# NEMA Enclosure Types

The purpose of this document is to provide general information on the definitions of NEMA Enclosure Types to architects, engineers, installers, inspectors and other interested parties. [For more detailed and complete information, NEMA Standards Publication 250-2003, "*Enclosures for Electrical Equipment (1000 Volts Maximum)*" should be consulted. This Standards Publication as well as all other NEMA publications are available from IHS @ 800 854-7179 or http://www.global.ihs.com]

## Definitions

**[*from NEMA 250-2003*]**

In Non-Hazardous Locations, the specific enclosure Types, their applications, and the environmental conditions they are designed to protect against, **when completely and properly installed**, are as follows:

**Type 1** Enclosures constructed for indoor use to provide a degree of protection to personnel against access to hazardous parts and to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt).

**Type 2** Enclosures constructed for indoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt); and to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (dripping and light splashing).

**Type 3** Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow); and that will be undamaged by the external formation of ice on the enclosure.

**Type 3R** Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow); and that will be undamaged by the external formation of ice on the enclosure.



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**Type 3S** Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow); and for which the external mechanism(s) remain operable when ice laden.

**Type 3X** Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow); that provides an additional level of protection against corrosion and that will be undamaged by the external formation of ice on the enclosure.

**Type 3RX** Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow); that will be undamaged by the external formation of ice on the enclosure that provides an additional level of protection against corrosion; and that will be undamaged by the external formation of ice on the enclosure.

**Type 3SX** Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow); that provides an additional level of protection against corrosion; and for which the external mechanism(s) remain operable when ice laden.

**Type 4** Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure.

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**Type 4X** Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); that provides an additional level of protection against corrosion; and that will be undamaged by the external formation of ice on the enclosure.

**Type 5** Enclosures constructed for indoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and settling airborne dust, lint, fibers, and flyings); and to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (dripping and light splashing).

**Type 6** Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (hose directed water and the entry of water during occasional temporary submersion at a limited depth); and that will be undamaged by the external formation of ice on the enclosure.

**Type 6P** Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (hose directed water and the entry of water during prolonged submersion at a limited depth); that provides an additional level of protection against corrosion and that will be undamaged by the external formation of ice on the enclosure.

**Type 12** Enclosures constructed (without knockouts) for indoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and circulating dust, lint, fibers, and flyings); and to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (dripping and light splashing).

**Type 12K** Enclosures constructed (with knockouts) for indoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and circulating dust, lint, fibers, and flyings); and to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (dripping and light splashing).

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**Type 13** Enclosures constructed for indoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt and circulating dust, lint, fibers, and flyings); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (dripping and light splashing); and to provide a degree of protection against the spraying, splashing, and seepage of oil and non-corrosive coolants.

**Table 1**
*[From NEMA 250-2003]*
Comparison of Specific Applications of Enclosures
for Indoor Nonhazardous Locations

| Provides a Degree of Protection Against the Following Conditions | Type of Enclosure | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1 *** | **2 *** | **4** | **4X** | **5** | **6** | **6P** | **12** | **12K** | **13** |
| Access to hazardous parts | X | X | X | X | X | X | X | X | X | X |
| Ingress of solid foreign objects (falling dirt) | X | X | X | X | X | X | X | X | X | X |
| Ingress of water (Dripping and light splashing) | ... | X | X | X | X | X | X | X | X | X |
| Ingress of solid foreign objects (Circulating dust, lint, fibers, and flyings **) | ... | ... | X | X | ... | X | X | X | X | X |
| Ingress of solid foreign objects (Settling airborne dust, lint, fibers, and flyings **) | ... | ... | X | X | X | X | X | X | X | X |
| Ingress of water (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 | ... | ... | ... |
| Ingress of water (Occasional temporary submersion) | ... | ... | ... | ... | ... | X | X | ... | ... | ... |
| Ingress of water (Occasional prolonged submersion) | ... | ... | ... | ... | ... | ... | X | ... | ... | ... |

* These enclosures may be ventilated.
** 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.

