

## PROTECTION CLASSES

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### 1. Introduction

The degree of protection is a system to classify the different systems provided by the containments or boxes that protect components that constitute a team.

There are different systems to identify the degree of protection, the most used worldwide are:

- Nomenclature according to IEC 60529 (IP)
- Nomenclature according to NEMA

### 2. Nomenclature according to IEC 60529

Especially used in Europe and Asia, and accepted internationally, defined with a numerical code behind the acronym IP (Ingress Protection), in the form IP xy

x - The first numerical symbol describes the level of protection against the entry of solid objects.

y - The second number symbol describes the level of protection against water ingress.

#### 2.1 First digit (entry of solid objects)

Digit	Protection against
0	No protection against contact, no protection against foreign bodies
1	Protection against touching by hand, protection against foreign bodies with $\varnothing > 50$ mm
2	Protection against contact with fingers, protection against foreign bodies with $\varnothing > 12$ mm
3	Protection against contact with tools, wires or similar equipment with a diameter larger than 2.5 mm, protection against foreign bodies with $\varnothing > 2.5$ mm
4	Protection against contact with tools, wires or similar with diameter larger 1 mm, protection against foreign bodies with $\varnothing > 1$ mm
5	Protection against any contact, protection against dust deposits inside
6	Complete protection against the ingress of dust

## 2.2 Second digit (entry of water)

Digit	Protection against
0	No protection against water
1	Protection against vertical water drops
2	Protection against diagonal water drips (up to a 15° angle)
3	Protection against diagonal water drips (up to a 60° angle)
4	Protection against splashed water from all directions
5	Protection against water jet (out of a nozzle) from all directions
6	Protection against strong water jet (out of a nozzle) from all directions
7	Protection against water ingress in case of temporary immersion (30 minutes)
8	Protection against water ingress in case of continuous immersion, requirements under agreement between manufacturer and user
9K	Protection against water ingress during high pressure (8.000 till 10.000 kPa) or steam jet cleaning from any direction

## 3. Nomenclature according to NEMA

Used especially in the USA and Canada and accepted internationally.

The types of protection are separated by installation in non-explosive area and installation in explosive area and for internal or outdoor installation.

The following tables are defined in the NEMA 250-2003 standard

### 3.1 Protection for specific applications in interiors and non-explosive areas

Protection against the following conditions	Protection type									
	1	2	4	4X	5	6	6P	12	12K	13
Access to dangerous areas	X	X	X	X	X	X	X	X	X	X
Enter of solid particles	X	X	X	X	X	X	X	X	X	X
Inlet of water (drops or light jets)		X	X	X	X	X	X	X	X	X
Enter of solid particles (circulating dust, fluff, fiber, etc.)			X	X		X	X	X	X	X
Dust ingress (sedimentation of dust, lint, fibers, etc.)			X	X	X	X	X	X	X	X
Water ingress (splashing and fogging)			X	X		X	X			
Oil and cooling media filtration								X	X	X
Oil or splash of coolant mist										X
Corrosive agents				X			X			
Water entry (occasional and temporary immersion)						X	X			
Water ingress (occasional prolonged immersion)							X			

### 3.2 Protection for specific outdoor applications and non-explosive areas

Protection against the following conditions	Protection type									
	3	3X	3R	3RX	3S	3SX	4	4X	6	6P
Access to dangerous areas	X	X	X	X	X	X	X	X	X	X
Ingress of water (rain, snow, hail)	X	X	X	X	X	X	X	X	X	X
Hail or parts covered by ice					X	X				
Income of foreign solids (dust brought by the wind, fluff, fibers and flying objects)	X	X			X	X	X	X	X	X
Water ingress (jets)							X	X	X	X
Corrosive agents		X		X		X		X		X
Water ingress (occasional and temporary immersion)									X	X
Water ingress (occasional prolonged immersion)										X

### 3.3 Protection for specific applications in explosive areas

In explosive areas, NEMA protection classes 7, 8, 9 and 10 are used, and depending on the application, groups A, B, C, D, E, F, or G defined in the NFPA 70 standard.

Types 7 and 10 define enclosures in which an internal explosion inside the enclosure is not transmitted to the outside.

Type 8 defines enclosures in which the equipment is submerged in oil.

Type 9 defines protections to prevent the explosion of combustible dust.

Provides protection against atmospheres typically containing:	Class	Protection type 7 y 8, Class I, Groups				Protection type 9, Class II, Groups			10
		A	B	C	D	E	F	G	
Acetylene	I	X							
Hydrogen, gas	I		X						
Diethyl ether, ethylene, cyclopropane	I			X					
Fuel, hexane, butane, naphtha, propane, acetone, toluene, isopropanol	I				X				
Metal powder	II					X			
Coal powder, soot, coke powder	II						X		
Flour, starches, cereal powder	II							X	
Fibers, incendiary fibers	II							X	
Methane with or without coal dust	MSHA								X

## 4. Comparison between the two norms

This table makes an approximate comparison between the two norms.

<b>NEMA</b>	1	2	3	3R	3S	4	4X	5	6	6P	12 y 12K	13
<b>IP</b>	20	20	55	24	55	66	66	53	67	68	54	54

The above information is based on the corresponding norms mentioned in the text.