

TECH NOTES

Enclosure NEMA Ratings and IP Waterproofing

NEMA (National Electrical Manufacturers Association) is a standards organization predominantly working on various standards in the electrical industry. Many enclosures used for housing wireless radios carry some kind of NEMA rating. For outdoor use, Pacific Wireless would recommend at least a NEMA 4 rated enclosure. Pacific Wireless RooTenna compartment antennas meet the NEMA 4 classification.

NEMA Standards Publication 250-2003, "*Enclosures for Electrical Equipment (1000 Volts Maximum)*" is the standard which is used to define various NEMA ratings on electrical enclosures.

NEMA Rating Types Explained:

NEMA 1

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.

NEMA 2

Type 2 enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.

NEMA 3

Type 3 enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, and sleet; and to be undamaged by the formation of ice on the enclosure.

NEMA 3R

Type 3R enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain; and to be undamaged by the formation of ice on the enclosure.

NEMA 4

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; and to be undamaged by the formation of ice on the enclosure.

NEMA 4X

Type 4X enclosures are intended for indoor and outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water; and to be undamaged by the formation of ice on the enclosure.

NEMA 6

Type 6 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during temporary submersion at a limited depth (1M); and to be undamaged by the formation of ice on the enclosure.

NEMA 7

Type 7 enclosures are for indoor use in locations classified as Class I, Groups A, B, C, or D, as defined in the National Electrical Code.

Type 7 enclosures shall be capable of withstanding the pressures resulting from an internal explosion of specified gases, and contain such an explosion sufficiently that an explosive gas-air mixture existing in the atmosphere surrounding the enclosure will not be ignited. Enclosed heat generating devices shall not cause external surfaces to reach temperatures capable of igniting explosive gas-air mixtures in the surrounding atmosphere. Enclosures shall meet explosion, hydrostatic, and temperature design tests.

NEMA 9

Type 9 enclosures are intended for indoor use in locations classified as Class II, Groups E, F, or G, as

defined in the National Electrical Code.

Type 9 enclosures shall be capable of preventing the entrance of dust. Enclosed heat generating devices shall not cause external surfaces to reach temperatures capable of igniting or discoloring dust on the enclosure or igniting dust-air mixtures in the surrounding atmosphere. Enclosures shall meet dust penetration and temperature design tests, and aging of gaskets (if used).

NEMA 12

Type 12 enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids.

NEMA 13

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.

IEC (International Electrotechnical Commission) is the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies. These serve as a basis for national standardization and as references when drafting international tenders and contracts.

The IEC standard #60529 defines waterproofing ratings (IP Codes) for various levels of protection against water ingress. This standard is used to define everything from electrical connections to enclosures.

IP (Ingress Progress) Codes in accordance with IEC 60529

There are several different uses of IP Codes, as described in IEC 60529. IP Codes can have the following arrangement:

1. First character only, such as IP 3X,
2. Second character only, such as IP X4, or
3. Both characters, such as IP 34.

The first character indicates the degree of protection against the ingress of solid foreign objects. First character definitions are as follows:

- 0 - Non-protected
- 1 - Protected against solid foreign objects of 50 mm diameter and greater
- 2 - Protected against solid foreign objects of 12.5 mm diameter and greater
- 3 - Protected against solid foreign objects of 2.5 mm diameter and greater
- 4 - Protected against solid foreign objects of 1.0 mm diameter and greater
- 5 - Dust-protected
- 6 - Dust-tight

The second character of the IP Code indicates the degree of protection against the ingress of water with harmful effects. Second character definitions are as follows:

- 0 - Non-protected
- 1 - Protected against vertically falling water drops
- 2 - Protected against vertically falling water drops as the enclosure is tilted 15 degrees
- 3 - Protected against spraying water
- 4 - Protected against splashing water
- 5 - Protected against water jetting
- 6 - Protected against powerful water jetting
- 7 - Protected against temporary immersion (1meter, 30 minutes)
- 8 - Protected against continuous immersion (1meter, > 30 minutes)

Typically outdoor enclosures used for wireless communications will have an IP code classification of IP65 or better. This means that the equipment is protected against falling or driving rain. Many manufacturers will specify specific parts of a product, for instance, the cable feedthru used in the Pacific Wireless RooTenna products seals the cable to IP68 waterproofing requirements. Also the gasket system in the Pacific Wireless RooTenna products seals the equipment to IP67 requirements, but because of the two breathe holes in the backpanel, the entire product can only be rated to IP65. If the two breathe holes are blocked with a silicon sealant, the RooTenna meets the IP67 requirements, but blocking these holes is not recommended because the breathe holes help reduce condensation inside the enclosure and Pacific Wireless feels the system is more reliable with the breathe holes open.