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**Table 2**
*[From NEMA 250-2003]*
Comparison of Specific Applications of Enclosures
for Outdoor Nonhazardous Locations

| Provides a Degree of Protection Against the Following Conditions | Type of Enclosure | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **3** | **3X** | **3R*** | **3RX*** | **3S** | **3SX** | **4** | **4X** | **6** | **6P** |
| Access to hazardous parts | X | X | X | X | X | X | X | X | X | X |
| Ingress of water (Rain, snow, and sleet ***)** | X | X | X | X | X | X | X | X | X | X |
| Sleet ****** | ... | ... | ... | ... | X | X | ... | ... | ... | ... |
| Ingress of solid foreign objects (Windblown dust, lint, fibers, and flyings) | X | X | ... | ... | X | X | X | X | X | X |
| Ingress of water (Hosedown) | ... | ... | ... | ... | ... | ... | X | X | X | X |
| Corrosive agents | ... | X | ... | X | ... | X | ... | X | ... | X |
| Ingress of water (Occasional temporary submersion) | ... | ... | ... | ... | ... | ... | ... | ... | X | X |
| Ingress of water (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.

In Hazardous Locations**, when completely and properly installed and maintained**, Type 7 and 10 enclosures are designed to contain an internal explosion without causing an external hazard. Type 8 enclosures are designed to prevent combustion through the use of oil-immersed equipment. Type 9 enclosures are designed to prevent the ignition of combustible dust.

**Type 7** Enclosures constructed for indoor use in hazardous (classified) locations classified as Class I, Division 1, Groups A, B, C, or D as defined in NFPA 70.

**Type 8** Enclosures constructed for either indoor or outdoor use in hazardous (classified) locations classified as Class I, Division 1, Groups A, B, C, and D as defined in NFPA 70.

**Type 9** Enclosures constructed for indoor use in hazardous (classified) locations classified as Class II, Division 1, Groups E, F, or G as defined in NFPA 70.

**Type 10** Enclosures constructed to meet the requirements of the Mine Safety and Health Administration, 30 CFR, Part 18.

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**Table B-1**

*[From NEMA 250-2003]*

Comparison of Specific Applications of Enclosures
for Indoor Hazardous Locations
(If the installation is outdoors and/or additional protection is required by Table 1 and Table 2, a combination-type enclosure is required.)

| **Provides a Degree of Protection Against Atmospheres Typically Containing** (See NFPA 497M for Complete Listing) | | **Enclosure Types 7 and 8, Class I Groups** ** | | | | **Enclosure Type 9, Class II Groups** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Class** | **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 |

* For Class III type ignitable fibers or combustible flyings see the National Electrical Code, Article 500.
** 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 marked on the product.

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## Comparison Between NEMA Enclosure Type Numbers and IEC Enclosure Classification 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. The NEMA Standard for Enclosures for Electrical Equipment does test for environmental conditions such as corrosion, rust, icing, oil, and coolants. For this reason, and because the test and evaluations for other characteristics are not identical, the IEC Enclosure Classification Designations cannot be exactly equated with the enclosure Type numbers in this Standard.

The IEC designation consists of the letters IP followed by two numerals. The first characteristic numeral indicates the degree of protection provided by the enclosure with respect to persons and solid foreign objects entering the enclosure. The second characteristic numeral indicates the degree of protection provided by the enclosure with respect to the harmful ingress of water.

Table A-1 provides an equivalent conversion from the enclosure Type numbers in this Standard to the IEC Enclosure Classification Designations. The enclosure type numbers meet or exceed the test requirements for the associated IEC Classification; for this reason Table A-1 cannot be used to convert from IEC Classifications to enclosure Type numbers.

