

# International Standards

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IEC 906-1	

## IP Codes (Ingress Protection)

IEC 529 outlines an international classification system for the sealing effectiveness of enclosures of electrical equipment against the intrusion into the equipment of foreign bodies (i.e., tools, dust, fingers) and moisture. This classification system utilises the letters 'IP' (Ingress Protection) followed by two digits. An 'X' is used for one of the digits if there is only one class of protection; i.e., IPX4, which addressed moisture resistance only.

### Degrees of Protection – First Digit

The first digit of the IP code indicates the degree that persons are protected against contact with moving parts (other than rotating shafts, etc.) and the degree that equipment is protected against solid bodies intruding into an enclosure.

### Degrees of Protection – Second Digit

The second digit indicates the degree of protection of the equipment inside the enclosure against the harmful entry of various forms of moisture (e.g., dripping, spraying, submersion, etc.).

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1st Digit	Protection from Solid Objects
0	No Protection
1	Protected against solid objects greater than 50 mm
2	Protected against solid objects greater than 12 mm
3	Protected against solid objects greater than 2.5 mm
4	Protected against solid objects greater than 1.0 mm
5	Dust Protected
6	Dust Tight

2nd Digit	Protection from Moisture
0	No Protection
1	Protected against vertically dripping water
2	Protected against dripping water when tilted up to 15°
3	Protected against spraying water @ up to 60° from vertical
4	Protected against splashing water from all directions
5	Protected against water jets
6	Protected against heavy seas & streaming water
7	Protected against effects of short-term immersion
8	Protected against submersion

# Standards

## NEMA, UL and CSA Ratings

### What's in a rating?

As a way of standardizing enclosure performance, organizations like NEMA, UL, CSA, IEC, VDE and TUV use rating systems to identify an enclosure's ability to resist external environmental influences. Resistance to everything from dripping liquid to hose-down to total submersion is defined by the ratings systems. While these ratings systems are all intended to provide information to help you make a safer, more informed product choice, there are differences among them.



### NEMA, UL and CSA Ratings

NEMA, UL and CSA are standard-writing organizations commonly recognized in North America. Their ratings are based on similar application descriptions and expected performance. UL and CSA both require enclosure testing by qualified evaluators. They also send site inspectors to make sure a manufacturer adheres to prescribed manufacturing methods and material specifications. NEMA, on the other hand, does not require independent testing and leaves compliance completely up to the manufacturer.

North American enclosure ratings systems also include a 4X rating that indicates resistance to corrosion. This rating is based on the enclosure's ability to withstand prolonged exposure to salt water spray.

While a 4X rating is a good indicator that an enclosure can resist corrosion, it does not provide information on how a specific corrosive agent will affect a given enclosure material. It is best to conduct a full analysis of the specific application and environment to determine the best enclosure choice.

### Exposure type non-hazardous location

Enclosure Rating	NEMA National Electrical Manufacturers Association (NEMA Standard 250) and Electrical and Electronic Mfg. Association of Canada (EEMAC)	UL Underwriters Laboratories Inc. (UL 50 and UL508)  LISTED	CSA Canadian Standards Association (Standard C22.2 No.94) 
Type 1	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	Indoor use primarily to provide protection against contact with the enclosed equipment and against a limited amount of falling dirt.	General purpose enclosure. Protects against accidental contact with live parts.
Type 2	Enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.	Indoor use to provide a degree of protection against limited amounts of falling water and dirt.	Indoor use to provide a degree of protection against dripping and light splashing of non-corrosive liquids and falling dirt.
Type 3	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.	Outdoor use to provide a degree of protection against windblown dust and windblown rain; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use; provides a degree of protection against rain, snow, and windblown dust; undamaged by the external formation of ice on the enclosure.
Type 3R	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.	Outdoor use to provide a degree of protection against falling rain; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use; provides a degree of protection against rain and snow; undamaged by the external formation of ice on the enclosure.
Type 4	Enclosures are intended for indoor or outdoor 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.	Either indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use; provides a degree of protection against rain, snow, windblown dust, splashing and hose-directed water; undamaged by the external formation of ice on the enclosure.
Type 4X	Enclosures are intended for indoor or outdoor 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.	Either indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure; resists corrosion.	Indoor or outdoor use; provides a degree of protection against rain, snow, windblown dust, splashing and hose-directed water; undamaged by the external formation of ice on the enclosure; resists corrosion.
Type 6	Enclosures are intended for use indoors or outdoors where occasional submersion is encountered; limited depth; undamaged by the formation of ice on the enclosure; resists corrosion.	Indoor or outdoor use to provide a degree of protection against entry of water during temporary submersion at a limited depth; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use; provides a degree of protection against the entry of water during temporary submersion.
Type 12	Enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids.	Indoor use to provide a degree of protection against dust, dirt, fiber flyings, dripping water, and external condensation of non-corrosive liquids.	Indoor use; provides a degree of protection against circulating dust, lint, fibers and flyings; dripping and light splashing of non-corrosive liquids; not provided with knockouts.
Type 13	Enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and non-corrosive coolant.	Indoor use to provide a degree of protection against lint, dust seepage, external condensation and spraying of water, oil, and non-corrosive liquids.	Indoor use; provides a degree of protection against circulating dust, lint, fibers and flyings, seepage and spraying of non-corrosive liquids, including oils and coolants.

