



**SENTRAN**

INNOVATIVE  
MEASUREMENT  
SOLUTIONS

# TECHNICAL BULLETIN

## ENVIRONMENTAL SEALING

### IP & NEMA Designations

#### INDEX OF PROTECTION (IP) RATINGS

*(International Electrotechnical Commission Index Of Protection)*

*SENTRAN uses the standard designations of the International Electrotechnical Commission Index Of Protection rating system to classify the sealing integrity of our sensors, transducers and load cell products. Although this rating system was not developed specifically for these types of products, in the absence of an sanctioned industry standard, we find the IP rating system to be a reliable reference standard. The IP rating classification system is the most widely accepted standard currently in use sensors, transducers and load cell products.*

#### PROTECTION AGAINST SOLID OBJECTS - FIRST DIGIT

- 0** No protection
- 1** Protected from solid objects up to 50 mm (e.g. accidental touch by hands)
- 2** Protected from solid objects up to 12 mm (e.g. accidental touch fingers)
- 3** Protected from solid objects larger than 2.5 mm (e.g. tools and small wires)
- 4** Protected from solid objects larger than 1 mm (e.g. small wires)
- 5** Protected from dust; limited entrance (no harmful deposit)
- 6** Totally protected from dust

#### PROTECTION AGAINST LIQUIDS - SECOND DIGIT

- 0** No protection
- 1** Protected from vertically falling drops of water (e.g. condensation)
- 2** Protected from direct sprays of water up to 15° from vertical
- 3** Protected from direct sprays of water up to 60° from vertical
- 4** Protected from water sprayed from all directions; Limited entrance allowed
- 5** Protected from low pressure jets of water from all directions; limited entrance allowed
- 6** Protected from strong jets of water; limited entrance a allowed (e.g. for use on ship decks)
- 7** Protected from the effects of immersion between 15 cm and 1 m for 30 minutes
- 8** Protected from extended periods of immersion under pressure

#### EXAMPLE - IP67

- 6** Totally protected from dust
- 7** Protected from the effects of immersion between 15 cm and 1 m for 30 minutes

#### NEMA STANDARDS

*(National Electrical Manufacturers Association)*

*SENTRAN uses the standard designations of the NEMA rating system to classify enclosure types for hazardous and non-hazardous locations for its products. These descriptions are offered for reference and are not intended as complete descriptions of NEMA standards. Please refer to the appropriate NEMA standards (NEMA standard 250) documentation for complete information on any of these references. (NEMA, 2101 "L" Street Northwest, Washington, D.C. 20037.)*

#### ENCLOSURE TYPES FOR NON-HAZARDOUS LOCATIONS

- Type 1** GENERAL PURPOSE. Enclosures are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment or locations where unusual service conditions do not exist.
- Type 2** DRIP TIGHT. Enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.
- Type 3** WEATHERPROOF (Weather Resistant). Enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain and sleet; undamaged by the formation of ice on the enclosure.
- Type 3R** RAIN TIGHT. Enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain and sleet; undamaged by the formation of ice on the enclosure.
- Type 4** WATERTIGHT. Enclosures are intended for indoors and outdoors use primarily to provide a degree of protection against windblown dust and rain, splashing water and hose-directed water; undamaged by the formation of ice on the enclosure.
- Type 4X** WATERTIGHT. Enclosures are intended for indoors and outdoors use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water and hose-directed water; undamaged by the formation of ice on the enclosure.
- Type 5** No NEMA equivalent.
- Type 6** SUBMERSIBLE. Enclosures are intended for indoors and outdoors where occasional submersion is encountered.
- Type 12** INDUSTRIAL USE. Enclosures are intended for indoor and outdoor use primarily to provide a degree of protection against dust falling dirt, and dripping non-corrosive liquids.
- Type 13** DUSTPROOF. Enclosures are intended for indoor and outdoor use primarily to provide a degree of protection against dust spraying of water, oil, and non-corrosive coolant.

continued ...



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#### ENCLOSURE TYPES FOR HAZARDOUS LOCATIONS

##### NEMA (A, B, C or D) Hazardous Locations.

CLASS I. Air Break-Explosion-Proof; Divisions 1 & 2: NEC Article 501

**Type 7** EXPLOSION PROOF. Enclosures are intended to be capable of withstanding the pressures resulting from an internal explosion of specified gas, and contain such an explosion sufficiently that an explosive air-gas mixture existing in the atmosphere surrounding the enclosure will not be ignited. Enclosed heat generating devices shall not cause external surfaces to reach temperatures capable of igniting explosive air-gas mixtures in the surrounding atmosphere. Enclosures shall meet explosion, hydrostatic and temperature design tests.

##### NEMA (E, F or G) Hazardous Locations.

CLASS II. Dust-Ignition-Proof; Divisions 1 & 2: NEC Article 502

**Type 9** CLASS II HAZARDOUS LOCATIONS. Enclosures are intended for indoor use in locations classified as Class II, Groups E, F, or G, as defined in the National Electrical Code (NEC). NEMA Type 9 enclosures shall be capable of preventing the entrance of dust.

**NOTE:** **Explosion proof enclosures** are designed to contain an explosion if an electrical device ignites a flammable substance within the enclosure, thus preventing ignition of the surrounding atmosphere. Explosion proof (XP) enclosures are often used to create a virtual "safe area" for instrumentation that must be located in an otherwise "hazardous area". Transmitters and dedicated controllers can be located in the environment with power and signal wiring/cabling placed in XP conduit. There is literally no maintenance required for these enclosures, which can provide an ideal application solution under the proper circumstances.

#### RELATED INFORMATION

##### INTRINSIC SAFETY BARRIERS

Intrinsic safety barriers are designed to limit the current and voltage conducted through a device's (sensors, transducers and load cells) power and/or signal wiring. This limiting effect in these devices prevent shorting or arcing within the device and its associated wiring, thus preventing ignition of the surrounding atmosphere. Intrinsic safety barriers are commonly used for devices that operate at very low power and signal levels, such as is the case with typical force measurement sensors, transducers and load cells.

The typical installation requires the force sensors, transducers and load cells to be installed in the Hazardous Area with any accompanying summing or junction box. The intrinsic safety barrier and other system instrumentation is installed in a Safe Area (Non-hazardous Environment), with the intrinsic safety barrier being the electrical "portal" between the environments.

The advantages of using intrinsic safety barriers is that it is a long-proven method of reliably limiting energy entering a hazardous location. The fact that these devices have no moving parts contribute to their reputation for low maintenance and reliability.

##### PURGING SYSTEMS

Purging systems are designed to supply one or multiple protected enclosures with compressed, clean "instrument air" or inert gases such as nitrogen or argon. Most purging applications require a minimum enclosure pressure of 0.10" water (<0.004 psi) This technique removes any flammable gases, and prevents the accumulation of ignitable dusts within the protected enclosure(s). Some of the benefits of a purging system are a continuous flow of "safe" air or gas throughout the enclosure, which also reduces heat build-up, moisture and dust accumulation and corrosion. Purging systems can produce a literally "safe area" in any typical standard instrumentation enclosure.

**For expert information and applications assistance** on intrinsically safe applications and purging systems for use with SENTRAN force sensors, transducers and load cells, complete weighing systems and instrumentation, please contact SENTRAN's Applications Engineering Group.