

## APPLICATION NOTE

# IP/NEMA RATING INTRODUCTION

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## **1. SCOPE**

This document provides an introduction to ingress protection method applicable both in Europe and North-America and a application guidance for use of Solid AT products in various environments according to the units' rating, per IP/NEMA. The document will refer to different approvals that are applicable for both European and American markets and fit to the environmental types of the application. With this information customers will be able to install Solid AT' products adequately and achieve proper matching to the environment.

## **2. OBJECTIVES**

- Familiarize the user with approval definitions and terms.
- Familiarize the user with Solid AT products environmental approvals.
- Familiarize the user with Solid AT sensors environmental approvals.

### **3. APPROVAL TYPES AND ENVIRONMENT CLASSIFICATION**

#### **3.1 APPROVAL TYPES**

The most commonly used protection methods are IP and NEMA, whereas:

- IP Classification – addresses the European market
- NEMA Classification – addresses the American market

The European method of Ingress Protection is based upon IEC 60529 and designates different IP levels:

Dust (first digit): 1 to 6

Water (second digit): 1 to 8

North American Ingress Protection method is based upon NEMA Standard 250. These standards are the basis for the North American for non hazardous Enclosure Types: 1, 2, 3, 3R, 3S, 4, 4X, 5, 6, 6P, 12, 12K and 13.

Hazardous area enclosures types will be marked as 7,8,9,10 whereas Type 7 and 10 enclosures are designed to contain an internal explosion without causing an external hazard. Type 8 enclosures are designed to prevent combustion through the use of oil-immersed equipment. Type 9 enclosures are designed to prevent the ignition of combustible dust.

##### **3.1.1 IP Classification**

The IP (Ingress Protection) standard (IEC Publication 60529) is a classification of degrees of protection provided by the environment for the electrical equipment.

The IEC designation consists of the letters IP followed by two numerals. The first characteristic numeral indicates the degree of protection provided by the environment with respect to persons and solid foreign objects entering the environment. The second characteristic numeral indicates the degree of protection provided by the environment with respect to the harmful ingress of water. The following table summarizes the types of environment and a general definition for these types.

<b>1<sup>st</sup> digit</b>	<b>Definition</b>	<b>2<sup>nd</sup> digit</b>	<b>Definition</b>
0	Non- protected	0	Non- protected
1	Against penetration of solid objects of 50mm diameter and more	1	Against vertical dripping water
2	Against penetration of solid objects of 12.5mm diameter and more	2	Against vertical dripping water at an angle of up to 15°
3	Against penetration of solid objects of 2.5mm diameter and more	3	Against vertical dripping water at a angle of up to 60°
4	Against penetration of solid objects of 1mm diameter and more	4	Against splashing water in all directions.
5	Dust protected	5	Against water jets in all directions
6	Dust tight	6	Against powerful jets of water and waves
		7	Against the affects of temporary immersion
		8	Against the affects of longed immersion under specified conditions

### 3.1.2 NEMA Environment Types

The NEMA standard is mostly known in North American countries and it classifies the degrees of protection provided by the environment to the electrical equipment. This standard intends to include environmental conditions such as corrosion, rust, icing, oil, and coolants.

The following table summarizes the types of environments and a general definition for these types.

Environment type	General definition
1,2,4,4X, 5,6,6P, 12,12K, 13	Indoor non hazardous locations
3,3R, 4,4X, 6,6P	Outdoor non hazardous locations
7,10	Environment is designed to contain an internal explosion without causing an external hazard
8	Environment is designed to prevent combustion through the use of oil-immersed equipment
9	Environment is designed to prevent the ignition of combustible dust

### 3.1.3 NEMA and IP Environment Classification Comparison

The IP standard deals only with the following 3 parameters:

- Protections of the equipment
- Protection of personal
- Protection of the equipment against penetration of water with harmful effects.

The standard doesn't specify degrees of protection against mechanical damage of equipment, risk of explosions, or conditions such as moisture (produced for example, by condensation), corrosive vapors, fungus, or vermin. The NEMA standard for the environments surrounding the electrical equipment tests environmental conditions such as corrosion, rust, icing, oil, and coolants. For this reason, the test and evaluations in comparison with the IP standard is not identical.

The following table summarizes the relations between these two standards:

<b>NEMA Type</b>	<b>NEMA definition</b>	<b>IP Class</b>
1	General-purpose. Protects against dust, light, and indirect splashing but is not dust-tight; primarily prevents contact with live parts; used indoors and under normal atmospheric conditions.	IP10
2	Drip-tight. Similar to Type 1 but with addition of drip shields; used where condensation may be severe (as in cooling rooms and laundries).	IP11
3 and 3S	Weather-resistant. Protects against weather hazards such as rain and sleet; used outdoors on ship docks, in construction work, and in tunnels and subways.	IP54
3R	Intended for outdoor use. Provides a degree of protection against falling rain and ice formation. Meets rod entry, rain, external icing, and rust-resistance design tests.	IP14
4 and 4X	Watertight (weatherproof). Must exclude at least 65 GPM of water from 1-in. nozzle delivered from a distance not less than 10 ft for 5 min. Used outdoors on ship docks, in dairies, and in breweries.	IP56
5	Dust-tight. Provided with gaskets or equivalent to exclude dust; used in steel mills and cement plants.	IP52
6 and 6P	Submersible. Design depends on specified conditions of pressure and time; submersible in water; used in quarries, mines, and manholes.	IP67
7	Hazardous. For indoor use in Class I, Groups A, B, C, and D environments as defined in the NEC.	—
8	Hazardous. For indoor and outdoor use in locations classified as Class I, Groups A, B, C, and D as defined in the NEC.	—
9	Hazardous. For indoor and outdoor use in locations classified as Class II, Groups E, F, or G as defined in the NEC.	—
10	MSHA. Meets the requirements of the Mine Safety and Health Administration, 30 CFR Part 18 (1978).	—
11	General-purpose. Protects against the corrosive effects of liquids and gases. Meets drip and corrosion-resistance tests.	—
12 and 12K	General-purpose. Intended for indoor use, provides some protection against dust, falling dirt, and dripping non corrosive liquids. Meets drip, dust, and rust resistance tests.	IP52
13	General-purpose. Primarily used to provide protection against dust, spraying of water, oil, and non corrosive coolants. Meets oil exclusion and rust resistance design tests.	IP54

### 3.2 SOLID AT' PRODUCTS APPROVAL

The following table describes Solid AT products and IP/NEMA environment rating, based on the following guidelines:

<b>Solid AT'S Products</b>	<b>Protection degree</b>
MicroScan	IP 65/NEMA 4
MonoScan	IP 65/NEMA 4
SmartScan25	IP 65 / NEMA 4 and NEMA 4X IP 67/NEMA 6
SmartScan50	IP 65 / NEMA 4 and NEMA 4X IP 67/ NEMA 6

**① Note:**  
**For CSA NI approval the MonoScan' connector meets only 3R while the MonoScan conduit is approved for IP65/NEMA 4 and NEMA 4X.**

### 3.3 SOLID AT' SENSORS APPROVAL

The following table describes Solid AT' sensors and IP/NEMA environmental classification according to the previous guidelines:

<b>Solid AT' sensors</b>	<b>Protection degree</b>
25KHz Standard range	IP 65 / NEMA 4 and NEMA 4X IP 67/NEMA 6
25KHz Long range	IP 65 / NEMA 4 and NEMA 4X IP 67/NEMA 6
50KHz	IP 65 / NEMA 4 and NEMA 4X IP 67/NEMA 6

**① NOTE:**  
**Solid AT' sensors are suitable for submerged applications.**