NEMA 250-2018

Enclosures for Electrical Equipment (1000 Volts Maximum)

Published by

National Electrical Manufacturers Association
1300 N. 17th Street, Suite 900
Rosslyn, VA 22209

www.nema.org

NOTICE AND DISCLAIMER

The information in this publication was considered technically sound by a consensus among persons engaged in its development at the time it was approved. Consensus does not necessarily mean there was unanimous agreement among every person participating in the development process.

The National Electrical Manufacturers Association (NEMA) Standards and guideline publications, of which the document herein is one, are developed through a voluntary Standards development process. This process brings together volunteers and/or seeks out the views of persons who have an interest in the topic covered by this publication. Although NEMA administers the process and establishes rules to promote fairness in the development of consensus, it does not write the documents, nor does it independently test, evaluate, or verify the accuracy or completeness of any information or the soundness of any judgments contained in its Standards and guideline publications.

NEMA disclaims liability for any personal injury, property, or other damages of any nature, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, application, or reliance on this document. NEMA disclaims and makes no guaranty or warranty, express or implied, as to the accuracy or completeness of any information published herein, and disclaims and makes no warranty that the information in this document will fulfill any particular purpose(s) or need(s). NEMA does not undertake to guarantee the performance of any individual manufacturer’s or seller’s products or services by virtue of this Standard or guide.

In publishing and making this document available, NEMA is not undertaking to render professional or other services for or on behalf of any person or entity, nor is NEMA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstance. Information and other Standards on the topic covered by this publication may be available from other sources, which the user may wish to consult for additional views or information not covered by this publication.

NEMA has no power, nor does it undertake to police or enforce compliance with the contents of this document. NEMA does not certify, test, or inspect products, designs, or installations for safety or health purposes. Any certification or other statement of compliance with any health- or safety-related information in this document shall not be attributable to NEMA and is solely the responsibility of the certifier or maker of the statement.

CONTENTS

Section 1 General 1
1.1 Scope 1
1.2 References 2
1.3 Definitions 3
Section 2 Enclosure Types, Features, and Applications 5
2.1 General 5
2.2 Explanation of the Enclosure Type Nomenclature 5
2.3 Specific Type Ratings 5
2.4 Ancillary Ratings 9
Section 3 Construction 10
3.1 General 10
3.2 Units Of Measurement 10
3.3 Materials—General 10
3.4 Materials—Polymeric 10
3.5 Corrosion Protection—General 10
3.5.1 Indoor Corrosion Protection 11
3.5.2 Outdoor Corrosion Protection 11
3.5.3 Annealed Coating 12
3.5.4 Bends and Forms on Zinc Coatings 12
3.5.5 Hot Dipped Galvanized Damage 12
3.5.6 Cast Iron 12
3.5.7 Corrosion Protection for Type 3X, 3RX, 3SX, 4X, and 6P Enclosures 12
3.6 Openings 12
3.6.1 Equipment Openings 12
3.6.2 Ventilation 13
3.6.3 Drainage Openings 13
3.7 Mounting 13
3.8 Conduit Connection 13
3.9 Hubs And Fittings 13
3.10 Knockouts 13
3.11 External Operating Mechanisms 14
3.12 Access To Interior 14
3.13 Closing Hardware 14
3.14 Gaskets 14
3.15 Observation Windows 15
3.16 Edge Sharpness on Enclosures 15
Section 4 Marking 16
4.1 Type Designations 16
4.2 Supplemental Markings 16
4.3 Location Of Markings 16
4.4 Enclosure Orientation 16
4.5 Conduit Hubs And Closure Plates 16
4.6 Equipment Openings 17
4.7 Drainage Openings 17
Section 5 Design Tests 18
5.1 General 18
5.1.1 Protection against Access to Hazardous Parts and against Solid Foreign Objects 18
5.1.2 Protection against Access to Hazardous Parts 18
5.1.3 Protection against Solid Foreign Objects 19
5.1.4 Degrees of Protection against Ingress of Water 21
5.1.5 Additional Protection Offered by Enclosure Types 23

