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Guide to NEMA and IEC Enclosure Ratings Application Note #4

Overview

There are a number of standards that exist worldwide to define the type and applicability of enclosures. In the United States the **National Electrical Manufacturers Association (NEMA)** are the most prevalent, worldwide the **International Electrotechnical Commission (IEC)** standards are most prevalent. Why is there not a single standard to define enclosures and their suitability for various applications? Why ask why?

More information on both of these organizations can be found at the following websites:

NEMA – www.nema.org - NEMA Standards Publication 250
IEC – www.iec.ch - Ingress Protection (IP) Standard 60529

This Application Note will discuss in limited detail the NEMA standards, the IEC standards, and then provide a cross reference from NEMA standards to IEC standards. Please refer to the appropriate sections of the latest revision of NEMA Standards Publication No. 250 for complete information regarding applications, features and design tests. Refer to the corresponding IP Standard 60529 for similar information on the IEC standards.

NEMA Definitions Pertaining to Non-Hazardous Locations:

Type	Description
1	Intended for use primarily to provide a degree of protection against limited amounts of falling dirt.
3	Intended for outdoor use primarily to provide a degree of protection against rain, sleet, windblown dust, and damage from external ice formation.
3R	Intended for outdoor use primarily to provide a degree of protection against rain, sleet, and damage from external ice formation.
3S	Intended for outdoor use primarily to provide a degree of protection against rain, sleet, windblown dust, and to provide for operation of external mechanisms when ice laden.
4	Intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, hose-directed water, and damage from external ice formation.
4X	Intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, hose-directed water, and damage from ice formation
6	Intended for indoor or outdoor use primarily to provide a degree of protection against hose-directed water, the entry of water during occasional temporary submersion at a limited depth, and damage from external ice formation.
6P	Intended for indoor or outdoor use primarily to provide a degree of protection against hose-directed water, the entry of water during prolonged submersion at a limited depth, and damage from external ice formation.
12	Intended for indoor use primarily to provide a degree of protection against circulating dust, falling dirt, and dripping non-corrosive liquids.
12K	Type 12 with knockouts.

NEMA Definitions Pertaining to Hazardous Locations:

Type	Description
7	Intended for indoor use in locations classified as Class I, Groups A, B, C, or D, as defined in the National Electrical Code.
8	Intended for indoor or outdoor use in locations classified as Class I, Groups A, B, C, or D, as defined in the National Electrical Code.
9	Intended for indoor use in locations classified as Class II, Groups E, F, or G, as defined in the National Electrical Code.
10	Constructed to meet the applicable requirements of the Mine Safety and Health Administration.

IEC Definitions

The IEC, standard 60529, has defined Ingress Protection as a two digit code. The **first digit** describes the degree of protection against access to hazardous parts and ingress of solid objects. The **second digit** designates the Ingress Protection against water. Please refer to the appropriate sections of IEC 60529 for complete information regarding applications, features, and design tests.

Therefore an **IP 65** rating means that the unit is: Protected against access with a wire (1.0 mm), is Dust tight and can handle Jetting water - any direction.

Protection Against Access to Hazardous Parts (First Digit)

Number	Description
0	Non-protected
1	Protected against access with back of hand (50 mm)
2	Protected against access with jointed finger (12 mm x 80 mm)
3	Protected against access with a tool (2.5 mm)
4, 5, 6	Protected against access with a wire (1.0 mm)

Protection Against Ingress of Solid Foreign Objects (First Digit)

Number	Description
0	Non-protected
1	Objects equal or greater than 50mm
2	Objects equal or greater than 12.5mm
3	Objects equal or greater than 2.5mm
4	Objects equal or greater than 1mm
5	Dust protected
6	Dust tight

Protection Against Ingress of Liquids (Second Digit)

Number	Description
0	Non-protected
1	Water dripping vertically
2	Water dripping, enclosure tilted up to 15°
3	Spraying water, up to 60° angle from vertical
4	Splashing water, any direction
5	Jetting water, any direction
6	Powerful jetting water, any direction
7	Temporary immersion in water
8	Continuous immersion in water

NEMA To IEC Enclosure Designations

The following information is provided by NEMA Standard No. 250 Appendix A as a guide to comparing NEMA enclosure types to IEC designations.

IEC Publication 60529 Classification of Degrees of Protection Provided by Enclosures provides a system for specifying the enclosures of electrical equipment on the basis of the degree of protection provided by the enclosure. IEC 60529 does not 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 (those creatures looking for a new home or to sharpen their teeth). NEMA Standards Publication 250 does 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 following table provides a guide for converting from NEMA Enclosure Type Numbers to IEC Enclosure Classification Designations. The NEMA Types meet or exceed the test requirements for the associated IEC Classifications; for this reason the table should not be used to convert from IEC classifications to NEMA Types and the NEMA to IEC conversion should be verified by test.

NEMA Enclosure Type Number	IEC Enclosure Designation
1	IP10
2	IP11
3	IP54
3R	IP14
3S	IP54
4 and 4X	IP56
5	IP52
6 and 6P	IP67
12 and 12K	IP52
13	IP54