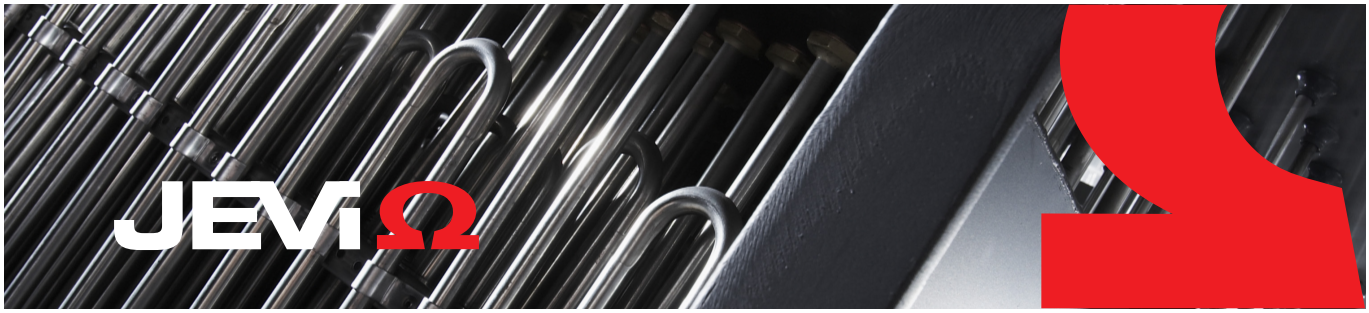

ATEX - GENERAL INFORMATION

In the chemical and petrochemical industry, as well as in the manufacturing industry, the offshore sector and the military, various media are produced, manufactured and stored in potentially explosive areas, thereby requiring special explosion proof equipment.

Our explosion proof solutions are manufactured in accordance with ATEX, which is an EU directive relating to electrical and mechanical equipment for use in potentially explosive areas.

We produce electric heating solutions for solid and liquid substances as well as for gases, and these can be supplied complete with control cabinets. Among other things, we produce:

- immersion heaters for liquid substances and gases
- circulation preheaters for liquid substances and gases
- gas preheaters for industrial gases such as hydrogen, CO2 and nitrogen
- air preheaters / reheaters
- finned tube heaters
- various industrial heating solutions
- junction boxes, thermostats, electronic temperature regulators and controllers for duct heaters

GENERAL

The term "explosive atmosphere" is defined as a mix of inflammable substances - in the form of gases, vapour, mist or dust - which can lead to fire spreading to the unburnt mix following ignition. Atmospheric conditions are normally defined as -20°C to +40°C, pressure 0.8 - 1.1 bar.

Electrical units for use in hazardous areas are divided into two groups:

GROUP I

Group I comprises electrical units used in explosive underground atmospheres, such as gasworks and mine workings. Group I units are to be used when the risk of explosion is due to methane, coal dust or a mixture of these. If a layer of coal dust forms on the unit, the maximum permissible surface temperature is 150°C. If no layer of coal dust forms, the maximum permissible surface temperature is 450°C.

GROUP II

Electrical units in hazardous environments (excl. group I). Take a look at temperature classification (page 2) to see the maximum permissible temperatures for units belonging to this group.

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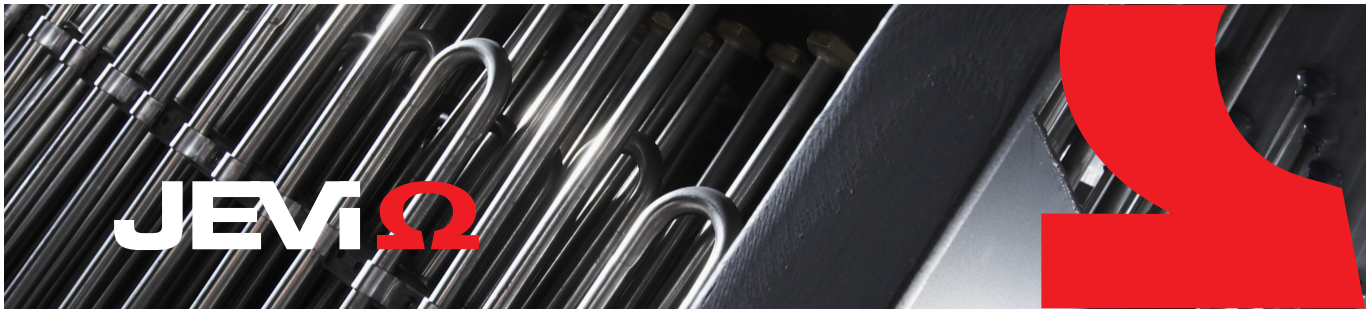

ZONE CLASSIFICATION

Hazardous areas comprise locations, environments, buildings and operating conditions in which explosive atmospheres prevail. To be able to indicate the risk of explosion in the areas mentioned, they are divided into zones; 3 zones for gases and 3 zones for dust, depending on how great the risk of explosion is.

