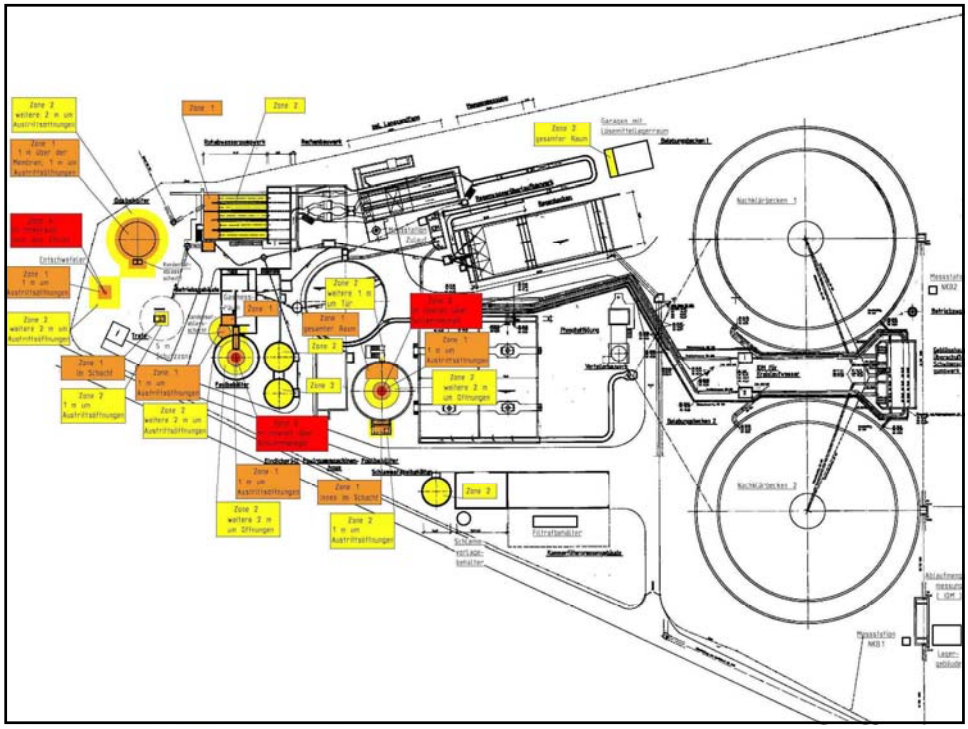
Edition 2.0 2015-01

INTERNATIONAL STANDARD

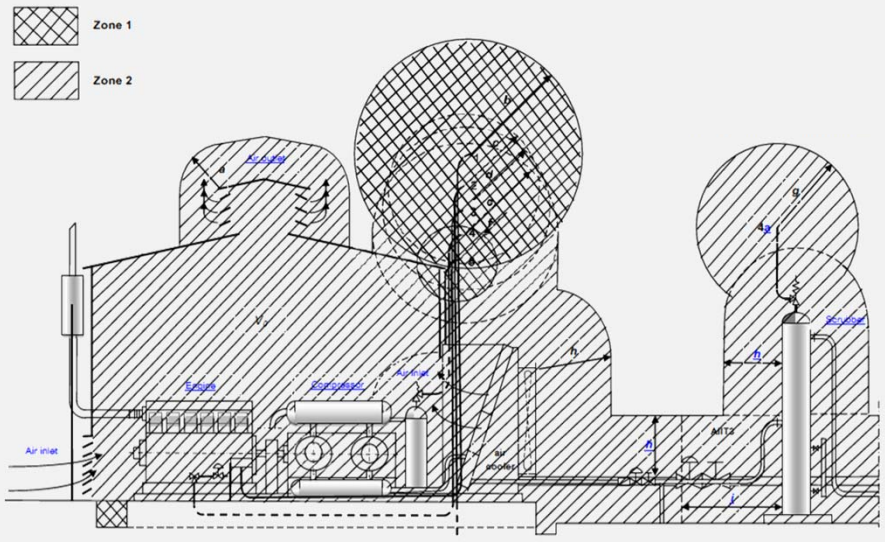
NORME INTERNATIONALE

Explosive atmospheres –
Part 10-2: Classification of areas – Explosive dust atmospheres

Atmosphères explosives –
Partie 10-2: Classement des emplacements – Atmosphères explosives poussiéreuses


Zone 2
weitere 2 m um Austrittsöffnungen
Zone 1
1 m über der Membran, 1 m um Austrittsöffnungen
Zone 1
1 m um Austrittsöffnungen
Zone 2
weitere 2 m um Austrittsöffnungen
Zone 1
im Schacht
Zone 2
1 m um Austrittsöffnungen
Zone 1
1 m um Austrittsöffnungen
Zone 2
weitere 2 m um Austrittsöffnungen
Zone 1
Zone 2
Zone 2
gesamter Raum
Garagen mit Löschmittellagerraum
Zone 2
weitere 1 m um Tür
Zone 1
gesamter Raum
Zone 2
Zone 3
Zone 1
1 m um Austrittsöffnungen
Zone 2
weitere 2 m um Öffnungen
Zone 1
1 m um Austrittsöffnungen
Zone 1
muss im Schacht
Zone 2
weitere 2 m um Öffnungen
Zone 2
1 m um Austrittsöffnungen
Zone 3
Nachklärbecken 1
Nachklärbecken 2

Area classification – Basic Example



Documentation – Equipment

- manufacturer's instructions for selection, installation and initial inspection;
- documents for Ex Equipment with "Specific Conditions of Use";
- descriptive system document for the intrinsically safe system;
- details of any relevant calculation or records of the routine test, for example for purging rates for instruments or analyser houses;

Documentation – Equipment

The following documents are available for the identification:

– **Marking**
(according IEC 60079-0)

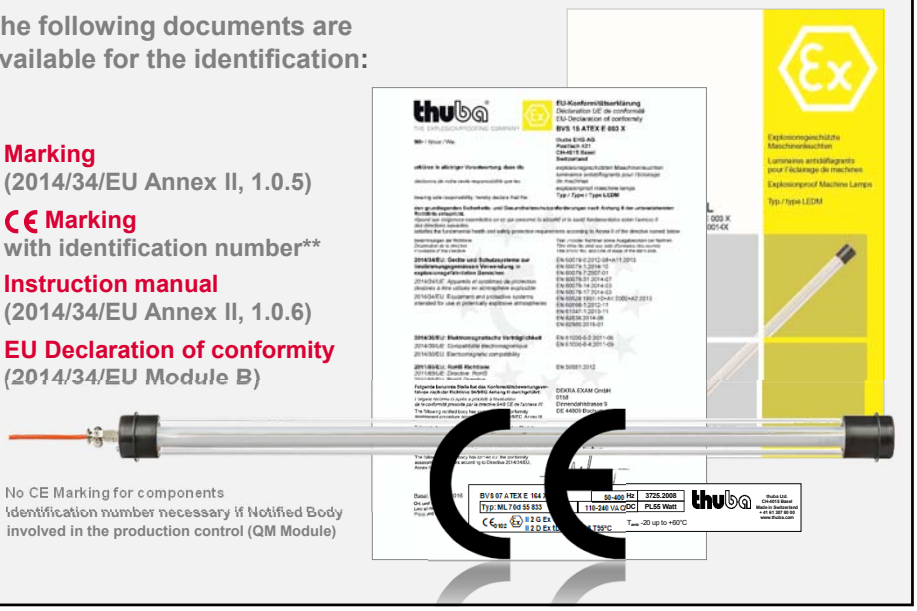
– **Instruction manual**
(according IEC 60079-0)

– **IECEx Certificate of Conformity**
(Online system!)

Documentation – Equipment

The following documents are available for the identification:

- **Marking**
  (2014/34/EU Annex II, 1.0.5)
- **CE Marking**
  with identification number**
- **Instruction manual**
  (2014/34/EU Annex II, 1.0.6)
- **EU Declaration of conformity**
  (2014/34/EU Module B)



* No CE Marking for components

** Identification number necessary if Notified Body involved in the production control (QM Module)

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	IECEx BVS 17.0067X	Issue No: 0	Certificate history: Issue No. 0 (2017-09-12)
Status:	Current		
Date of Issue:	2017-09-12	Page 1 of 4	
Applicant:	thuba EHB Ltd. Blauensteinerstraße 16 4015 Basel Switzerland		
Equipment:	Hand and Tube light types HL**d ** **** ** and TL**d ** **** **		
Optional accessory:			
Type of Protection:	Equipment protection by flameproof enclosures "d", Equipment dust ignition protection by enclosure "t"		
Marking:	Ex db IIC T6/T5 Gb Ex tb IIIC T80°C/T95°C Db		

Approved for issue on behalf of the IECEx Jörg Koch

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres

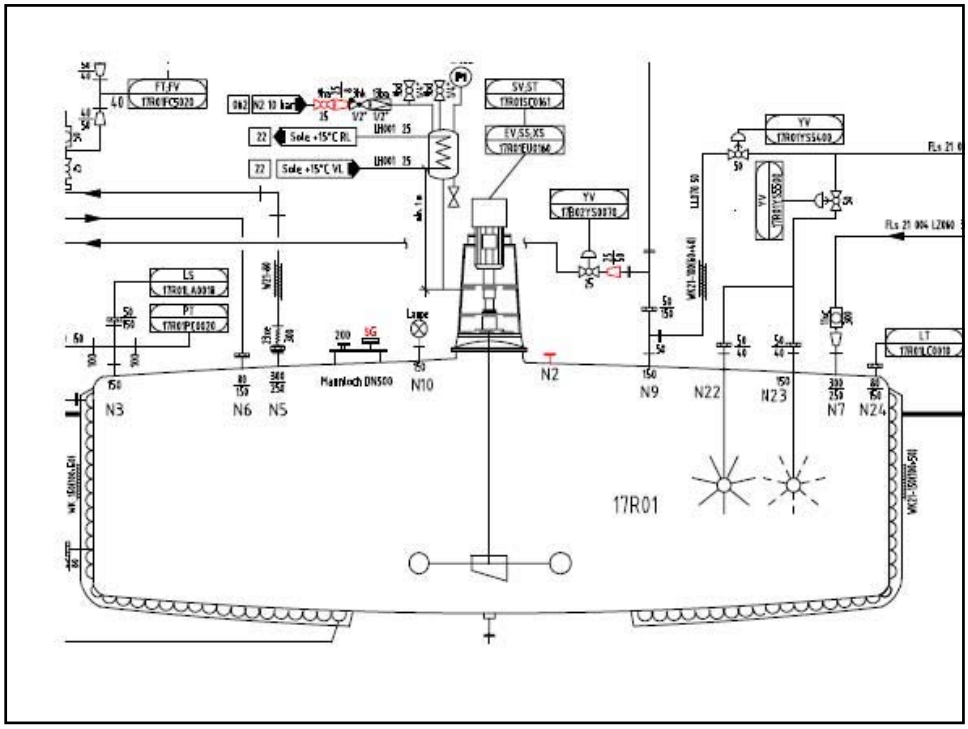
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	IECEx BVS 16.0026U	Issue No: 0	Certificate history: Issue No. 0 (2016-05-10)
Status:	Current	Page 1 of 4	
Date of Issue:	2016-05-10		
Applicant:	thuba Ltd. Blauensteinerstrasse 16 4015 Basel Switzerland		
Equipment:	Empty enclosure type eCAM ** ** **		
Optional accessory:			
Type of Protection:	Equipment dust ignition protection by enclosure "t", Equipment protection by increased safety "e"		
Marking:	Ex eb IIC Gb Ex tb III C Db		

Approved for issue on behalf of the IECEx H.-Ch. Simanski

Documentation – Installation

- necessary information to ensure correct installation of the Ex Equipment;
- documentation relating to the suitability of the Ex Equipment for the area and environment to which it will be exposed;
- the plans showing types and details of wiring systems;
- records of selection criteria for cable entry devices;
- drawings and schedules relating to circuit identification;
- records of the initial inspection



Documentation – Personnel

- **Evidence of personnel competency**

  The competency of the person(s) shall be relevant to the type of work to be undertaken.

Initial inspection

On completion of the erection, initial inspection of the equipment and installation shall be carried out in accordance with IEC 60079-14.