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**Table A-1**
**CONVERSION OF NEMA ENCLOSURE TYPE RATINGS**
**TO IEC 60529 ENCLOSURE CLASSIFICATION DESIGNATIONS (IP)**

**(Cannot be Used to Convert IEC Classification Designations to NEMA Type Ratings)**

| IP First Character | NEMA Enclosure Type | | | | | | | | | | | | | | | | | | IP Second Character |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3, 3X, 3S, 3SX | | 3R, 3RX | | 4, 4X | | 5 | | 6 | | 6P | | 12, 12K, 13 | | |
| IP0_ | | | | | | | | | | | | | | | | | | | IP_0 |
| IP1_ | | | | | | | | | | | | | | | | | | | IP_1 |
| IP2_ | | | | | | | | | | | | | | | | | | | IP_2 |
| IP3_ | | | | | | | | | | | | | | | | | | | IP_3 |
| IP4_ | | | | | | | | | | | | | | | | | | | IP_4 |
| IP5_ | | | | | | | | | | | | | | | | | | | IP_5 |
| IP6_ | | | | | | | | | | | | | | | | | | | IP_6 |
| | | | | | | | | | | | | | | | | | | | IP_7 |
| | | | | | | | | | | | | | | | | | | | IP_8 |
| | A | B | A | B | A | B | A | B | A | B | A | B | A | B | A | B | A | B | |

A = A shaded block in the “A” column indicates that the NEMA Enclosure Type exceeds the requirements for the respective IEC 60529 IP First Character Designation. The IP First Character Designation is the protection against access to hazardous parts and solid foreign objects.

B = A shaded block in the “B” column indicates that the NEMA Enclosure Type exceeds the requirements for the respective IEC 60529 IP Second Character Designation. The IP Second Character Designation is the protection against the ingress of water.

EXAMPLE OF TABLE USE

An IEC IP 45 Enclosure Rating is specified. What NEMA Type Enclosures meet and exceed the IP 45 rating?

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Referencing the first character, 4, in the IP rating and the row designated “IP4_” in the leftmost column in the table; the blocks in Column “A” for NEMA Types 3, 3X, 3S, 3SX, 4, 4X, 5, 6, 6P, 12, 12K, and 13 are shaded. These NEMA ratings meet and exceed the IEC protection requirements against access to hazardous parts and solid foreign objects.

Referencing the second character, 5, in the IP rating and the row designated “IP_5” in the rightmost column in the table; the blocks in Column “B” for NEMA Types 3, 3X, 3S, 3SX, 4, 4X, 6, and 6P are shaded. These NEMA ratings meet and exceed the IEC requirements for protection against the ingress of water. The absence of shading in Column “B” beneath the “NEMA Enclosure Type 5” indicates that Type 5 does not meet the IP 45 protection requirements against the ingress of water. Likewise the absence of shading in Column “B” for NEMA Type 12, 12K and 13 enclosures indicates that these enclosures do not meet the IP 45 requirements for protection against the ingress of water. Only Types 3, 3X, 3S, 3SX, 4, 4X, 6, and 6P have both Column “A” in the “IP4_” row and Column “B” in the “IP_5” row shaded and could be used in an IP45 application.

The NEMA Enclosure Type 3 not only meets the IP 45 Enclosure Rating, but also exceeds the IEC requirements because the NEMA Type **requires** an outdoor corrosion test; a gasket aging test; a dust test; an external icing test; and **no** water penetration in the rain test. Slight differences exist between the IEC and NEMA test methods, but the IEC rating **permits** the penetration of water if “it does not deposit on insulation parts, or reach live parts.” The IEC rating does **not** require a corrosion test; gasket aging test; dust test or external icing test. Because the NEMA ratings include additional test requirements, this table **cannot** be used to select IP Designations for NEMA rated enclosure specifications.

IEC 60529 specifies that an enclosure shall only be designated with a stated degree of protection indicated by the first characteristic numeral if it also complies with all lower degrees of protection. Furthermore IEC 60529 states that an enclosure shall only be designated with a degree of protection indicated by the second characteristic numeral if it also complies with all lower degrees of protection up to and including the second characteristic numeral 6. An enclosure designated with a second characteristic numeral 7 or 8 only is considered unsuitable for exposure to water jets (designated by second characteristic numeral 5 or 6) and need not comply with requirements for numeral 5 or 6 unless it is dual coded. Since the IEC protection requirements become more stringent with increasing IP character value up through 6, once a NEMA Type rating meets the requirements for an IP designation up through 6, it will also meet the requirements for all lower IP designations. This is apparent from the shaded areas shown in the table.

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