ZONE 0

includes areas where there is always or very often a risk of explosion in the form of gas, mist or vapour.

ZONE 1

includes areas where there is occasionally a risk of explosion under normal operating conditions due to inflammable substances in the form of gas, mist or vapour.

ZONE 2

includes areas where there is rarely a risk of explosion or where there is a risk of explosion for fairly short periods due to gas, mist or vapour.

ZONE 20

includes areas where there is always or very often a risk of explosion due to inflammable substances in the form of dust.

ZONE 21

includes areas where there is occasionally a risk of explosion under normal operating conditions due to inflammable substances in the form of dust.

ZONE 22

includes areas where there is rarely a risk of explosion or where there is a risk of explosion for fairly short periods due to inflammable substances in the form of dust.

TEMPERATURE CLASSIFICATION

To ensure optimum use of the explosion proof equipment, this has to be divided into temperature classes. The lowest ignition temperature for explosive gases or vapour mixtures must exceed the surface temperature of the unit. The highest permissible surface temperatures are applicable to class T1 and the lowest permissible surface temperatures to class T6. An electric preheater which meets the requirements for temperature class T4, for example, automatically meets the requirements for T5 and T6.

TEMPERATURE CLASS

T1: Gas or vapour mixtures with an ignition temperature of >450°C and a maximum permissible surface temperature of 450°C for the unit.

T2: Gas or vapour mixtures with an ignition temperature of >300°C and a maximum permissible surface temperature of 300°C for the unit.

T3: Gas or vapour mixtures with an ignition temperature of >200°C and a maximum permissible surface temperature of 200°C for the unit.

T4: Gas or vapour mixtures with an ignition temperature of >135°C and a maximum permissible surface temperature of 135°C for the unit.

T5: Gas or vapour mixtures with an ignition temperature of >100°C and a maximum permissible surface temperature of 100°C for the unit.

T6: Gas or vapour mixtures with an ignition temperature of >85°C and a maximum permissible surface temperature of 85°C for the unit.

GAS CLASSIFICATION

The risk of gas ignition is crucial to definition of gas classification A, B or C. Classification B is also applicable to classification A, and classification C is applicable to both A and B.

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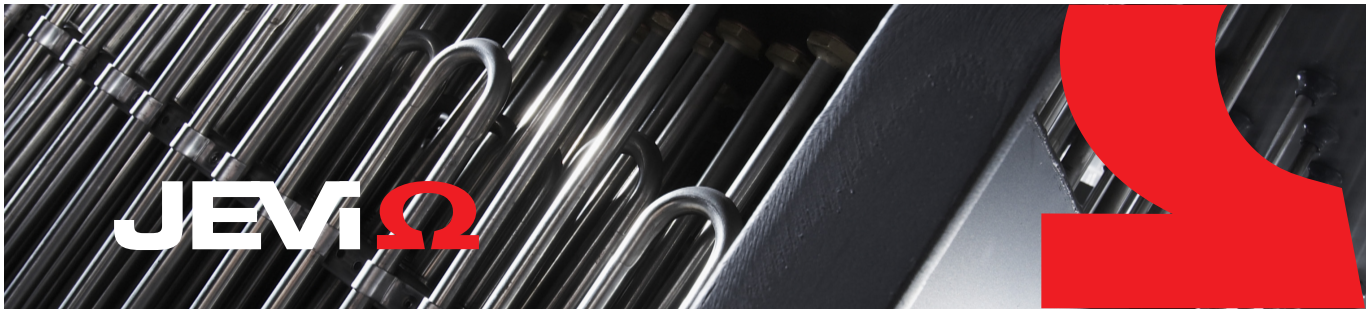

PRESSURE PROOF ENCLOSURE

-d- cenelec EN 60079-1

Electrical parts which may cause an explosion in hazardous areas must be enclosed in a connecting box. This box must be designed to withstand the pressure from the explosion (attenuation effect) and prevent the explosion being transmitted to the surrounding area.