Table 1 – Inspection schedule for Ex "d", Ex "e", Ex "n" and Ex "t/tD"

	Check that:	Ex 'd'	Ex 'e'	Ex 'n' Ex't/tD'
		Grade of inspection: Detailed		
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 (only for 't/tD')			t
5	Degree of protection (IP grade) of equipment is appropriate for the level of protection/group/conductivity	X	X	t
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 are no unauthorized modifications	X	X	X
10	There are no visible unauthorized modifications			
11	Bolts, cable entry devices (direct and indirect) and blanking elements are of the correct type and are complete and tight			
	– physical check	X	X	X
	– visual check			
12	Threaded covers on enclosures are of the correct type, are tight and secured			
	– physical check	X		
	– visual check			

Assurance of conformity of equipment

Qualifications of personnel (Annex A)

- **General understanding of relevant electrical engineering**
- **Practical understanding of explosion protection principles and techniques**
- **Understanding of and ability to read and assess engineering drawings**
- **Working knowledge and understanding of relevant Standards in explosion protection**
- **Basic knowledge of quality assurance, including the principles of auditing, documentation, traceability of instrument calibration**

Selection of equipment

Relationship between equipment protection level (EPLs) and zones

Zone	Equipment protection levels (EPL)
0	Ga
1	Gb or Ga
2	Gc, Gb or Ga

EPL . . . Equipment Protection Level (EPL)

Relation between EPLs 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	ob	IEC 60079-6
	Increased safety	e, eb	IEC 60079-7

Selection according to equipment grouping

Gas/vapour subdivision	Equipment group
IIA	II, IIA, IIB or IIC
IIB	II, IIB or IIC
IIC	II, IIC

Temperature class

Temperature class required by the area classification	Ignition temperature of gas or vapour	Allowable temperature classes of equipment
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

Relationship between equipment protection level (EPLs) and zones

Zone	Equipment protection levels (EPL)
20	Da
21	Db or Da
22	Dc, Db or Da

EPL . . . Equipment Protection Level (EPL)

Relationship between EPLs and type of protection

EPL	Type of protection	Code	Standard
Db	Pressurization	pxb	IEC 60079-2
	Intrinsically safe	ib	IEC 60079-11
	Encapsulation	mb	IEC 60079-18
	Protection by enclosure	tb	IEC 60079-31

Selection according to equipment group III

Group	Dust
IIIA	Fibers (> 500 µm)
IIIB	Non-conductive dust (> 10^3 Ω)
IIIC	Conductive dust (≤ 10^3 Ω)

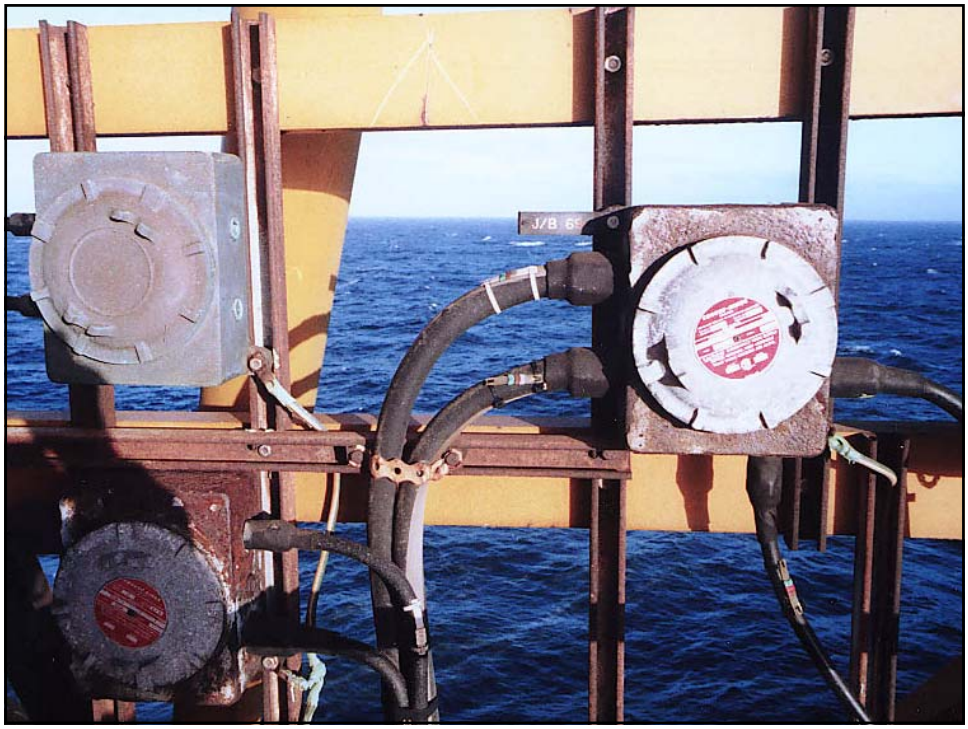
Selection according to equipment group III

Gas/vapour subdivision	Equipment group
IIIA	IIIA, IIIB oder IIIC
IIIB	IIIB oder IIIC
IIIC	IIIC

EPL . . . Equipment Protection Level (EPL)

Selection to cover external influences

- **Thermal effects**
- **Chemical effects**
- **Mechanical effects**
- **Effects of movement and vibration**
- **Electrical effects**
- **Moisture**
- **Ingress of process liquids**
- **Corrosion**



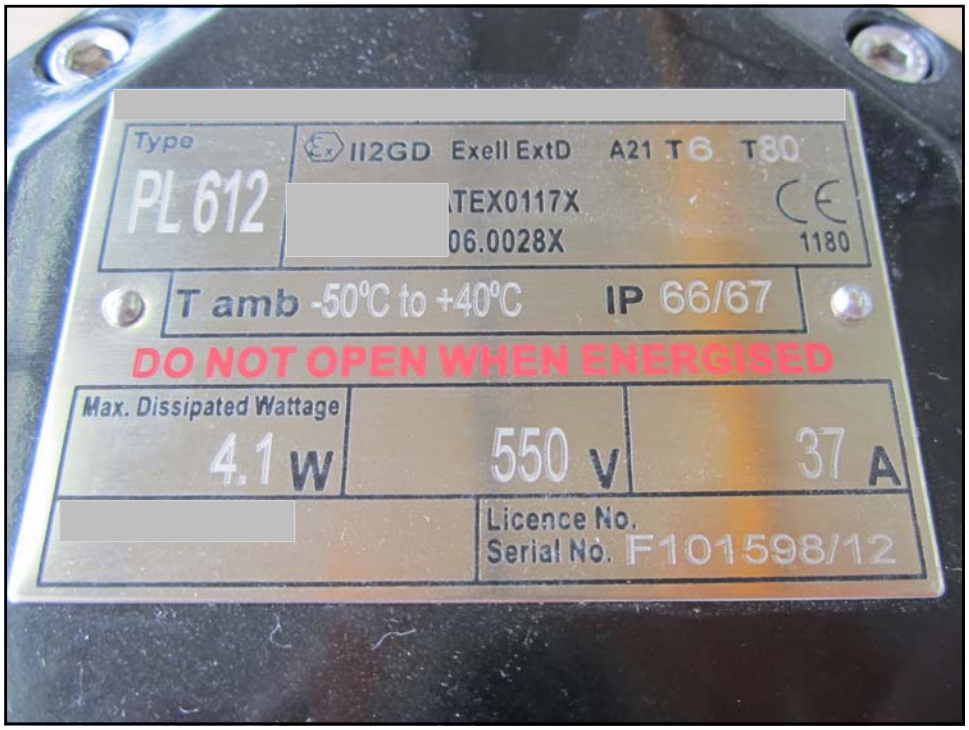
Selection to cover external influences

Ambient temperature

Equipment shall normally be designed for use in an ambient temperature range between –20 ºC and 40 ºC; in this case, no additional ambient temperature marking is required.

Example of extended ambient temperature range T_{amb}

–50 ºC ≤ T_{amb} ≤ 60 ºC.

