

NEMA/IP Enclosure Types

The National Electrical Manufacturers Association (NEMA) provides descriptions, classifications, and test criteria relating to enclosures for electrical equipment. Tables 12-13, 12-14, and 12-15 compare the specific applications of enclosures for indoor and outdoor nonhazardous locations and indoor hazardous locations.

Provides a Degree of Protection Against the Following Environmental Conditions	Type of Enclosure									
	1*	2*	4	4X	5	6	6P	12	12K	13
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X	X	X	X
Falling dirt	X	X	X	X	X	X	X	X	X	X
Falling liquids and light splashing		X	X	X	X	X	X	X	X	X
Circulating dust, lint, fibers, and flyings**			X	X		X	X	X	X	X
Settling airborne dust, lint, fibers, and flyings**			X	X	X	X	X	X	X	X
Hosedown and splashing water			X	X		X	X			
Oil and coolant seepage								X	X	X
Oil or coolant spraying and splashing										X
Corrosive agents				X			X			
Occasional temporary submersion						X	X			
Occasional prolonged submersion							X			
*These enclosures may be ventilated. However, Type 1 may not provide protection against small particles of falling dirt when ventilation is provided in the enclosure top. Consult the manufacturer.										
**These fibers and flyings are nonhazardous materials and are not considered Class III type ignitable fibers or combustible flyings. For Class III type ignitable fibers or combustible flyings, see the National Electrical Code, Article 500.										

Table 12-13: Specific Applications of Enclosures for Indoor Nonhazardous Locations

Provides a Degree of Protection Against the Following Environmental Conditions	Type of Enclosure						
	3	3R*	3S	4	4X	6	6P
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X
Rain, snow, and sleet**	X	X	X	X	X	X	X
Sleet***			X				
Windblown dust	X		X	X	X	X	X
Hosedown				X	X	X	X
Corrosive agents					X		X
Occasional temporary submersion						X	X
Occasional prolonged submersion							X
*These enclosures may be ventilated.							
**External operating mechanisms are not required to be operable when the enclosure is ice covered.							
***External operating mechanisms are operable when the enclosure is ice covered.							

Table 12-14: Specific Applications of Enclosures for Outdoor Nonhazardous Locations

Provides a Degree of Protection Against Atmospheres Typically Containing:*	Class	Type 7 and 8 Enclosures**				Type 9 Enclosures**			Type 10
		A	B	C	D	E	F	G	10
Acetylene	I	X							
Hydrogen, manufactured gas	I		X						
Diethyl ether, ethylene, cyclopropane	I			X					
Gasoline, hexane, butane, naphtha, propane, acetone, toluene, isoprene	I				X				
Metal dust	II					X			
Carbon black, coal dust, coke dust	II						X		
Flour, starch, grain dust	II							X	
Fibers, flyings***	III							X	
Methane with or without coal dust	MSHA								X
<p>*For complete listing, see NFPA 497M-1986, Classification of Gases, Vapors and Dusts for Electrical Equipment in Hazardous (Classified) Locations.</p> <p>**For Class III type ignitable fibers or combustible flyings, see the National Electrical Code, Article 500.</p> <p>***Due to the characteristics of the gas, vapor, or dust, a product suitable for one Class or Group may not be suitable for another Class or Group unless so marked on the product.</p>									

Table 12-15: Specific Applications of Enclosures for Indoor Hazardous Locations

Tables 12-16 and 12-17 describe the features each enclosure is expected to have and the tests applied to each.

