

## Methods of Protection Increased Safety (Exe)

EN IEC 60079-7 (EN IEC 60079-0 also applies)

This protection concept is not applicable to equipment or components containing semi-conductor devices, unless these are separately protected by another method, e.g. a flameproof switch or encapsulated fuse. Resistors are permitted, if they are the single layer wire wound type or electric trace heating cables.

Many types of standard industrial equipment can be certified using increased safety:

- Terminals for electrical connections.
- Junction boxes and control stations.
- Cable glands (most of the requirements are covered by EN IEC 60079-0. An increased safety cable gland meets IP54 minimum).
- Motors and generators (brushless type, e.g. induction or synchronous machines).
- Luminaires (fluorescent or GLS type lamp permitted. Other lamp types have very high surface temperature and are not permitted).
- Transformers, including current transformers.
- Other devices containing electromagnetic windings (e.g. solenoids).
- Batteries, including lead acid type that may evolve hydrogen during charging.
- Measuring instruments (moving iron type).
- Other types of equipment not specifically detailed in the standard but for which principles for the above requirements can be applied.

### Requirements Applicable to all Products

The principles of the increased safety protection concept are:

- No sparking contacts.
- No semi-conductor devices (the failure mode is not possible to ascertain).
- No hot surfaces above temperature class.
- High integrity electrical connections.
- Increased creepage (distance over insulation surface) between live parts and to earth potential.

- Increased clearance distance (through air) between live parts and to earth potential (not applicable to the rotor of a rotating machine).
- High quality insulation materials that have a rated continuous operating temperature of at least 20°C greater than that achieved under rated voltage and at maximum ambient conditions.
- Winding wires must comply with IEC standard industrial Grade 1, or Grade 2 if tested to Grade 1 specification.
- The ingress protection rating of the equipment is IP40 for equipment containing fully insulated live parts, or IP54 minimum for equipment containing uninsulated live parts.



### Specific Requirements

#### Motors

A standard, totally enclosed industrial motor complying with the requirements stated above will require a thermal test at manufacturer's rated full load to determine normal running temperatures.

Increased safety motors must also be connected to a protective time/current device that will disconnect the machine under locked rotor conditions. An additional test to determine the maximum surface temperature with the rotor locked to prevent rotation is also conducted and a time  $t_E$  is calculated which specifies the maximum length of time permitted under locked rotor condition before the safety device operates.

Rotors with slip rings may also be covered under Increased Safety provided a separate protection

method is applied to the sparking or semi-conductor parts.

A range of standard motors can be covered on a certificate or, more usually, a certificate will be specific to a single motor having a specific or multiple ratings.

Motors to be used with an inverter (variable speed drive) require special consideration.

#### Luminaires

It is usual for a range of luminaires to be covered on a single certificate. Depending on lamp rating, not all types will require testing provided the client will accept the thermal test results from a luminaire having a higher rating. Emergency (battery back up with an inverter) luminaries may also be included on a certificate.

A luminaire copper/iron choke or ballast can be assessed and tested against increased safety. An electronic starter or electronic high frequency ballast contains semi-conductor devices and must be protected by another protection concept.

Luminaires are subjected to a thermal test at a voltage between 0.9 and 1.1 times manufacturer's rated voltage to determine maximum surface temperature. Fluorescent luminaries are also subjected to an additional test to simulate partial failure of the lamp by including a diode.

Electronic high frequency ballasts, protected by another concept of protection, are also subjected to a performance test under simulated lamp end of life conditions. These tests are designed to determine the maximum surface temperature of the lamp around the cathode. The cathode temperature is not measured directly.

#### Measuring instruments

Please contact Sira for more information.

#### Junction boxes

A range of different size junction boxes can be covered on a single certificate. Testing is either conducted on specific arrangements of terminals, with specified maximum current, or by testing the worst case terminal and length of conductor to dissipate the maximum power inside the enclosure. Under the maximum dissipated power

method, the manufacturer may select a specific arrangement of terminals, provided the maximum dissipated power is not exceeded.

#### **Method**

Assessment of the equipment is conducted to determine what tests are required to demonstrate compliance with the standard.

Usually a thermal test is conducted first, to determine the maximum temperature of components and parts under maximum service conditions (i.e. using manufacturer's rating for the device, related to the maximum ambient temperature in service). An additional test at 0.9 to 1.1 times rated voltage may also be conducted at this time to determine maximum surface temperature. Again this is related to maximum ambient temperature in service.

The temperature results are assessed to confirm compliance with the temperature limits specified in the standard.

Enclosures undergo thermal endurance (high humidity and high temperature) of non-metallic parts. This is followed by impact and ingress protection testing. Component parts that are intended to be fitted inside another enclosure do not require these tests.

#### **How Can Sira Help?**

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