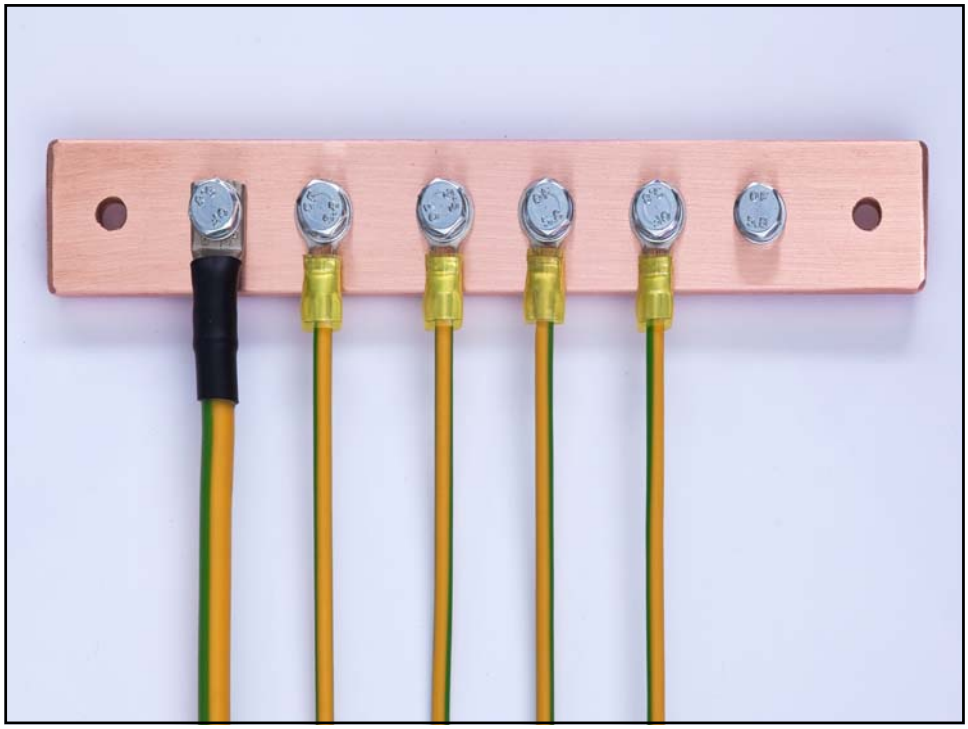


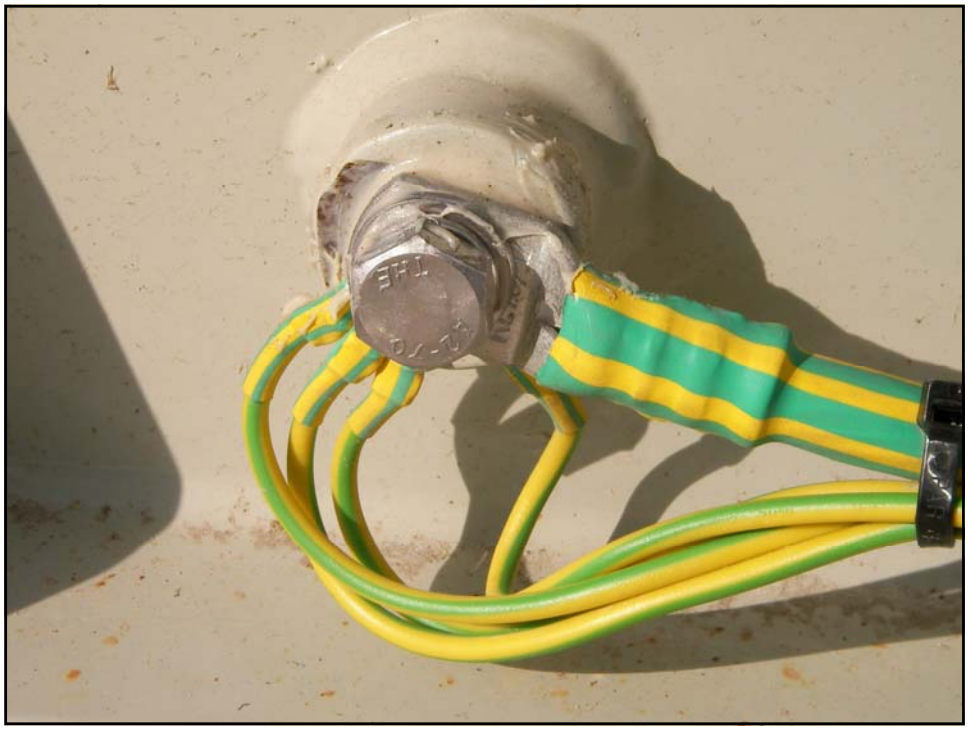
Protection from dangerous sparking

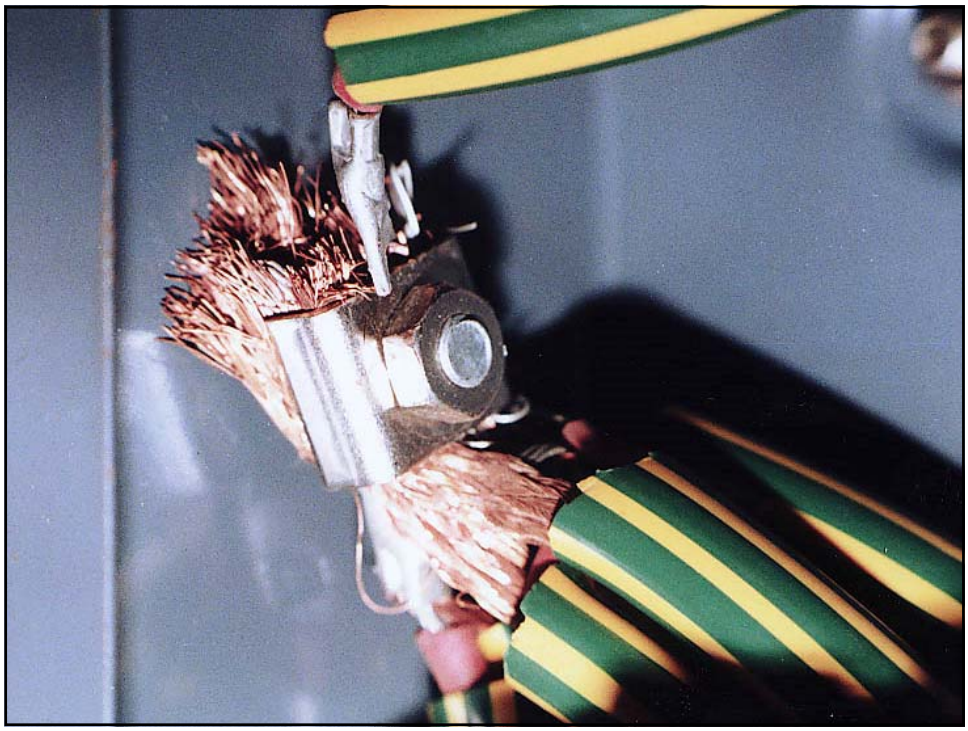
Potential equalization

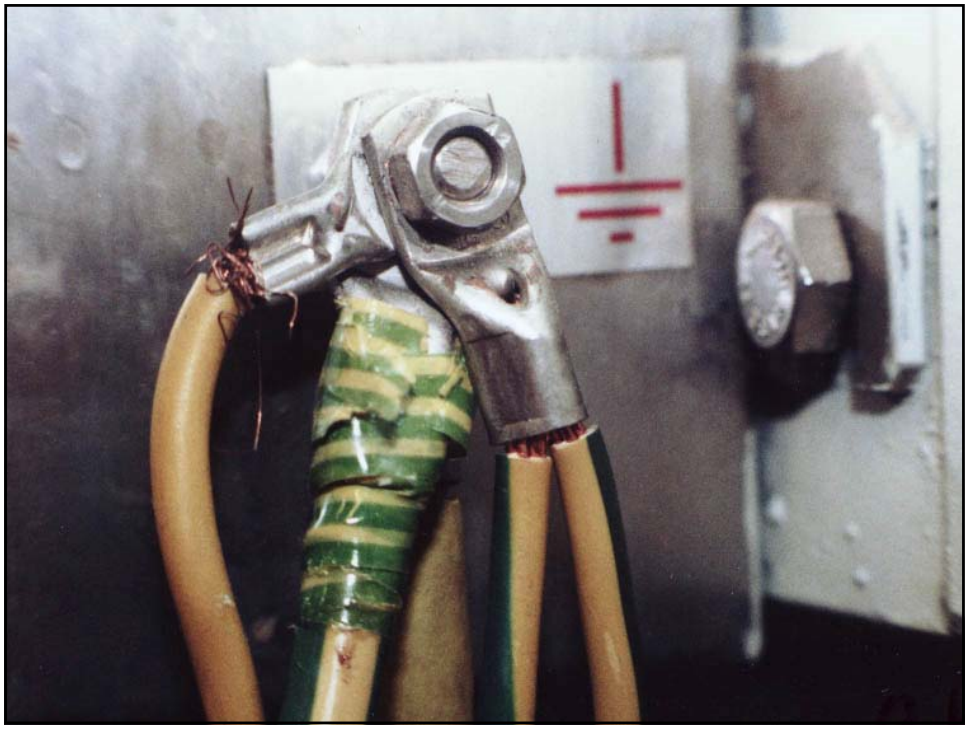
The minimum size for bonding conductors for the *main connection* to a protective rail shall be *at least 6 mm²* (based on conductivity of copper) in accordance to IEC 60364-5-54 and *supplementary connections* shall be a minimum of *4 mm²*.

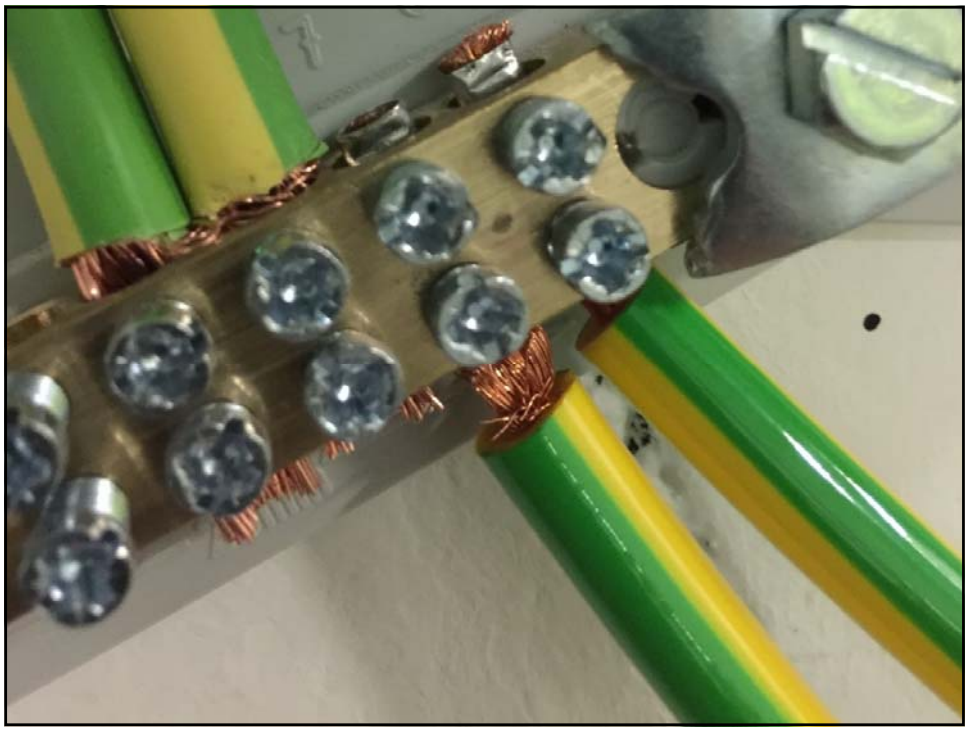
Connections shall be secure against self loosening and shall minimize the risk of corrosion which may reduce the effectiveness of connection.











Wiring systems

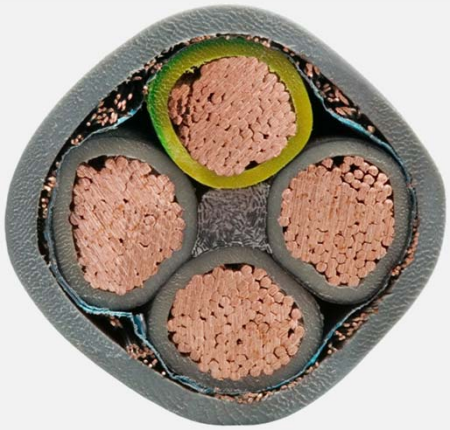
Cables for fixed installations

Cables shall be:

- **Sheathed with thermoplastic, thermosetting, or elastomeric material.**
  They shall be circular and compact.
  Any bedding or sheath shall be extruded.
  Fillers, if any, shall be non hygroscopic.
- **Mineral insulated metal sheathed, or**
- **Special, e.g. flat cables with appropriate cable glands.**

Cable for fixed installations

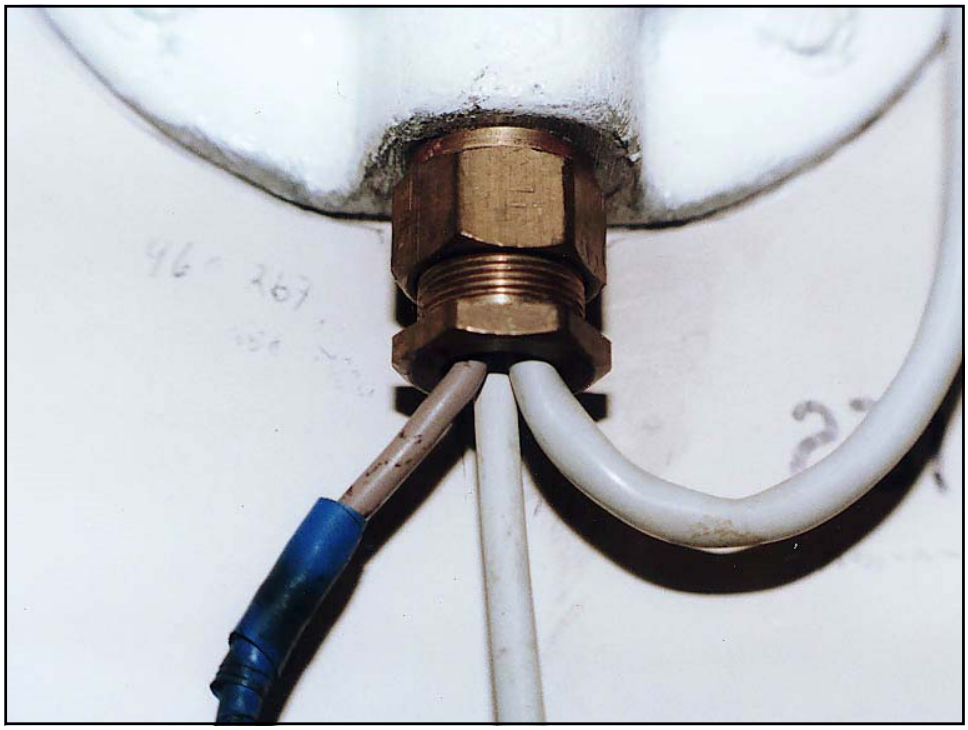
Cable for fixed installations



Cable for fixed installations

Cables for fixed installations

Cable entry systems and blanking elements



Selection of cable glands

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	X		
Ex “i” – Group II	X	X	X	
Ex “t”				X
Ex “i” – Group III				X

Connections of cables to equipment

Certificate with the suffix “X”

If an additional clamping is required to prevent pulling and twisting of the cable transmitting the forces to the conductor terminations inside the enclosure, a clamp shall be provided, as close as practicable to the gland along the cable.

NOTE 1
Cable clamps within 300 mm of the end of the cable gland are preferred.

Connections of cables to equipment

evoprene:	-50 °C to +70 °C
Suitable for equipment of group II with a degree of mechanical hazard:	low
Installation in equipment with wall thicknesses of:	at least 1,5 mm
Protection against contact, foreign matter and water:	at least IP 54 acc. to EN 60 529:1991

(16) Report PTB Ex 99-30113

(17) Special conditions for safe use

Only permanently laid cables and conduits may be entered. The user must guarantee suitable clamping.

The maximu[illegible]al load of the cables and conduits entered is to be taken into account.

The cable ent[illegible]ay be used only in places where they are protected against the influence of mechanical da[illegible].

