

General Information

NEMA Types – Definitions Pertaining to Non-Hazardous Locations

Enclosures for Electrical Equipment



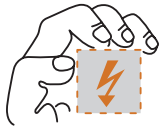







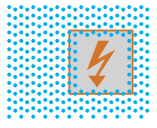
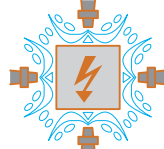
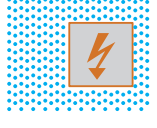
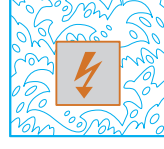
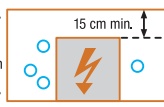
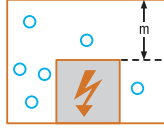
An enclosure is a surrounding case constructed to provide protection from accidental contact with the enclosed equipment and to provide protection to the enclosed equipment from specified environmental conditions. A brief description of the more common types of enclosures used by the electrical industry follows.

- Type 1 Enclosure:** Intended for indoor use primarily to provide protection against contact with enclosed equipment and a degree of protection against falling dirt.
- Type 2 Enclosure:** Intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.
- Type 3 Enclosure:** Intended for outdoor use primarily to provide a degree of protection against wind-blown dust, rain, sleet and external ice formation.
- Type 3R Enclosure:** Intended for outdoor use primarily to provide a degree of protection against falling rain, sleet and external ice formation.
- Type 3S Enclosure:** Intended for outdoor use primarily to provide a degree of protection against wind-blown dust, rain and sleet, and to provide for operation of external mechanism when ice laden.
- Type 3X Enclosure:** Intended for outdoor use primarily to provide a degree of protection against wind-blown dust, rain, sleet and external ice formation and corrosion.
- Type 3SX Enclosure:** Intended for outdoor use primarily to provide a degree of protection against wind-blown dust, rain, sleet and corrosion, and to provide for operation of external mechanism when ice laden.
- Type 4 Enclosure:** Intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, wind-blown dust and rain, splashing water and hose-directed water.
- Type 4X Enclosure:** Intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, wind-blown dust and rain, splashing water and hose-directed water.
- Type 6 Enclosure:** Intended for indoor or outdoor use primarily to avoid a degree of protection against contact with enclosed equipment, falling dirt, hose-directed water, entry of water during occasional temporary submersion at a limited depth and external ice formation.
- Type 6P Enclosure:** Intended for indoor or outdoor use primarily to avoid a degree of protection against contact with enclosed equipment, falling dirt, hose-directed water, entry of water during prolonged submersion at a limited depth and external ice formation.
- Type 12 Enclosure:** Intended for indoor use primarily to provide a degree of protection against dust falling dirt and dripping non-corrosive liquids.
- Type 13 Enclosure:** Intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil and non-corrosive coolant.

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International Standards IP Protection Classification Data

The letters IP followed by two characteristic numbers symbolize the degree of protection.

First Digit			Second Digit		
IP	Test		IP	Test	
0		No protection	0		No protection
1		Protection against solid bodies larger than 50 mm (for example accidentally touching with the hand)	1		Protection against vertical water drops condensation
2		Protection against solid bodies larger than 12 mm (for example a finger)	2		Protected against water drops at up to 15° from the vertical
3		Protection against solid bodies larger than 2.5 mm (tools, wires)	3		Protected against rain at up to 60° from the vertical
4		Protection against solid bodies larger than 1 mm (tools, small wires)	4		Protected against water splashing from all directions
5		Protection against dust (no harmful deposits)	5		Protected against water sprayed from a hose from all directions
6		Complete protection against dust	6		Protected against water projections similar to sea wave splashes
			7		Protected against the effects of immersion
			8		Protected against effects of prolonged immersion under pressure

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Engineering Properties of Enclosures

Property	Test Method	Opaque Polycarbonate Covers & Boxes	Clear Polycarbonate Cover	FRP	NORYL
Thermal and Mechanical					
Temperature Range (°C)	-	-34 to 110°	-34 to 110°	-50 to 160°	-40 to 85°
Specific Gravity (oz./in ³)	ASTM D792	1.20	1.20	1.79	0.85
Thermal Conductivity (BTU•in./hr•ft ² •°C)	ASTM D177	1.35	1.35	1.68	0.86
Heat Deflection Temperature @ 264 PSI (°C)	ASTM D648	265	260	392	180
Tensile Strength (PSI)	ASTM D638	8,800	9,000	13,000	3,400
Flexural Strength (PSI)	ASTM D790	13,500	14,000	19,000	6,800
Compressive Strength @ 10% Deformation (PSI)	ASTM D695	12,500	12,500	24,000	5,200
Impact Strength IZOD Notched (ft lb./in.)	ASTM D256	12	12	12	-
Water Absorption – 24 hrs. @ 23°C (%)	ASTM D570	0.15	0.15	0.17	0.06
UV Rating	UL 746C	F1	F1	F2	
Electrical					
Dielectric Strength (volts/mil.)	ASTM D149	380	380	467	192
Dielectric Constant	ASTM D150				
60 Hz		3.0	3.0	-	-
100 Hz		-	-	-	2.27
106 Hz		2.96	2.96	-	2.18
Volume Resistivity @ 23°C (ohms-cm)	ASTM D257	>1016	>1016	2.0 x 1015	1.0 x 1016
Arc Resistance (sec.)	ASTM D495	120	120	200+	67