TECHNICAL BULLETIN

IP and NEMA Enclosure Ratings Explained

Tempest Enclosures have historically been rated using the US NEMA (National Electrical Manufacturers Association) standards, with a rating of NEMA 3R, and tested under UL50, section 30. This has caused understandable confusion internationally, since the NEMA standards are not used outside the United States.

This article should help explain the differences and similarities between the two systems – which unfortunately have no direct means of correlation, since their testing requirements differ quite markedly.

Definition: NEMA3R

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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This standard has proved to be very satisfactory from the point of view of Tempest's mission – to protect and assure longest possible life of lighting and projection equipment in an outdoor

environment. With thousands of enclosures in all parts of the world, in all climate types and even at sea, Tempest enclosures have proven themselves time and time again.

So, why not IP65?

This is probably the question we hear most often – and it deserves an answer!

First, let's review the IES International Protection (often referred to as Ingress Protection) ratings system. Each rated product is tested to the appropriate standards to assure protection at two levels – the ingress of physical objects such as fingers or dust (first digit), and the ingress of water (second digit). The standard also provides for an optional third letter in certain circumstances, but we need not concern ourselves with that here.

First digit:

The first digit indicates the level of protection that the enclosure provides against access to hazardous parts (e.g., electrical conductors, moving parts) and the ingress of solid foreign objects.

Level	Protected against (object size)	Effective against
0	—	No protection against contact and ingress of objects
1	>50 mm	Any large surface of the body, such as the back of a hand, but no protection against deliberate contact with a body part
2	>12.5 mm	Fingers or similar objects
3	>2.5 mm	Tools, thick wires, etc.
4	>1 mm	Most wires, screws, etc.
5	dust protected	Ingress of dust is not entirely prevented, but it must not enter in sufficient quantity to interfere with the satisfactory operation of the equipment; complete protection against contact
6	dust tight	No ingress of dust; complete protection against contact

Second digit:

Protection of the equipment inside the enclosure against harmful ingress of water.

Level	Protected against:	Details
0	not protected	—
1	dripping water	Dripping water (vertically falling drops) shall have no harmful effect.
2	dripping water when tilted up to 15°	Vertically dripping water shall have no harmful effect when the enclosure is tilted at an angle up to 15° from its normal position.
3	spraying water	Water falling as a spray at any angle up to 60° from the vertical shall have no harmful effect.
4	splashing water	Water splashing against the enclosure from any direction shall have no harmful effect.
5	water jets	Water projected by a nozzle against enclosure from any direction shall have no harmful effects.
6	powerful water jets	Water projected in powerful jets against the enclosure from any direction shall have no harmful effects.
7	immersion up to 1m	Ingress of water in harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time (up to 1 m of submersion).
8	immersion beyond 1m	The equipment is suitable for continuous immersion in water under conditions which shall be specified by the manufacturer. NOTE: Normally, this will mean that the equipment is hermetically sealed. However, with certain types of equipment, it can mean that water can enter but only in such a manner that produces no harmful effects.

Based on this, Tempest enclosures would carry an IP rating of 54 – Some protection against dust ingress, and good protection against water spray and splashing. Keep in mind the NEMA3R rating also specifically tests for snow and sleet, which are not covered by the IP system. NEMA also carries a corrosion-resistance requirement, which is also not in the IP standard. So you can start to see that the two standards are inherently quite different, and comparisons between them tend to be erratic.

In the case of IP65, we would have a problem with the no ingress of dust requirement (that would get us to the 6). It is critically important to remember that in order to protect the equipment inside the enclosure, we change the air approximately every 2 seconds when the lamp is on. That's a lot of air, traveling at high velocity, and it's very effective! But, it inevitably means that we need to provide large, filtered air inlet vents, and equivalent exhaust vents, for the air to pass through. The inlet vents are invariably filtered to prevent passage of dust particles larger than 5 microns and in most cases to block the moisture that carries contaminants such as salt or chlorine – so 6 is not an option – by definition, we have to allow some level of dust ingress along with the air, or we'd have no ventilation. So the best first digit possible in these circumstances is a 5 - *Ingress of dust is not entirely prevented, but it must not enter in sufficient quantity to interfere with the satisfactory operation of the equipment; complete protection against contact*. For all practical purposes, this is perfectly satisfactory.

For the second digit, we are happy with a 4 – splashing water will have no deleterious effect on a Tempest Enclosure. Of course, you could spray most of the enclosure with a fire hose (that would get us a 5), BUT, a fire hose directed into an air vent with the lamp on and the fan(s) running would cause water to be sucked into the enclosure, with potentially damaging consequences. Depending on the enclosure type, it is possible in certain circumstances that some splashing or spraying water might seep through the filters into the enclosure. For that reason, all Tempest enclosures are provided with weep holes or plugs that are specifically designed to allow any such small amounts of water to drain harmlessly away. And because Tempest enclosures are built from inherently corrosion-resistant materials, such minor water ingress will not cause internal damage. Note that the NEMA3R standard specifically requires that such drainage should never expose live electrical parts to the passage of draining water.

Tempest Enclosures have the overwhelming bottom-line advantage that they WORK, effectively protecting delicate, expensive equipment in the most challenging environments. If we maintain realistic expectations of the levels of ingress protection required to achieve this objective, then users may be assured of long and trouble-free operation of the enclosure and the equipment it is there to protect.