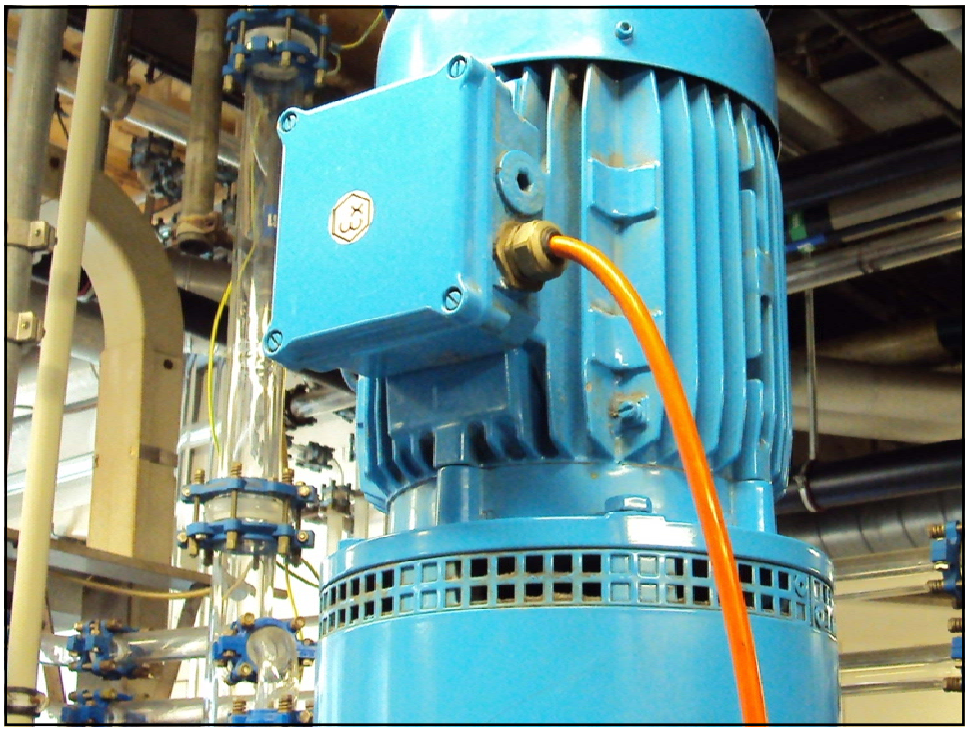
(18) Essential health and safety requirements

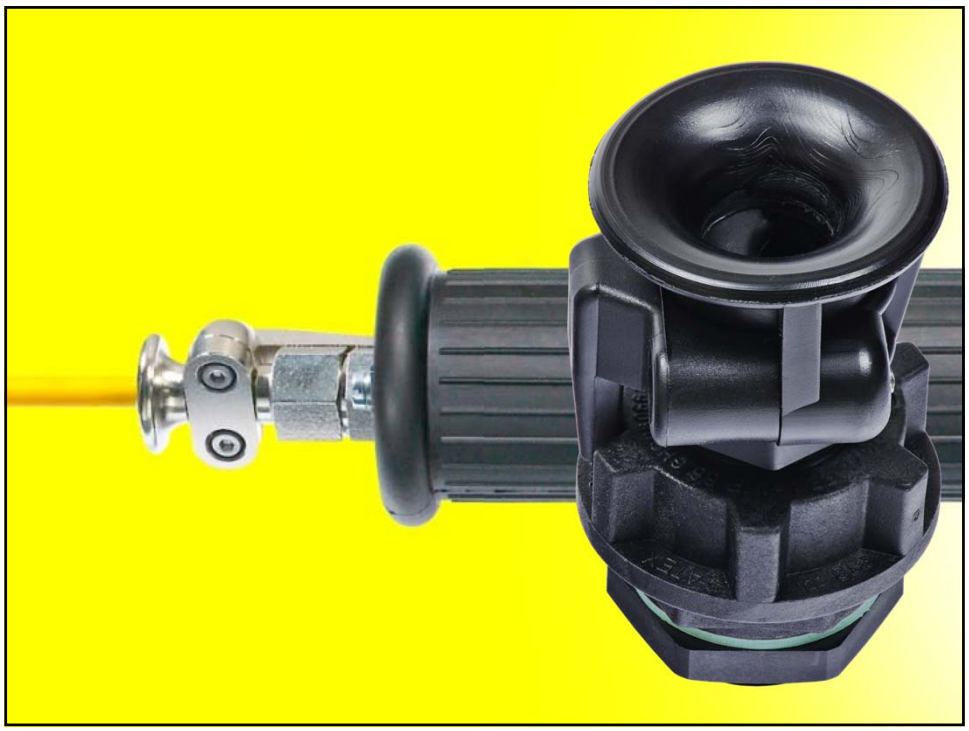
The degree of protection - at least IP 54 according to EN 60529:1991 - will be guaranteed only by adequate selection od cable and conduit entries, of the sealings tested and by proper installation of the cable and conduit entries into the electrical apparatus.

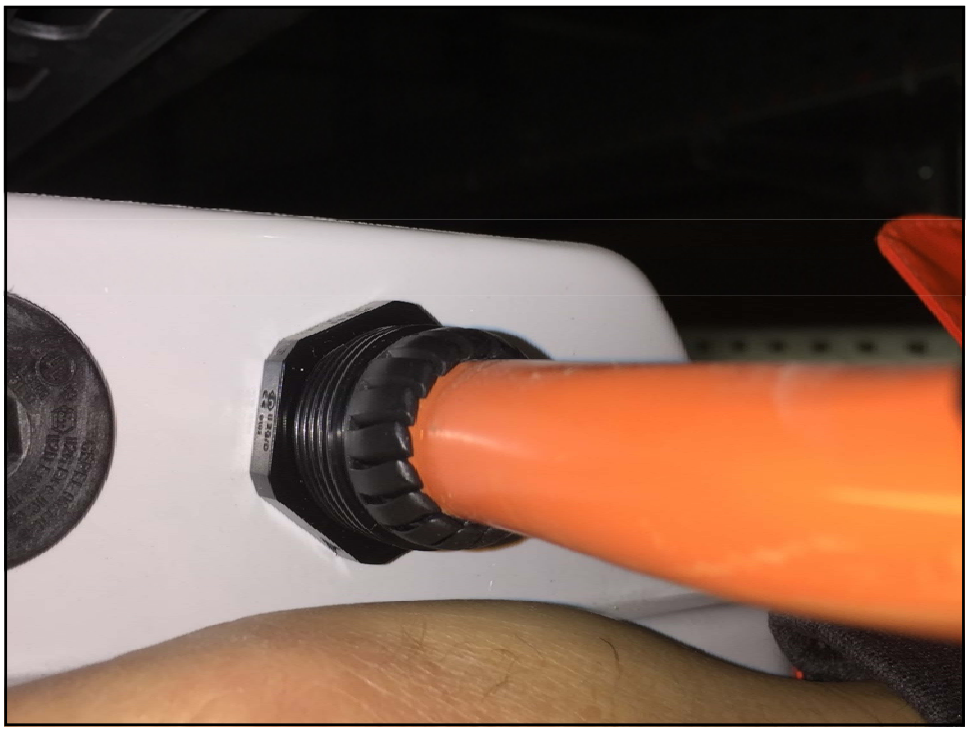
Zertifizierungsstelle Explosionsschutz — Braunschweig, November 16, 1999

By order:

Dr.-Ing. U. Engel







Unused openings

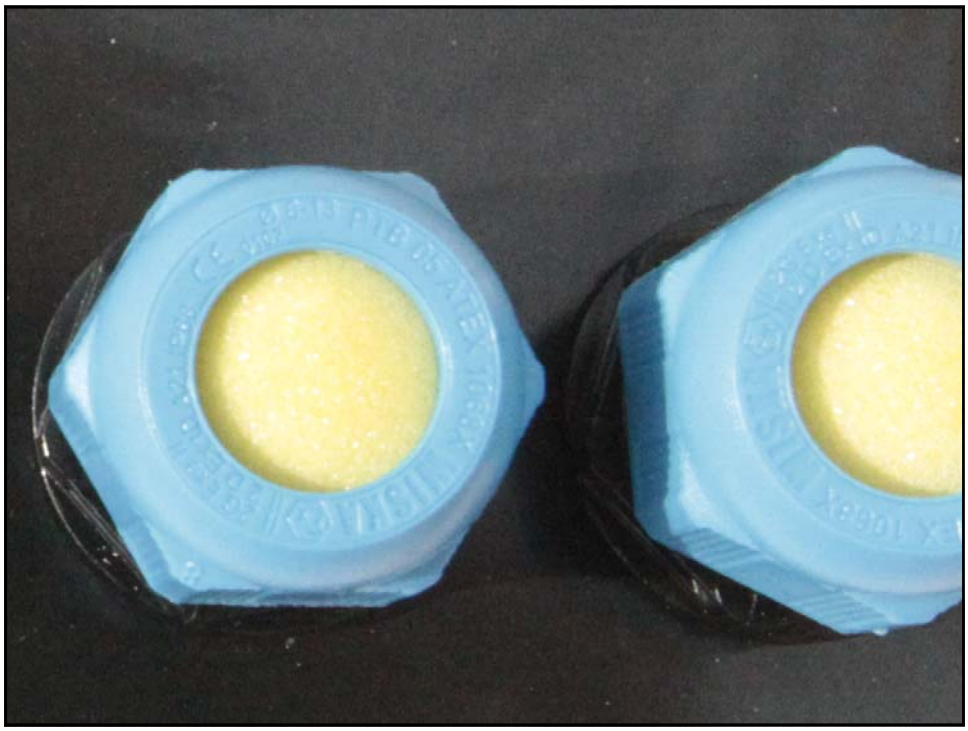
With the exception of enclosures containing only one intrinsically safe circuit unused entries in the enclosure shall be sealed by blanking elements in accordance with table 10 and that maintain the ***degree of ingress protection IP 54*** or that required by the location, whichever is the higher.

Blanking elements shall ***comply with IEC 60079-0***, and be of a type that can only be removed with the aid of tools.

Unused openings


ROSEMOUNT


ATEX 1126X



Additional requirements for type of protection “d”

The cable entry system shall comply with one of the following:

- **barrier cable glands in compliance with IEC 60079-1 and certified as equipment;**
- **cable glands in compliance with IEC 60079-1, certified as an equipment and combined with the cables complying with 9.3.2(a) and with a minimum length of the connected cable of 3 m**

NOTE 1 The minimum length of cable is to minimize the potential for flame transmission through the cable (see also Annex E).

10.6 Additional requirements for type of protection “d”

Table 3 – Cylindrical threaded joints

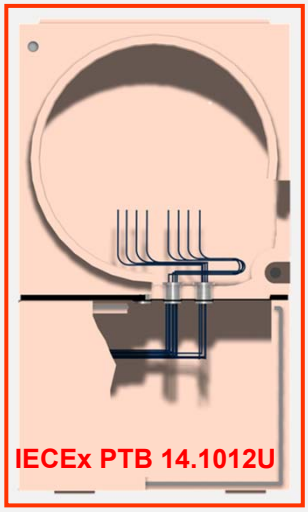
Pitch	≥0,7 mm[a]
Thread form and quality of fit	Medium or fine tolerance quality according to ISO 965-1 and ISO 965-3[b]
Threads engaged	≥5
Depth of engagement	
Volume <100 cm^3	≥5 mm
Volume >100 cm^3	≥8 mm

[a] Where the pitch exceeds 2 mm, special manufacturing precautions may be necessary (for example, more threads engaged) to ensure that the electrical apparatus can pass the test for non-transmission of an internal ignition which is prescribed in 15.2.

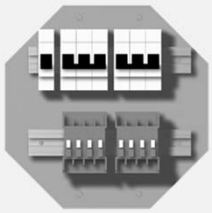
[b] Cylindrical threaded joints which do not conform with ISO 965-3 in respect of thread form or quality of fit, are permitted if the test for non-transmission of an internal ignition, prescribed in 15.2, is passed, when the width of the threaded joint specified by the manufacturer is reduced by the amount specified in Table 6.