NEMA Type	Description	Requirements/Design Tests
1	Indoor use primarily to provide a degree of protection against limited amounts of falling dirt.	Rod Entry, Rust Resistance
2	Indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.	Rod Entry, Rust Resistance, Drip
3	Outdoor use primarily to provide a degree of protection against windblown dust, rain, sleet, and external ice formation.	Rain, Outdoor Dust, External Icing, Corrosion Protection
3R	Outdoor use primarily to provide a degree of protection against falling rain, sleet, and external ice formation.	Rod Entry, Rain, External Icing, Corrosion Protection
3S	Outdoor use primarily to provide a degree of protection against windblown dust, rain, sleet, and to provide for operation of external mechanisms when ice laden.	Rain, Outdoor Dust, External Icing, Corrosion Protection
4	Indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, hose-directed water, and external ice formation.	External Icing, Hosedown, Corrosion Protection
4X	Indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, hose-directed water, and external ice formation.	External Icing, Hosedown, Corrosion Protection
5	Indoor use primarily to provide a degree of protection against settling airborne dust, falling dirt, and dripping noncorrosive liquids.	Drip, Settling Airborne Dust, Rust Resistance
6	Indoor or outdoor use primarily to provide a degree of protection against hose-directed water, and the entry of water during occasional temporary submersion at a limited depth.	Submersion, External Icing, Hosedown, Corrosion Protection
6P	Indoor or outdoor use primarily to provide a degree of protection against hose-directed water, and the entry of water during prolonged submersion at a limited depth.	Air Pressure, External Icing, Hosedown, Corrosion Protection
12	Indoor use primarily to provide a degree of protection against circulating dust, falling dirt, and dripping noncorrosive liquids.	Drip, Circulating Dust, Rust Resistance
12K	Indoor use (with knockouts) primarily to provide a degree of protection against circulating dust, falling dirt, and dripping noncorrosive liquids other than at knockouts.	Drip, Circulating Dust, Rust Resistance
13	Indoor use primarily to provide a degree of protection against lint, dust, spraying of water, oil, and noncorrosive coolant.	Rust Resistance, Oil Exclusion

Table 12-16: Nonhazardous Area Enclosures

NEMA Type	Description	Requirements/Design Tests*
7	Indoor use in locations classified as Class I, Groups A, B, C, and D, as defined in the National Electrical Code.	ANSI/UL 698, ANSI/UL 877, ANSI/UL 886, ANSI/UL 894
8	Indoor or outdoor use in locations classified as Class I, Groups A, B, C, and D, as defined in the National Electrical Code.	ANSI/UL 698, ANSI/UL 877, Rain
9	Indoor use in locations classified as Class II, Groups E, F, and G, as defined in the National Electrical Code.	ANSI/UL 698, ANSI/UL 877, ANSI/UL 886, ANSI/UL 894
10	Constructed to meet the applicable requirements of the Mine Safety and Health Administration.	In accordance with the Mine Safety and Health Administration

*ANSI/UL 698, Industrial Control Equipment for Use in Hazardous Locations.
ANSI/UL 877, Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G.
ANSI/UL 886, Outlet Boxes and Fittings for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G.
ANSI/UL 894, Switches for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G.

Table 12-17: Hazardous Area Enclosures

The International Electrotechnical Commission (IEC) provides international classifications (IP Codes) of enclosures for electrical equipment. Table 12-18 can be used to convert NEMA Enclosure Type Numbers to IEC Enclosure Classification Designations. However, since NEMA Types meet or exceed the test requirements for the IEC Classifications, this table cannot be used to convert IEC Classifications to NEMA Types.

NEMA Enclosure Type Number	IEC Enclosure Classification 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

Table 12-18: Conversion of NEMA Type Numbers to IEC Classification Designations

Table 12-19 provides a brief description of the IP Code elements. Full details are specified in the clauses listed in the last column.

Element	Numerals or Letters	Meaning for the Protection of Equipment	Meaning for the Protection of Persons	Reference
Code Letters	IP	—	—	—
First characteristic numeral	0 1 2 3 4 5 6	Protection against ingress of solid foreign objects: <ul style="list-style-type: none"> • (not protected) • ≥ 50 mm diameter • ≥ 12.5 mm diameter • ≥ 2.5 mm diameter • ≥ 1.0 mm diameter • dust protected • dust tight 	Protection against access to hazardous parts with: <ul style="list-style-type: none"> • (not protected) • back of hand • finger • tool • wire • wire • wire 	Cl. 5
Second characteristic numeral	0 1 2 3 4 5 6 7 8	Protection against ingress of water with harmful effects: <ul style="list-style-type: none"> • (not protected) • vertically dripping • dripping (15° tilted) • spraying • splashing • jetting • powerful jetting • temporary immersion • continuous immersion 	—	Cl. 6
Additional letter (optional)	A B C D	—	Protection against access to hazardous parts with: <ul style="list-style-type: none"> • back of hand • finger • tool • wire 	Cl. 7
Supplementary letter (optional)	H M S W	Supplementary information specific to: <ul style="list-style-type: none"> • high-voltage apparatus • motion during water test • stationary during water test • weather conditions 	—	Cl. 8

Table 12-19: Elements of the IP Code