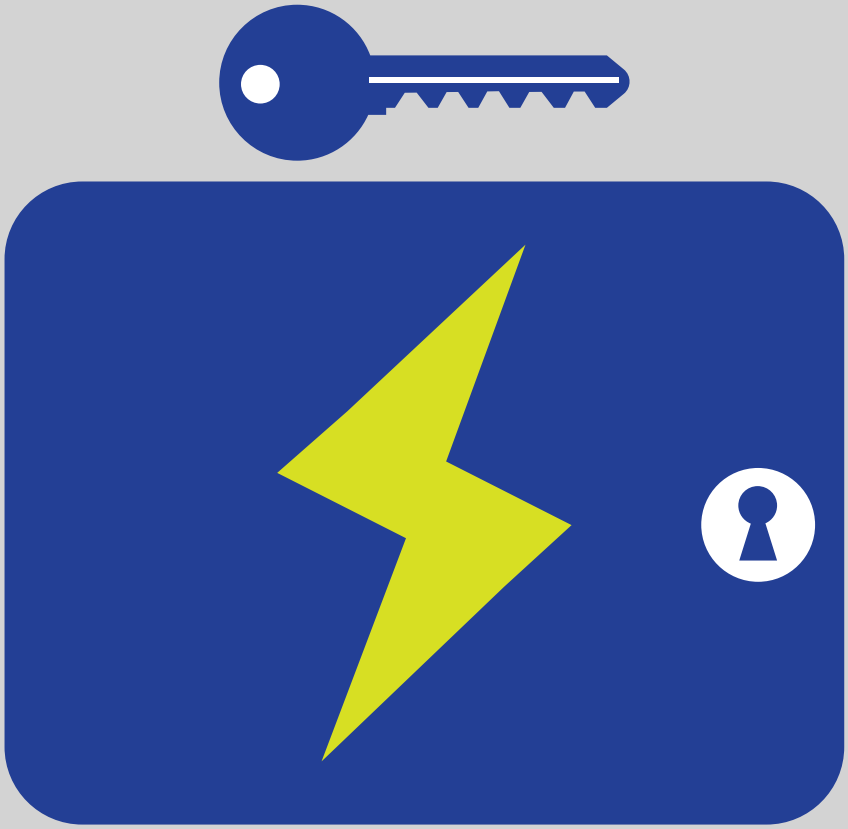
NEMA Standards in Plain English



A Guide to Electrical Enclosures

FALCON™ STRUCTURES
Think Inside the Box.

Introduction

NEMA created electrical equipment enclosure standards to protect key equipment from damage, and, most importantly, to prevent safety hazards to people. Different settings call for different electrical enclosure standards. For instance, a dairy that regularly hoses down its work-spaces would need a water tight enclosure while a typical warehouse could safely use a simpler electrical enclosure option. Vendors, manufacturers, buyers and legislators use NEMA's standards as an industry short hand for an enclosure's capabilities and appropriate use.

We hope this guide will give readers a clear understanding of NEMA's enclosure standards for non-hazardous locations.

Frequently Asked Questions

What is NEMA?

The National Electrical Manufacturers Association (NEMA) describes itself as, "the association of electrical equipment and medical imaging manufacturers.[1]" Their expertise ranges from the manufacture of MRI machines to the proper installation of lighting systems.

Which standards does this guide cover?

This guide covers standards for enclosures used in non-hazardous locations. Hazardous locations, such as mining sites and oil rigs, pose an especially high risk for fires and explosions and require special considerations beyond the scope of this guide.

We will cover Types 1, 2, 3, 3R, 3S, 3X, 3RX, 3SX, 4, 4X, 6, 6X, 12, 12K, and 13 but not Types 7, 8, 9, 10, or 11.

Can an enclosure have openings for ventilation or drainage?

Enclosure types 1, 2, 3R, 3RX may have openings for drainage and ventilation if the enclosure can still offer the protections described in the standard. For example, an enclosure with thoughtfully placed ventilation slats can still protect equipment from falling dirt and occasional splashing. Since 2, 3R, 3RX may be exposed to splashing water, NEMA requires drainage openings to accompany ventilation openings.

Can enclosures meet multiple standards?