Equipment protection by flameproof enclosures “d”

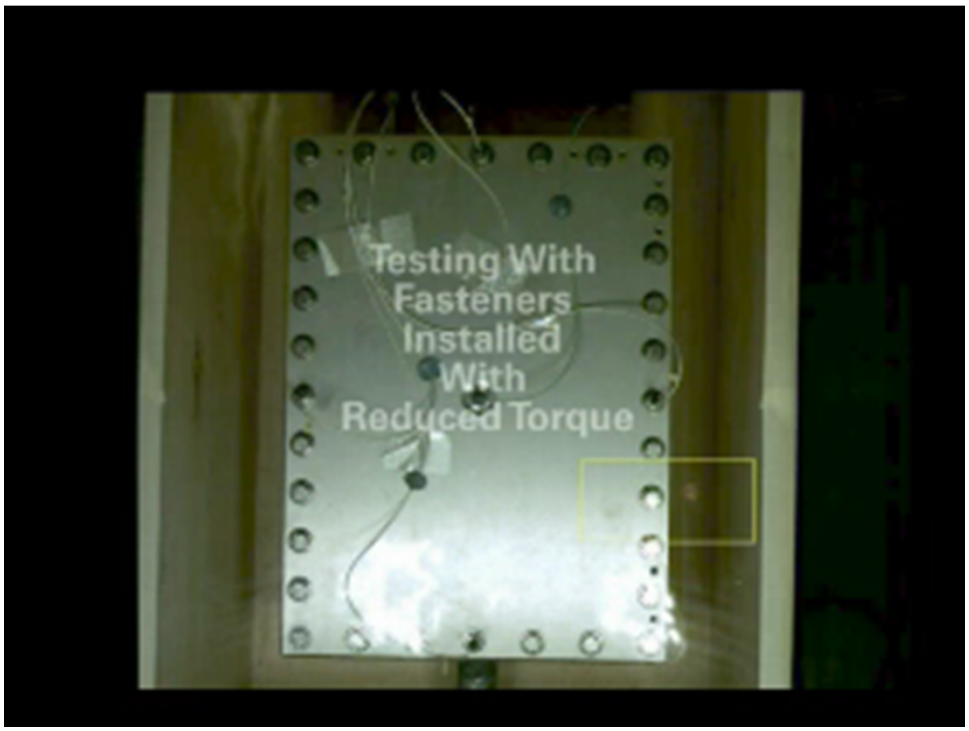
14. General



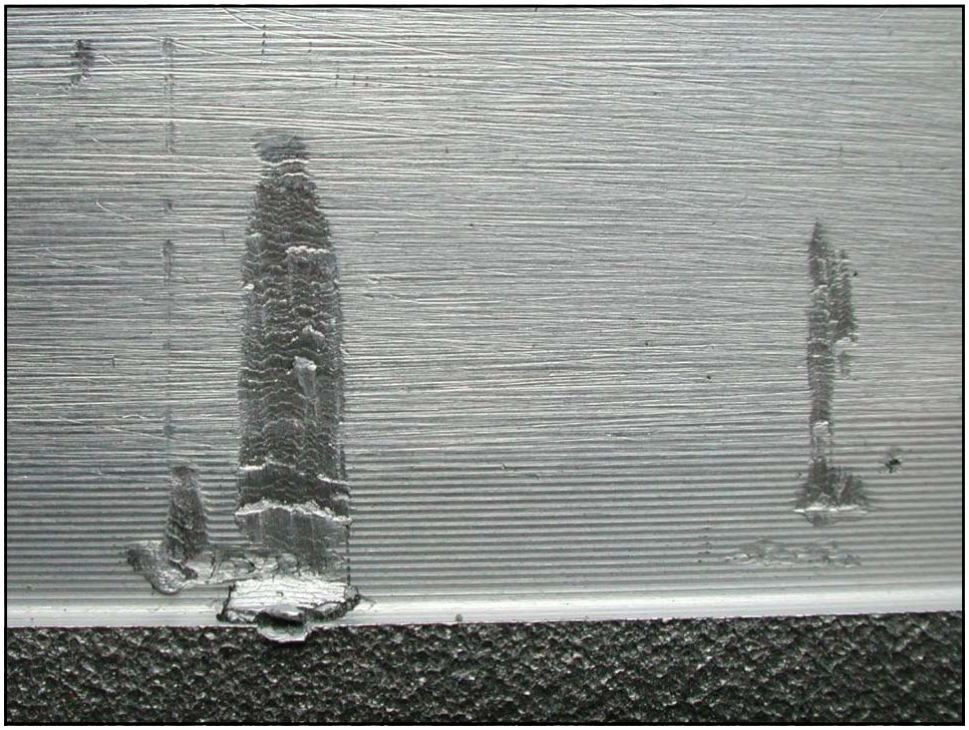
IECEx PTB 14.1012U

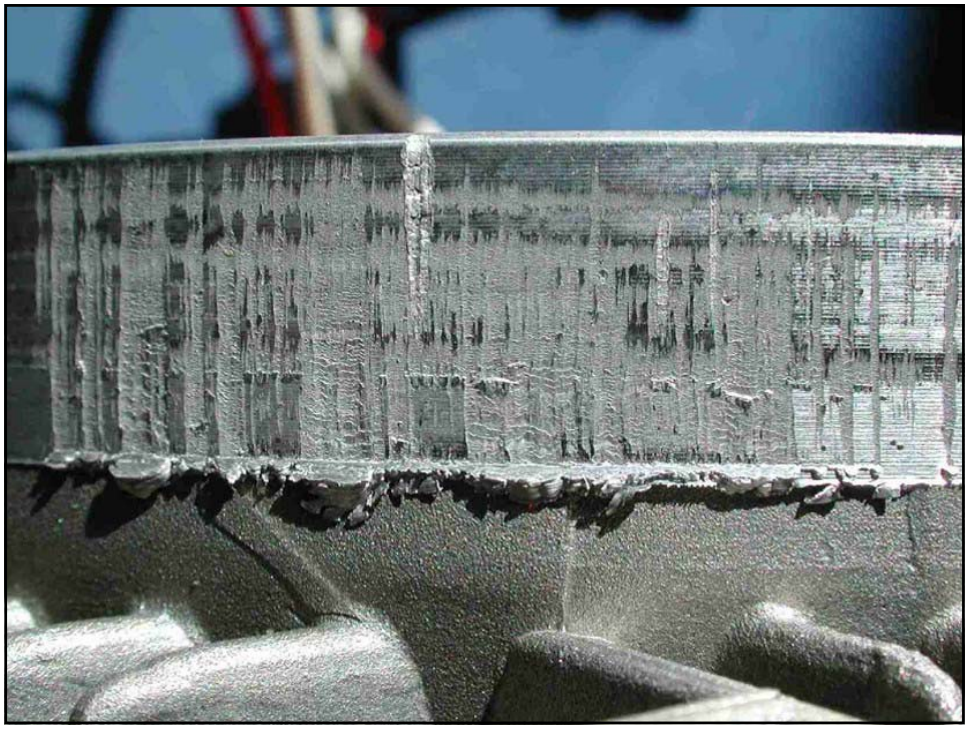


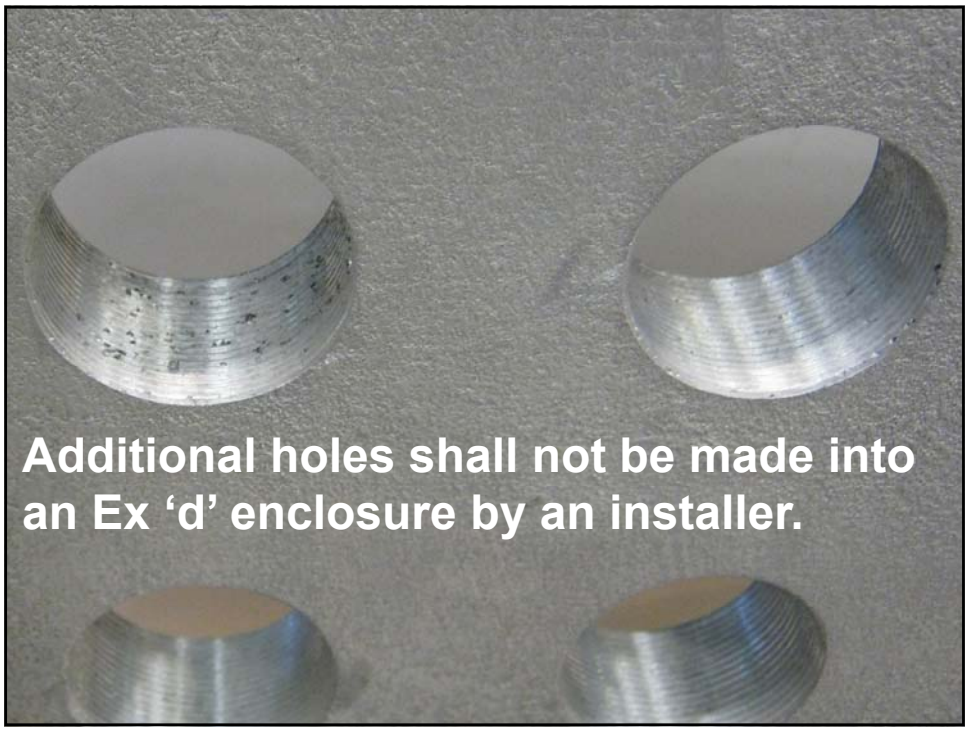
IECEx PTB 14.1021X



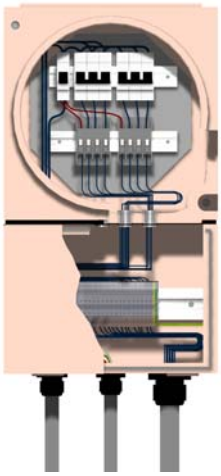

Another test is performed to confirm that the
joints



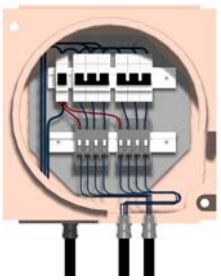



Additional holes shall not be made into an Ex ‘d’ enclosure by an installer.

