

TECHNICAL NOTE

Testing and certification of outdoor enclosures

NEMA 250, Type 3R vs IEEE C37.20.2

When outdoor enclosures are needed for medium voltage (MV) switchgear, we often see requirements in the specifications for compliance to NEMA 3R. This can be confusing since NEMA 3R is defined in the NEMA 250 standard which specifically states that is for equipment with a maximum voltage of 1000 V. MV switchgear is rated above 1000 V.

Medium voltage switchgear is designed and tested to the requirements set forth in ANSI/IEEE C37.20.2 for indoor and outdoor metal-clad construction in non-hazardous applications. The C37.20.2 (IEEE standard) has design criteria and testing requirements for outdoor enclosures. Tests include the organic coating qualification and rain tests as defined by C37.100.1, Standard of Common Requirements for High-Voltage Power Switchgear Rated Above 1000 V Annex F¹.

NEMA 3R enclosures are designed for indoor or outdoor nonhazardous locations as defined by the NEMA 250 standard. The 3R enclosure type can be constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts, provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (falling dirt), 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.

¹ IEEE C37.20.2-2015 and C37.20.3-2013 are under revision and will no longer reference C37.100.1 for outdoor enclosure requirements. The requirements will be defined within the standards in subsequent publications.

Table 1 shows a side-by-side comparison of NEMA 3R and IEEE requirements.

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Table 1

NEMA 3R	IEEE
Non-hazardous locations	Greater definition for non-hazardous locations (ref. C37.20.2-2015, sec. 8.1.4)
Access to hazardous parts	More stringent. Ref. C37.20.2-2015, Annex B
Ingress of solid foreign objects (falling dirt)	Equal. Ref. C37.20.2-2015, Annex B
Ingress of water (dripping and light splashing)	More stringent. Ref. C37.20.2-2015, par. 6.2.9 & C37.100.1-2018, Annex F.
Ingress of water (rain, snow, and sleet*)	Equal. Ref. C37.100.1-2018, Annex F.
Outdoor corrosion protection (**)	Equal. C37.20.2-2015 requires compliance with UL 1332, which is equal to or better than Designation G90.
Rod entry test	More stringent. Ref. C37.20.2-2015, Annex B, para. B.3.3.1
Icing tests	None required

* Per NEMA 250-2018, external operating mechanisms are not required to be operable when the enclosure is ice covered.

** Per NEMA 250-2018, type 3R outdoor ferrous enclosures, and external ferrous parts attached to these enclosure types are to be protected against corrosion by hot-dipped mill-galvanized sheet steel conforming with the coating Designation G90 in Table 1 of ASTM A 653/A 653M.

Table 2 shows a comparison of testing requirements for the various tests performed to meet either NEMA 250-2018, type 3R or IEEE C37.20.2-2015 outdoor enclosure requirements.

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Table 2

	NEMA 250-2018, Type 3R	IEEE C37.20.2-2015 and IEEE C37.100.1-2018, Annex F
Rod Diameter	Not greater than 19 mm (3/4 in)	Not greater than 13 mm (1/2 in) (for ventilation openings directly accessible to live parts the rod diameter is limited to 0.125 in)
Water Pressure	5 psi	66 psi (+/- 10%)
Spray Pattern	Nozzles directed at the top and exposed sides	Nozzles oriented so that the upper edge of the water spray is horizontal
Spray Angle	45°	60°-80°
Distance nozzle to switchgear	55 in	2.5 m-3 m
Distance between nozzles	28 in	2 m
Floor coverage	N/A	1 m
Icing test	Required	Not required
Corrosion test	600 hr salt spray	600 hr salt spray

It is important to note that both the NEMA 250-2018 and IEEE C37.20.2-2015 rain tests allow small amounts of water in the switchgear as long as there is no accumulation and no water has entered the enclosure at a level higher than the lowest live part.

Icing tests are used to ensure that external operating mechanisms will still function when iced over. Since there are no external operating mechanisms (those that will operate a power circuit breaker or any other switching device), then the icing test is considered irrelevant to MV switchgear outdoor enclosures.

Summary

ABB MV metal-clad outdoor switchgear enclosures are designed and tested to IEEE C37.20.2 and exceed the NEMA 250, Type 3R enclosure testing requirements. However, since C37.20.2 does not require icing tests, nor references NEMA 250 as a normative standard, ABB does not claim a formal NEMA 3R certification of the outdoor MV metal-clad switchgear enclosures.

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