Yes. For example, a Type 4 enclosure is splash resistant and dust-tight, while a Type 2 enclosure is only splash resistant. Since the Type 4 enclosure meets Type 2 requirements (splash-resistance) and more, it can be used as a Type 2 enclosure. However, because enclosures with additional protective features generally cost more, most businesses use an enclosure that meets the needs of the situation and nothing more.

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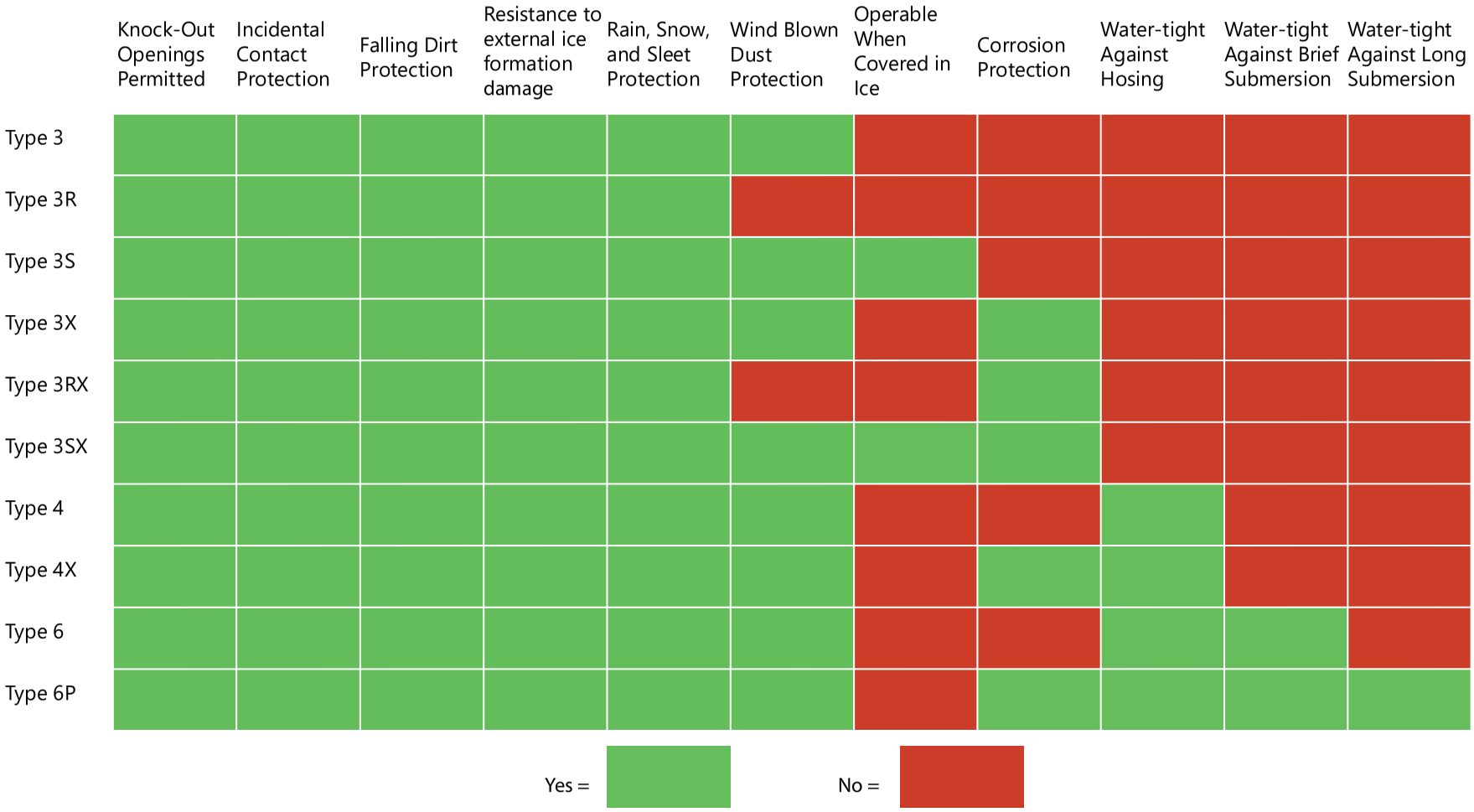
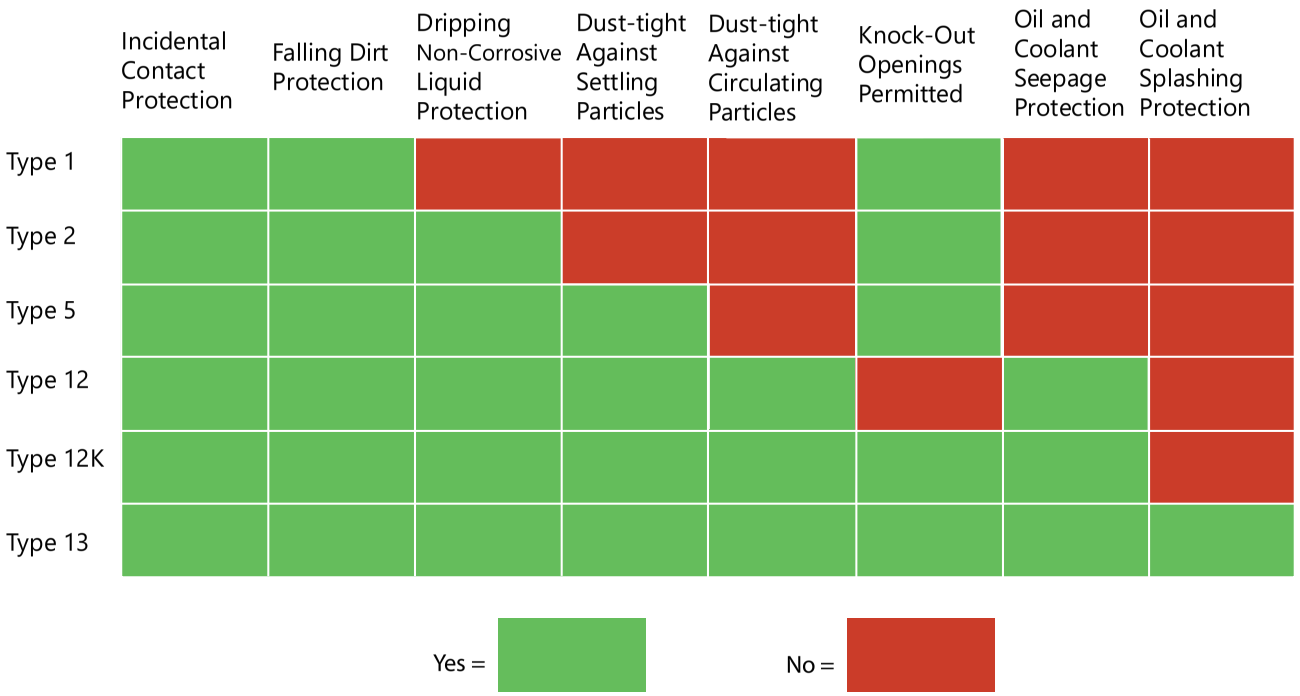
[1]You can visit their website www.nema.org for more information. Their document "NEMA Standards Publication 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum)" informed this guide.