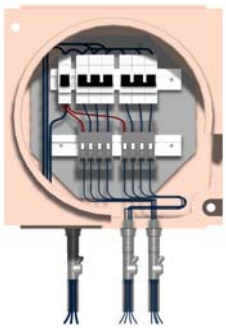
Installation



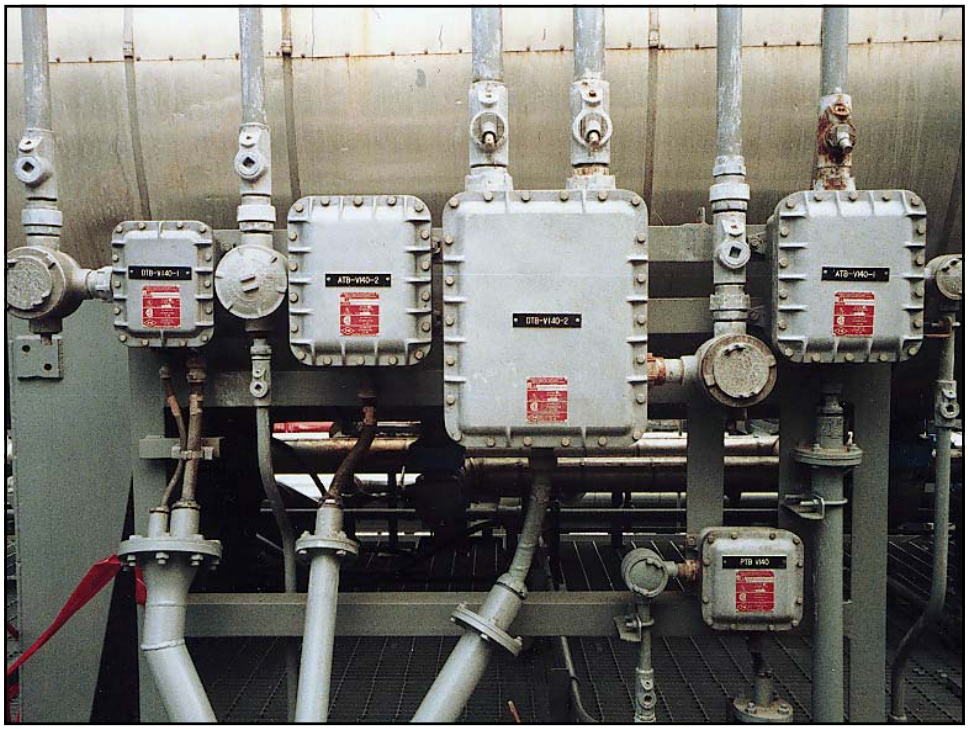
Indirect



Direct



Conduit entries

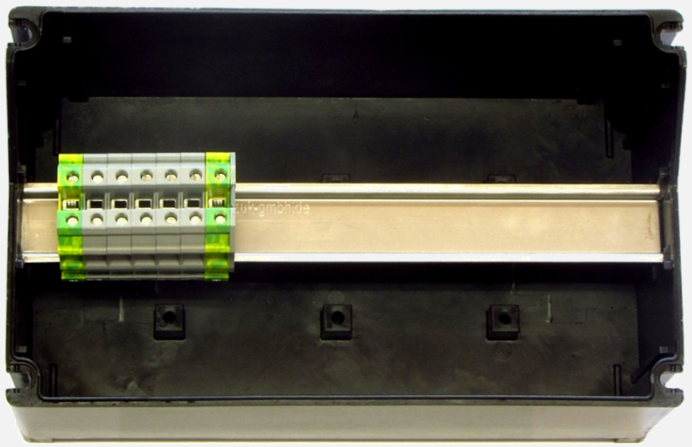


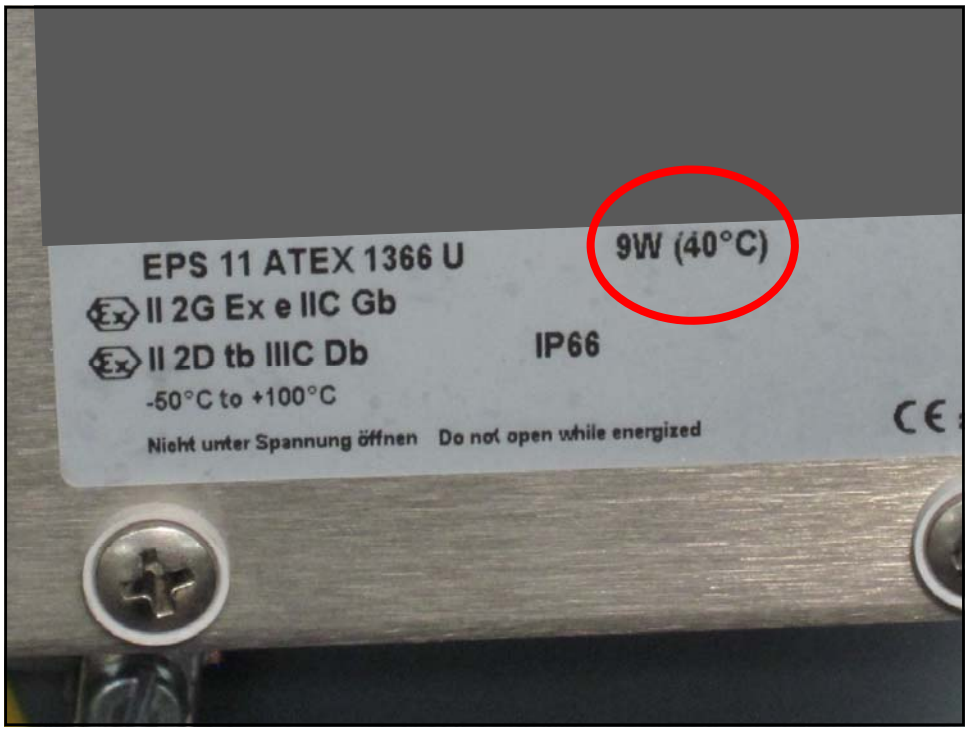
Equipment protection by increased safety “e”

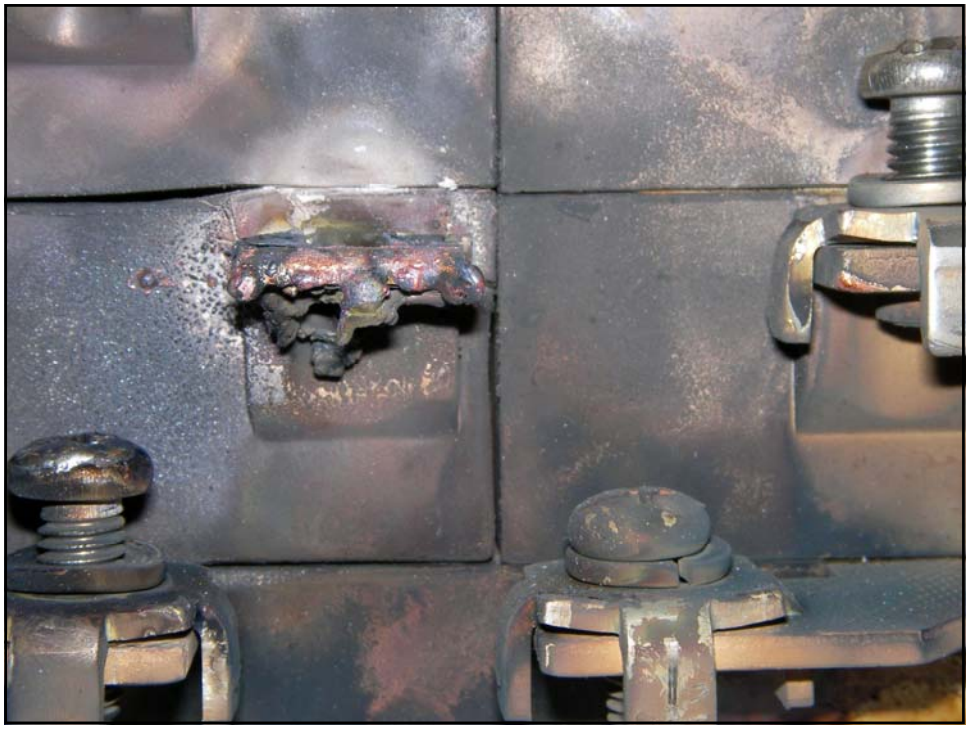
Maximum dissipated power

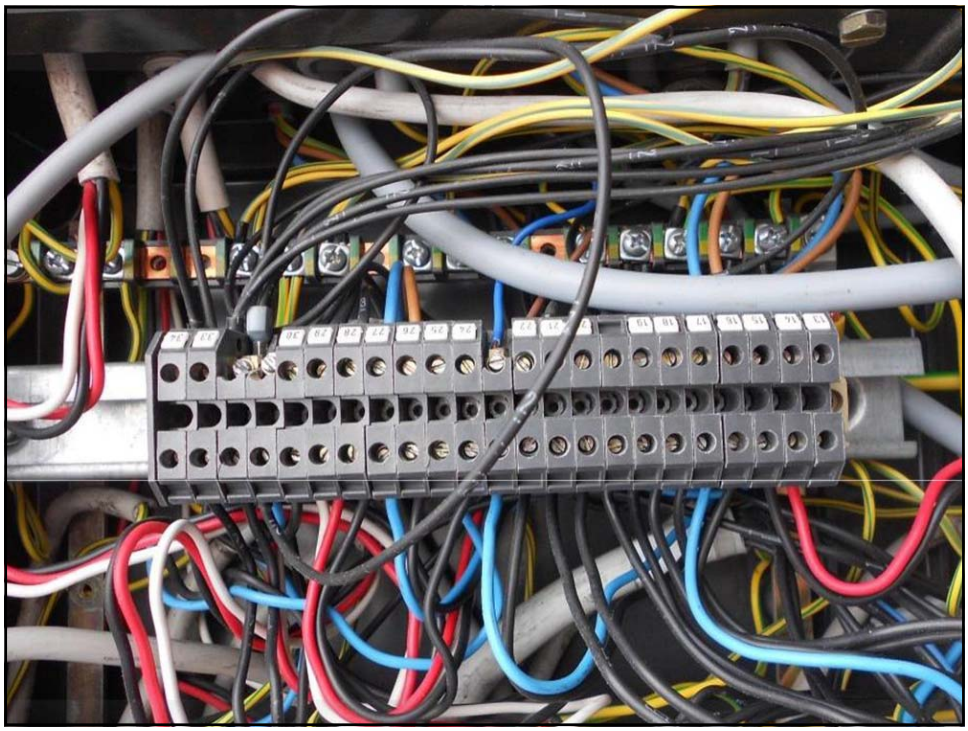
Current	Cross-section in [mm²]							
[A]	1,5	2,5	4	6	10	16	25	35
6	102							
10	68	102						
16	23	45	84					
20	9	26	51	64				
25		12	28	24	52			
35			8	5	52	44		
50					10	44		
63						16		
80								
100								
max. number of terminals	51	51	42	32	26	22		