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# Standards

## CE and IEC Classifications

### CE

The CE Mark is a European Union (EU) compliance symbol and acronym for Conformité Européenne. The CE Mark indicates that a product complies with all European directives and essential Harmonized Standards for health, safety,



environment, and consumer protection that may apply to that product. In addition, the CE Mark promotes free trade movement from outside and within the EU.

For industrial control equipment, the CE Mark is not intended to be applied to empty enclosures because such enclosures are inactive components of a final assembly. The responsibility for insuring compliance to all applicable EU Directives and Harmonized Standards belongs with the final equipment manufacturer.

Hoffman enclosures are designed in compliance with European standards and are eligible to receive a Manufacturer's Declaration of Conformity. The certificate assists the final equipment manufacturer in obtaining the CE Mark. Contact Applications Engineering at (612) 422-2868 for further information.

Hoffman enclosures meet the requirements of the applicable European standards specified below.

### Applicable European Directives

73/23/EEC Low Voltage Directive for Electrical Equipment within Certain Voltage Limits

89/336/EEC EMC Directive Relating to Electromagnetic Compatibility

Note: The EMC Directive is only secondarily applicable since an empty enclosure does not produce electromagnetic interference.

### Applicable European Standards

EN60529-1 (IEC529-1) Degrees of Protection Provided by Enclosures

EN60204-1 (IEC204-1) Electrical Equipment of Industrial Machines

### International Standards' IP Protection Classification

IEC Publication 529, Classification of Degrees of Protection by Enclosures, provides a system for specifying enclosures of electrical equipment on the basis of the degree of protection required. IEC 529 does not specify degrees of protection against risk of explosions or conditions such as moisture (produced, for example, by condensation), corrosive vapors, fungus, or vermin. NEMA Standards Publication 250 does



not test for environmental conditions such as corrosion, rust, icing, oil, and coolants. For this reason, and because the tests and evaluations for other characteristics are not identical, the IEC enclosure classification designations cannot be exactly equated with NEMA enclosure Type numbers.

The table on below provides a cross-reference from NEMA enclosure Type numbers to IEC enclosure classification designations. This cross-reference is a Hoffman approximation based on the most current available information on enclosure test performance and is not sanctioned by NEMA, IEC, VDE, or any affiliated agency.

To use the table, first find the appropriate NEMA rating along the vertical axis and then read across the horizontal axis for the corresponding IP rating. Do not use this table to convert IEC classification designations to NEMA Type numbers.



*In Europe, IEC ratings are based on performance criteria similar to NEMA. Nevertheless, there are differences in how enclosure performance is interpreted. For example, UL and CSA test requirements specify that an enclosure fails the watertight test if even a single drop of water enters the enclosure. In the IEC standards for each protection level (IP), a certain amount of water is allowed to enter the enclosure. IEC does not specify degrees of protection against risk of explosions or conditions such as moisture or corrosive vapors. NEMA, on the other hand, does specify for most environmental conditions. For this reason, and because the tests and evaluations for other characteristics are not identical, the IEC enclosure classification designations cannot be exactly equated with NEMA enclosure Type numbers.*

### Cross Reference (Approximate) NEMA, UL, CSA, vs. IEC Enclosure Type

(Cannot be used to convert IEC Classifications to NEMA Type numbers)

Enclosure Rating	IP23	IP30	IP32	IP55	IP64	IP65	IP66	IP67
Type 1	•							
Type 2		•						
Type 3					•			
Type 3R			•					
Type 3S					•			
Type 4							•	
Type 4X							•	
Type 6								•
Type 12				•				
Type 13						•		

IEC 529 has no equivalents to NEMA enclosure Types 7, 8, 9, 10, or 11.

•Indicates compliance



#### UNITED STATES

[www.omega.com](http://www.omega.com)  
1-800-TC-OMEGA  
Stamford, CT.

#### CANADA

[www.omega.ca](http://www.omega.ca)  
Laval(Quebec)  
1-800-TC-OMEGA

#### GERMANY

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### • Flow and Level

Air Velocity Indicators, Doppler Flowmeters, Level Measurement, Magnetic Flowmeters, Mass Flowmeters, Pitot Tubes, Pumps, Rotameters, Turbine and Paddle Wheel Flowmeters, Ultrasonic Flowmeters, Valves, Variable Area Flowmeters, Vortex Shedding Flowmeters

### • pH and Conductivity

Conductivity Instrumentation, Dissolved Oxygen Instrumentation, Environmental Instrumentation, pH Electrodes and Instruments, Water and Soil Analysis Instrumentation

### • Data Acquisition

Auto-Dialers and Alarm Monitoring Systems, Communication Products and Converters, Data Acquisition and Analysis Software, Data Loggers Plug-in Cards, Signal Conditioners, USB, RS232, RS485 and Parallel Port Data Acquisition Systems, Wireless Transmitters and Receivers

### • Pressure, Strain and Force

Displacement Transducers, Dynamic Measurement Force Sensors, Instrumentation for Pressure and Strain Measurements, Load Cells, Pressure Gauges, Pressure Reference Section, Pressure Switches, Pressure Transducers, Proximity Transducers, Regulators, Strain Gages, Torque Transducers, Valves

### • Heaters

Band Heaters, Cartridge Heaters, Circulation Heaters, Comfort Heaters, Controllers, Meters and Switching Devices, Flexible Heaters, General Test and Measurement Instruments, Heater Hook-up Wire, Heating Cable Systems, Immersion Heaters, Process Air and Duct, Heaters, Radiant Heaters, Strip Heaters, Tubular Heaters