NEMA Standards for Outdoor/Indoor Enclosures in Non-Hazardous Locations



NEMA Standards for Indoor Enclosures in Non-Hazardous Locations



Explanations for the Protections and Features Offered.

NEMA requires each type of enclosure to provide a specific set of protections. We explain these protections below.

Incidental Contact Protection: Preventing incidental contact is the most basic function of any enclosure. People or other external objects should not be able to accidentally make contact with the contents of the enclosures. All NEMA standardized equipment enclosures should protect against incidental contact.

Falling Dirt Protection: Falling dirt should not be able to easily enter the enclosure. To implement this protection, manufactures do not include large, unshielded openings in the enclosures. All NEMA standardized equipment should protect against falling dirt.

Indoor Protections

Dripping Non-Corrosive Liquid Protection: The enclosure should provide protection from the occasional splash or drip of a non-corrosive liquid, usually fresh water. Imagine a piece of equipment inside of an industrial laundry room where water condenses on the windows and pipes. Under this protection, the equipment should be safe from condensation occasionally dripping on the enclosure.

Dust-tight Against Settling Particles: The enclosure should be tight against settling air-borne dust, lint, fibers, and flyings. These protections become relevant in industrial settings where non-ignitable dusts are present, such as cement factories. Please note that these protections only apply to non-ignitable, and non-combustible particles. NEMA details standards for settings where ignitable particles are present in National Electric Code, Article 502.

Dust-Tight Against Circulating Particles: The enclosure should be tight against circulating air-borne dust, lint, fibers, and flyings. This protection is similar to the settling air-borne dust and particle protection, but assumes circumstances where dust particles are regularly and actively moving through the air. Circulating particle protection is even more dust-tight than settling particle protection. Again, these protections apply to non-ignitable and non-combustible particles.

Knock-Out Openings: Knock-outs are sections of the enclosure wall that are easy to remove or "knock-out" with a hammer or pliers. They are similar in function to a perforated tab or square on a cardboard box of macaroni that a user would push in with their thumb to make a small tidy opening. Knock-outs provide convenient opening for auxiliary devices, raceways, cable, or fittings. All enclosures except for Type 12 enclosures are permitted to have knock-outs.

A Type 1 electrical enclosure with the panel open.

A close-up of a knock-out opening being used. Below, you can see the indents of knock-outs that have not been punched out.

Outdoor Protections

Resistance to Damage from External Ice Formation: If ice forms over the external surface of an enclosure, the enclosure should be undamaged.

Rain, Snow and Sleet Protection: The enclosure should prevent rain, snow and sleet from entering the enclosure and damaging the equipment.

Wind Blown Dust Protection: Damaging amounts of wind-blown dust should not be able to enter the enclosure. Wind-blown dust is of particular concern for outdoor jobsites such as construction zones. An "R" in a type name denotes that the enclosure does not provide protection against windblown dust.

Operable When Covered in Ice: The external mechanisms such as hinges should still be usable when the enclosure is covered in a layer of ice. For instance, a technician should be able to open the enclosure even if the enclosure is iced over. The technician should also be able to remove the ice with a hand tool without damaging the enclosure. An "S" in an enclosure name denotes that the enclosure is still operable when covered in ice.

Corrosion Protection: Corrosion occurs when the enclosure's materials chemically react with certain liquids and vapors and weaken the enclosure over time. NEMA considers enclosures made from copper, bronze, brass composed of at least 80 percent copper, stainless steel, or aluminum corrosion resistant. Manufacturers must appropriately galvanize, enamel, or paint other materials. Corrosion protection is important in settings such as water treatment plants where corrosive vapors may waft off of treatment ponds.

Water Tight Against Hosing: If a steady stream of water hits the enclosure, no water should enter. This protection is critical in environments such as dairies and breweries where employees regularly hose down their work spaces.

Water Tight Against Temporary Submersion: The enclosure should be water tight if submerged in 6 feet of water for thirty minutes.

Water Tight Against Prolonged Submersion: The enclosure should be water tight if submerged in 6 feet of water for a prolonged period of time.

Oil and Coolant[2] Seepage: The enclosure should protect the equipment from seeping or dripping oils and coolants.

Oil and Coolant Splashing and Spraying: The enclosure should protect the equipment spraying oils or coolants.

A Type 3R enclosure attached to the outside of a shipping container structure.

[2] At first glance, these tests seem redundant to the water tightness tests. However, oil and coolants may react with gasket materials and thus loosen seals that are otherwise water-tight.

Falcon's experience with NEMA electrical enclosures

Falcon Structures modifies shipping containers into mobile work space, living space, and equipment shelters. Our electricians pre-install wiring and the appropriate NEMA standard electrical enclosures within the container structures to ensure a fast, plug-and-play set-up for customers.

Since 2003, Falcon's container structures have protected people and equipment everywhere from the windy prairies of North Dakota to the industrial settings of power plants. We hope our experience in protecting equipment will be a helpful resource for project managers and product procurement specialists across industries.

If you would like to learn more about how Falcon Structures modifies shipping containers, contact us at 877-704-0177 or visit our site www.falconstructures.com.

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(Left) Equipment shelters Falcon made for Energy Transfer. (Right) Equipment shelter Falcon made for WesTech.