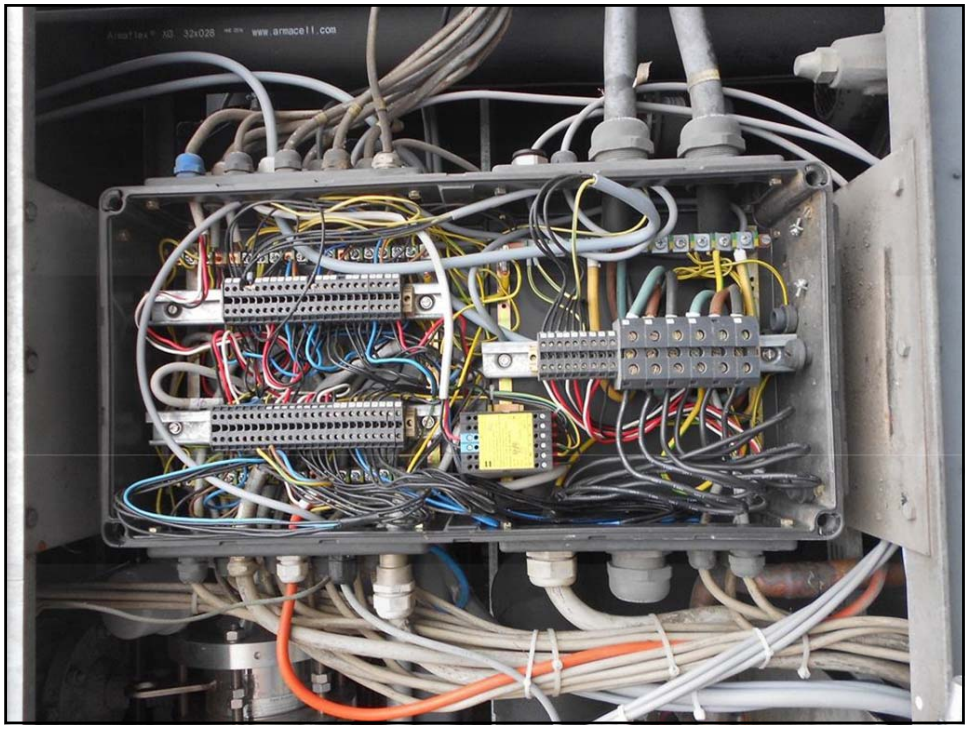
Maximum dissipated power







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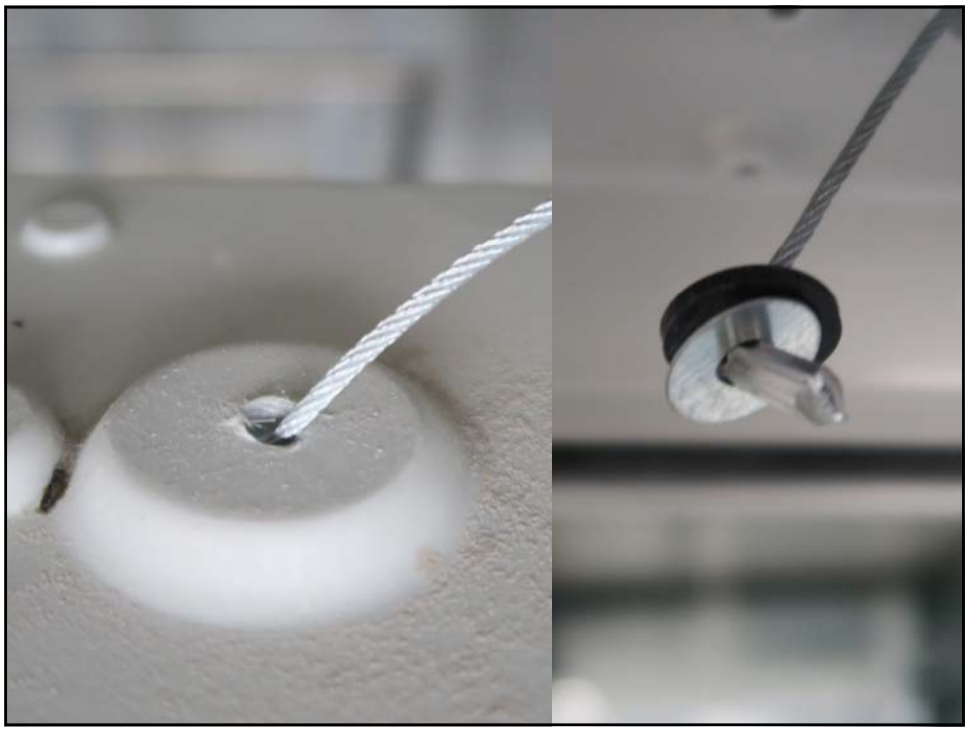
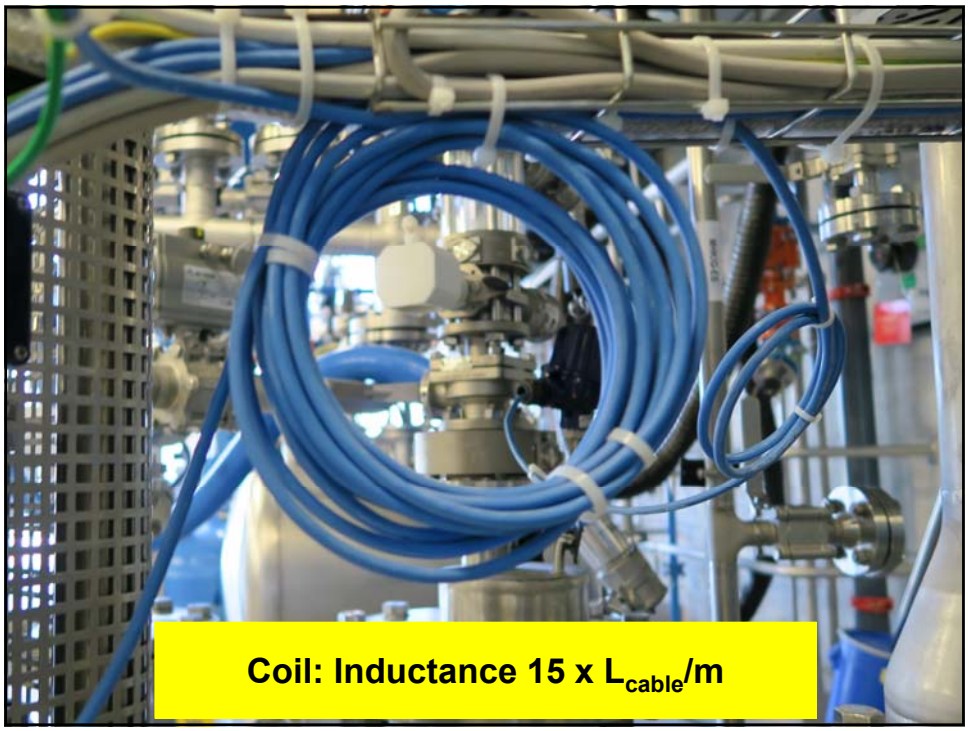
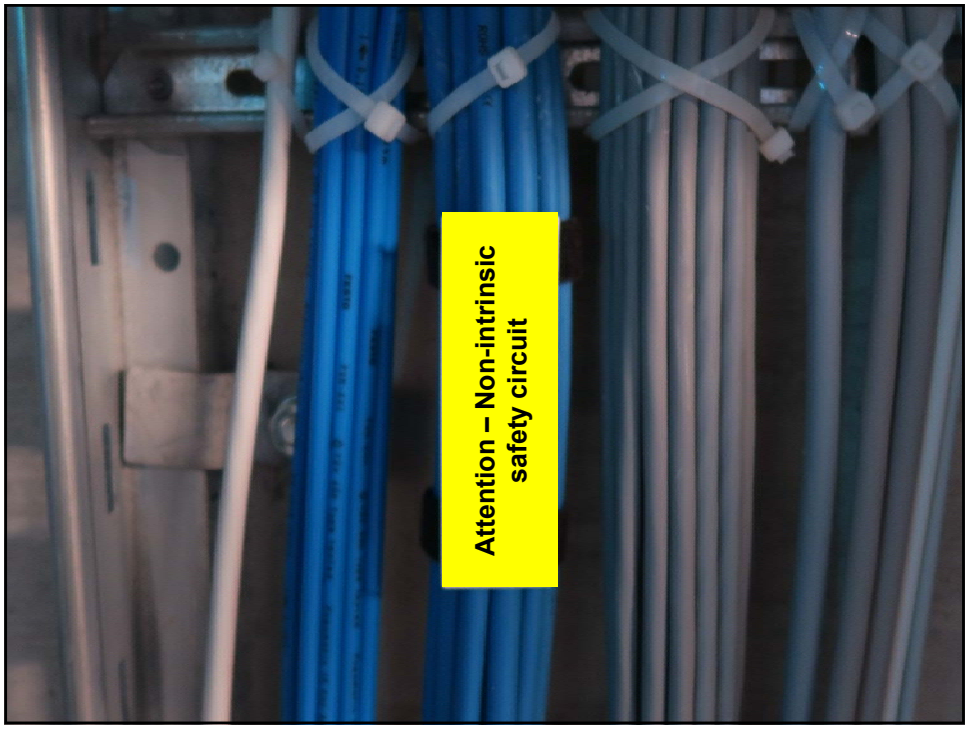


Equipment protection by intrinsic safety “i”





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Croatian Standards Institute

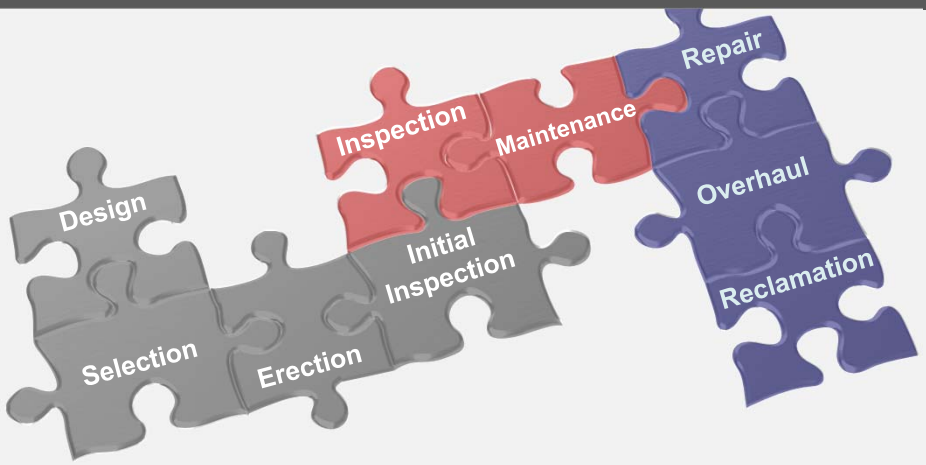
IEC IECEx

UNITED NATIONS
ECONOMIC COMMISSION FOR EUROPE

IECEx International Conference 2018
Split, Croatia

Electrical installations inspection and maintenance

Standards



IEC 60079-14 **IEC 60079-17** **IEC 60079-19**

Inspection and maintenance

- Electrical equipment in hazardous areas require more inspection and maintenance than equipment in non hazardous areas.
- Lack of inspection and maintenance introduce the risk of explosion.
- Where maintenance is subcontracted, they should be made aware of the rules.
- Competency control should be in place.

Inspection

Inspection

↓

Documentation and organisation check

↓

Technical inspection

Table 1 – Inspection schedule for Ex "d", Ex "e" and Ex "n" installations
(D = Detailed, C = Close, V = Visual)

	Check that:	Ex "d"			Ex "e"			Ex "n"		
		Grade of inspection								
		D	C	V	D	C	V	D	C	V
A	**APPARATUS**									
1	Apparatus is appropriate to area classification	X	X	X	X	X	X	X	X	X
2	Apparatus group is correct	X	X		X	X		X	X	
3	Apparatus temperature class is correct	X	X		X	X		X	X	
4	Apparatus circuit identification is correct	X			X			X		
5	Apparatus circuit identification is available	X	X	X	X	X	X	X	X	X
6	Enclosure, glass parts and glass-to-metal sealing gaskets and/or compounds are satisfactory	X	X	X	X	X	X	X	X	X
7	There are no unauthorized modifications	X			X			X		
8	There are no visible unauthorized modifications		X	X		X	X		X	X
9	Bolts, cable entry devices (direct and indirect) and blanking elements are of the correct type and are complete and tight									
	– physical check	X	X		X	X		X	X	
	– visual check			X			X			X
10	Flange faces are clean and undamaged and gaskets, if any, are satisfactory	X								
11	Flange gap dimensions are within maximal values permitted	X	X							
12	Lamp rating, type and position are correct	X			X			X		
13	Electrical connections are tight				X			X		
14	Condition of enclosure gaskets is satisfactory				X			X		
15	Enclosed-break and hermetically sealed devices are undamaged							X		
16	Restricted breathing enclosure is satisfactory							X		
17	Motor fans have sufficient clearance to enclosure and/or covers	X			X			X		
18	Breathing and draining devices are satisfactory	X	X		X	X		X	X	
B	**INSTALLATION**									
1	Type of cable is appropriate	X			X			X		
2	There is no obvious damage to cables	X	X	X	X	X	X	X	X	X
3	Sealing of trunking, ducts, pipes and/or conduits is satisfactory	X	X	X	X	X	X	X	X	X
4	Stopping boxes and cable boxes are correctly filled	X								
5	Integrity of conduit system and interface with mixed system is maintained	X			X			X		
6	Earthing connections, including any supplementary earthing bonding									

Visual Inspection

Inspection which identifies, without the use of access equipment or tools, those defects, such as missing bolts, which will be apparent to the eye.

Closed Inspection

Inspection which encompasses those aspects covered by a visual inspection and, in addition, identifies those defects, such as loose bolts, which will be apparent only by the use of access equipment, for example steps, (where necessary), and tools.

NOTE

Close inspections do not normally require the enclosure to be opened, or the equipment to be de-energized.

Detailed Inspection

Inspection which encompasses those aspects covered by a close inspection and, in addition, identifies those defects, such as loose terminations, which will only be apparent by opening the enclosure, and/or using, where necessary, tools and test equipment.