It is assumed that explosive gases and vapours can penetrate, but the explosion is limited to the inner part of the box, i.e. it is restricted to the actual source of ignition (sparks).

Pressure proof boxes are classified as A, B or C. The safety requirements for B are more stringent than A, and the same is true for C in relation to B.

The pressure proof connecting box undergoes overpressure testing which differs depending on whether type A, B or C is being tested. The purpose of this test is to examine whether the connecting box is able to withstand the test pressure as the gas mixture cannot escape from the box. The results of the test are crucial to whether the authorised testing institute will approve the box complete with heating elements.

ENHANCED SAFETY

-e- cenelec EN 60079-7

This special structure makes it possible to create enhanced safety by avoiding high surface temperatures and also preventing sparks in the inner and outer sections of the electrical unit.

Explosion is therefore ruled out entirely in the -e- structure. The maximum surface temperature is the crucial parameter.

The junction box has a degree of protection of up to IP66. The box is as standard in stainless steel and with hinged lid. Coating and other materials on request.

Summary

EX de || C T3

- T3: Defines max. surface temperature on parts placed in the ex area. T3 = 200ºC
- C: Defines which gases/medium the classification includes. A, B or C. C includes both A and B.
- ||: Defines the gas group I or II.
  I: Ex areas in mines and related areas
  II: All ex equipment used above ground level
- de: Defines the construction of the enclosure.
  - -e- Terminal box where the electrical connections, terminals and thermostats are constructed with regards to increased safety.
  - -d- Flameproof enclosure which can resist a pressure built up of an explosion.
  - -ed- As -e- but it is possible to use components classified as -d- inside the terminal box (thermostats).
  - -de- As -d- but it is possible to use components classified as -e- inside the terminal box (terminals and thermostats).
- EX: Ex equipment.
- EX: European Standard, approved equipment.

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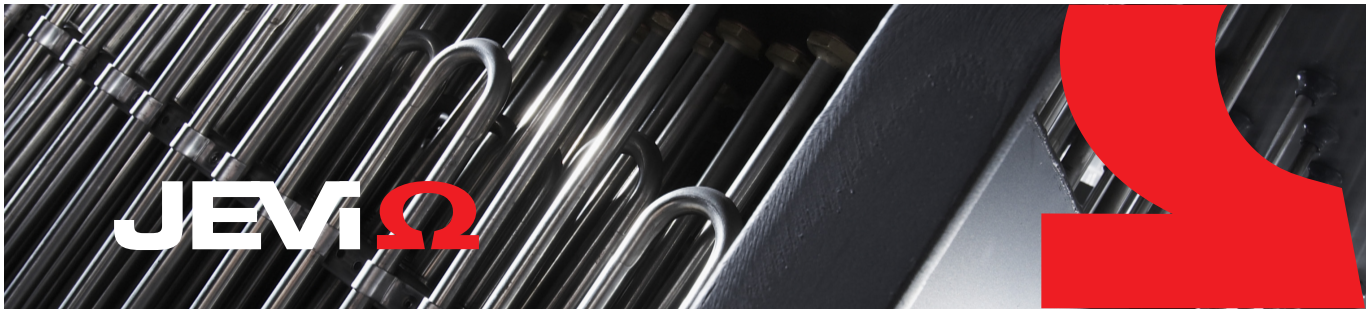

BASIC ELEMENT

Ex e II heating element

One of the basic elements of explosion proof equipment is the tubular heating element. This heating element comprises a nickel chrome resistance thread surrounded by a metal cap and insulated with compact magnesium oxide. These elements can be bent to achieve optimum utilisation.

The standard sizes of the elements are Ø8.5mm, Ø10.2mm, Ø12.7mm and Ø16mm.

Cover material:

AISI 304/316/321/310, SMO254, Incoloy 800/825, Inconel 600, titanium and copper. Other materials on agreement.

We have developed a heating element with enhanced safety, Ex e II, in accordance with EN 60079-0 and EN 60079-7. This element forms a basis for equipment with enhanced safety; this means that special rules have been implemented with regard to the design (in order to create an opportunity for enhanced safety) in order to prevent high surface temperatures as well as sparks in the inner or outer electrical parts. These Ex e II elements can be built into a junction box with a minimum degree of protection of IP54 fitted with Ex e terminals.

Pressure proof thermostats and thermoelements fitted in a junction box are used for maximum temperature protection and control. All coupling units in the junction box must be of pressure proof design.

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