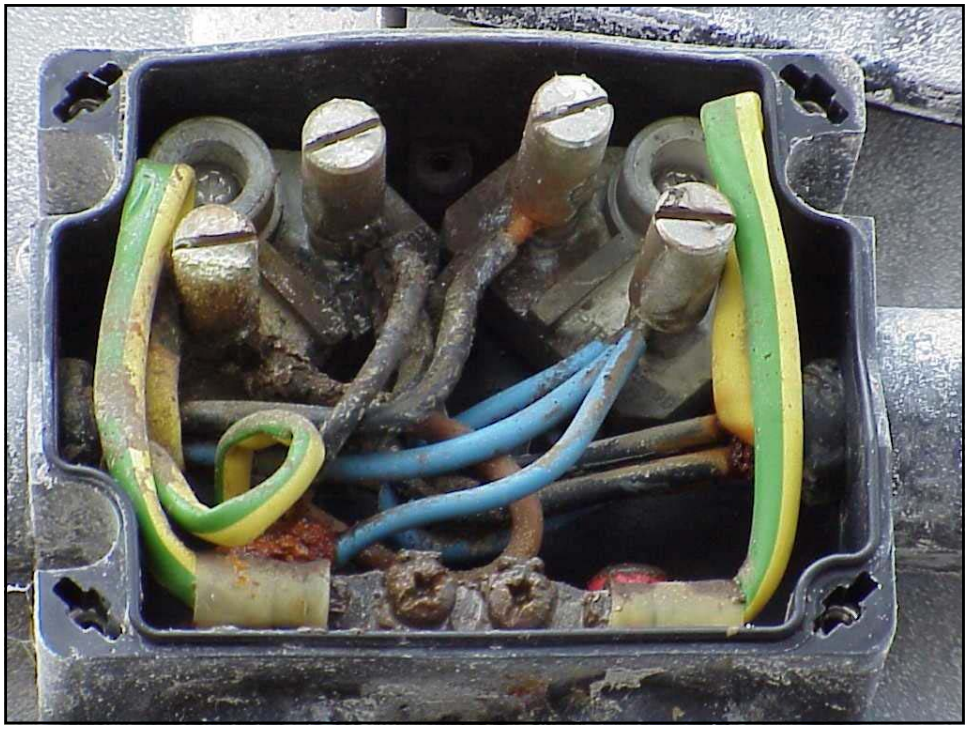
Inspection of portable equipment

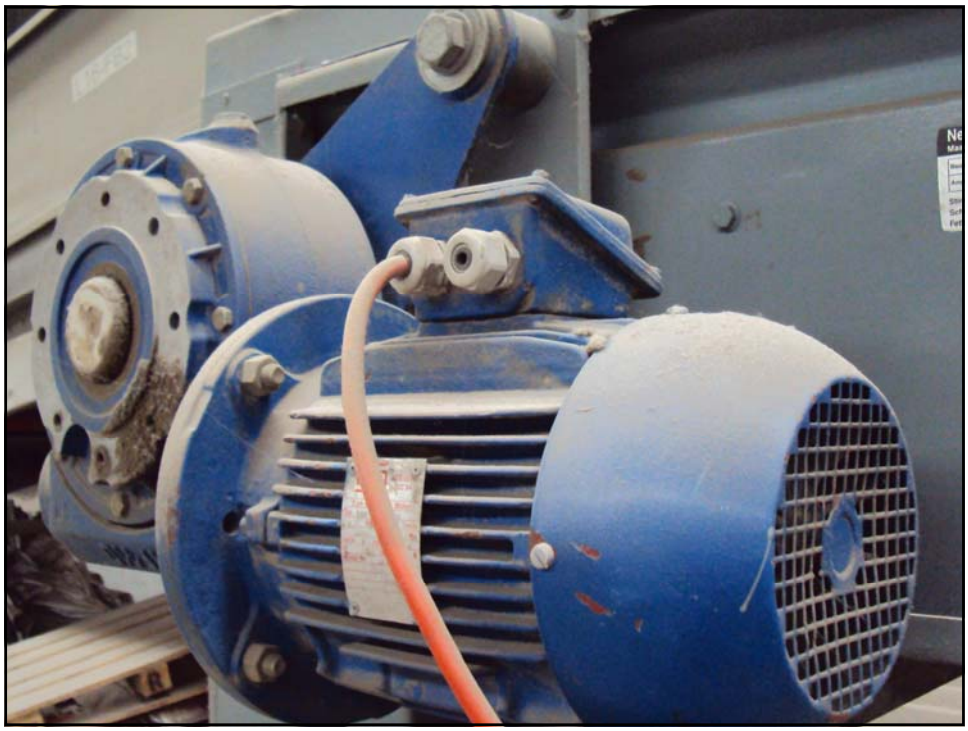
Potable electrical equipment (hand-held, portable and transportable) is particularly prone to damage or misuse and therefore the interval between periodic inspections may need to be reduced.

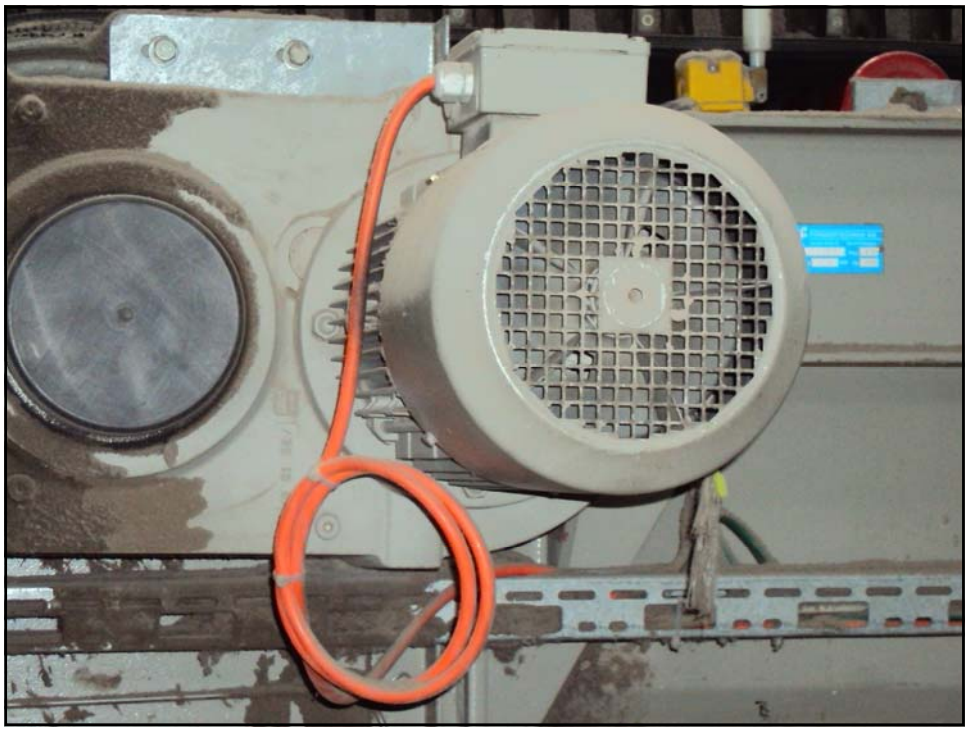
Inspection of portable equipment

Portable electrical equipment shall be submitted to a close inspection at least every 12 months. Enclosures which are frequently opened (such as battery housings) shall be given a detailed inspection.
In addition, the apparatus shall be visually checked by the user, before use, to ensure that the apparatus is not obviously damaged.

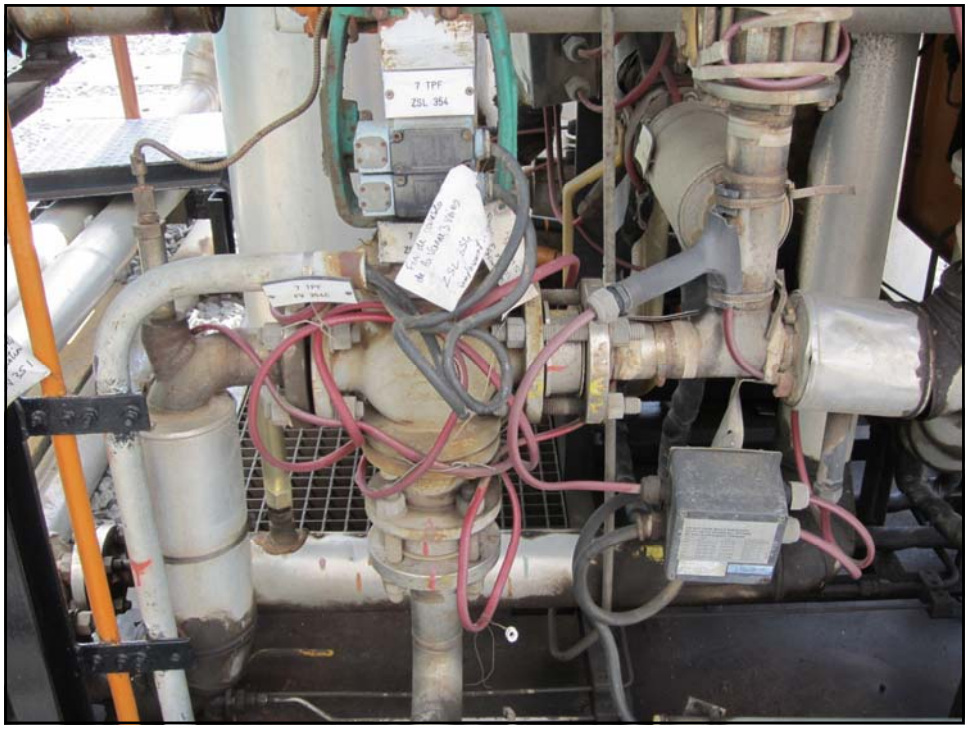
Integrity of enclosures
Cable entries
Blanking elements







Trace heating system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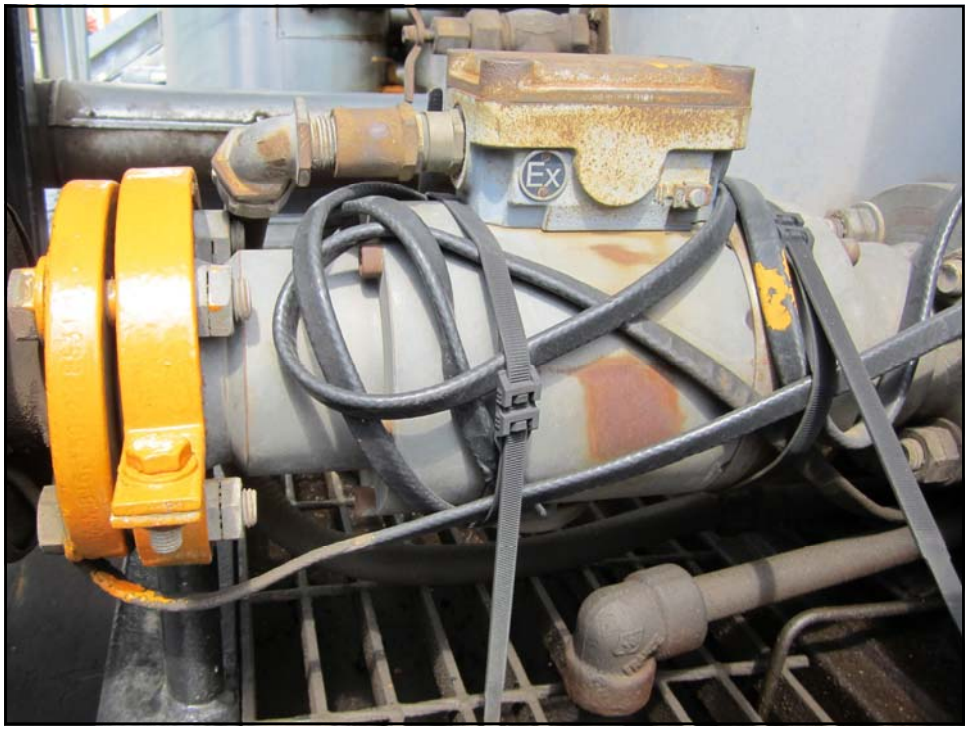
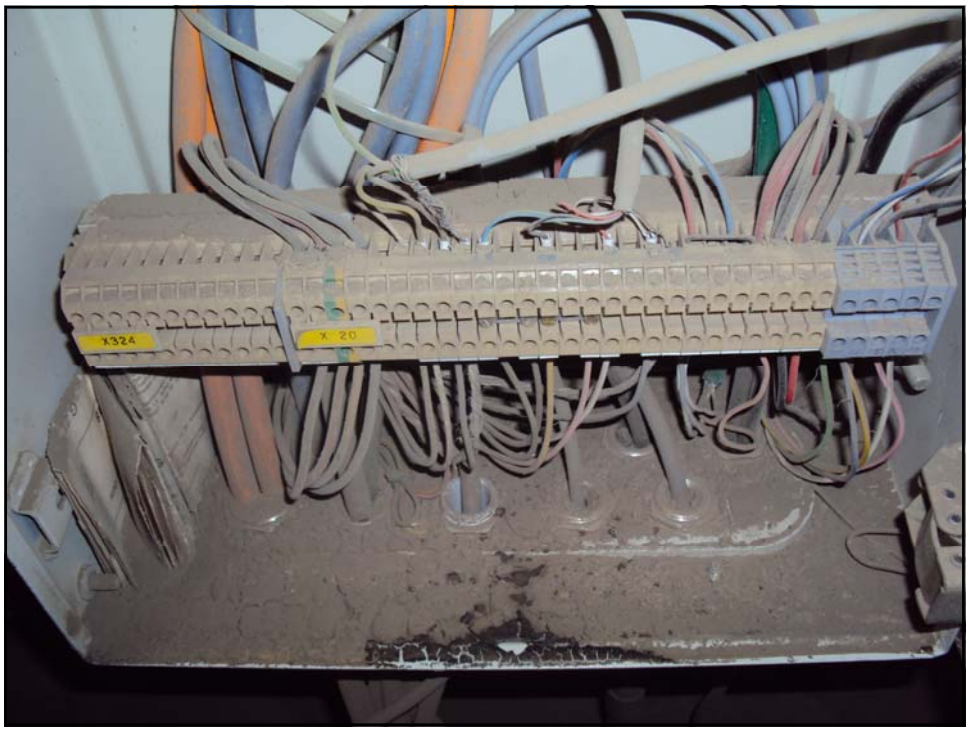

Ex

Dust applications


X324
X 20

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Thank you for your attention!

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