5.2 Test For Protection Against Access To Hazardous Parts 24
5.2.1 Nonventilated Enclosures Test Method 24
5.2.2 Ventilated Enclosures Test Method 24
5.2.3 Evaluation 24
5.3 Test For Protection Against Ingress Of Water (Dripping And Light Splashing) 24
5.3.1 Method A 25
5.3.2 Method B 25
5.3.3 Evaluation 25
5.4 Test For Protection Against Ingress Of Water (Rain) 25
5.4.1 Method 25
5.4.2 Evaluation 26
5.5 Tests For Protection Against Ingress Of Solid Foreign Objects (Windblown, Circulating and Settling Dust, Lint, Fibers, And Flyings) 29
5.5.1 Outdoor (Windblown) Dust Test 29
5.5.2 Indoor (Circulating and Settling) Dust Tests 30
5.6 External Icing Test 31
5.6.1 Test Method 31
5.6.2 Evaluation 32
5.7 Test For Protection Against Ingress Of Water (Hosedown) 32
5.7.1 Test Method 32
5.7.2 Evaluation 32
5.8 Indoor Corrosion Protection (Rust-Resistance Test (24-Hour Salt Spray Test)) 32
5.8.1 Test Equipment 33
5.8.2 Salt Solution 33
5.8.3 Air Supply 33
5.8.4 Temperature 33
5.8.5 Test Procedure 33
5.8.6 Evaluation 33
5.9 Outdoor Corrosion Protection 33
5.9.1 600-Hour Salt Spray Test 33
5.9.2 Evaluation 33
5.9.3 1200-Hour Moist Carbon Dioxide—Sulfur Dioxide—Air Test 34
5.10 Corrosion Protection—Type 3X, 3RX, 3SX, 4X, Or 6P Enclosures 34
5.10.1 Evaluation 34
5.11 Test For Protection Against Ingress Of Water (Temporary Submersion) 34
5.11.1 Test Method 34
5.11.2 Evaluation 34
5.12 Test For Protection Against Ingress Of Water (Prolonged Submersion) 34
5.12.1 Alternate Tests 35
5.13 Oil Exclusion Test 35
5.13.1 Test Method 35
5.13.2 Evaluation 36
5.14 Gasket Material Tests 36
5.14.1 Aging Test Conditioning 36
5.14.2 Evaluation 36
5.14.3 Alternate Evaluation 36
5.14.4 Oil Immersion Test 36
5.15 High Pressure Power Wash Test 36
5.15.1 Test Method 36
Section 6 Field Modifications 42
6.1 Painting of Enclosure Exteriors (Excluding types 7 and 9) 42
Annex A Comparison Between NEMA Enclosure Type Numbers and ANSI/IEC Enclosure Classification Designations 45

A.1 General 45

Tables

Table 2-1 Comparison of Specific Applications of Enclosures for Indoor Locations 5
Table 2-2 Comparison of Specific Applications of Enclosures for Indoor & Outdoor Locations 6
Table 3-1 Knockout Dimensions 14
Table 5-1A Degrees of Protection Against Access to Hazardous Parts 19
Table 5-1B Degrees of Protection Against Solid Foreign Objects 20
Table 5-1C Degrees of Protection against Water 22
Table 5-1D Additional Protection 23
Table 5-2 Tightening Torque 25
Table A-1 Conversion of NEMA Enclosure Type Ratings to ANSI/IEC 60529 Enclosure Classification Designations (IP) 47

Figures

Figure 5-1 Rain-test spray-head piping 27
Figure 5-2 Rain-test spray-head 28
Figure 5-3 Fan Jet nozzle dimensions 37
Figure 5-4 Fan Jet nozzle resulting dimensions of spraying hole for checking purpose 38
Figure 5-5 Example of different quality achievements of the surface finish of the fan jet nozzle 39
Figure 5-6 Set-up for measuring the impact force of the water jet for determining the protection against high pressure and temperature water jet, degree of protection against ingress of water IP X9 40
Figure 5-7 Impact force distribution 40
Figure 5-8 Test set-up for determining the protection against high-pressure and temperature water jet; degree of protection against ingress of water IPX9 for small enclosures 41

FOREWORD

This Standards publication covers the classification and description of enclosures for electrical equipment. Enclosures for rotating apparatus have not been included. The primary purpose of this publication is to permit a potential user to determine:

a. The type of enclosure appropriate for the application.
b. The features the enclosure is expected to have.
c. The tests applied to the enclosure to demonstrate its conformance to the description.

These Standards are used by the electrical industry to provide guidelines for the manufacture and proper application of enclosures and to promote the benefits of repetitive manufacturing and widespread enclosure availability.

Each type of enclosure is described in general and functional terms where practicable and omits reference to structural details and specific applications except where they are essential to the identification of the enclosure type. For such structural details and specific applications, see the appropriate NEMA product Standards publication.

Individual product Standards publications incorporating enclosure construction unique to the product design may reflect the type of designations contained herein provided the design tests for such construction equal or exceed the requirements of this Standards publication.

User needs have been considered throughout the development of this publication. Proposed or recommended revisions should be submitted to:

Senior Technical Director, Operations
National Electrical Manufacturers Association
1300 N. 17th Street, Suite 900
Rosslyn, VA 22209

NEMA 250-2018 revises and supersedes NEMA 250-2014.

NFPA 70®, *National Electrical Code*®, and NEC are registered trademarks of the National Fire Protection Association, Quincy, MA.

This Standards publication was developed by the NEMA Enclosure Section of the National Electrical Manufacturers Association. Section approval of the Standard does not necessarily imply that all section members voted for its approval or participated in its development. At the time it was approved, the Enclosure Section was composed of the following members:

Adalet	Cleveland, OH
Allied Moulded Products, Inc.	Bryan, OH
Arlington Industries, Inc.	Scranton, PA
Boltswitch, Inc.	Crystal Lake, IL
Calpipe Industries, Inc.	Rancho Dominguez, CA
Eaton	Cleveland, OH
Emerson Automation Solutions	Rosemont, IL
GE	Boston, MA
Hubbell Incorporated	Shelton, CT
Legrand, North America	West Hartford, CT
Millbank Manufacturing Company	Kansas City, MO
Hoffman Enclosures Inc.	Anoka, MN
Rittal North America LLC	Urbana, OH
Robroy Industries, Inc.	Verona, PA
Schneider Electric	Andover, MA
Siemens Industry Inc.	Norcross, GA
Snake Tray	Bay Shore, NY
Space Age Electronics	Sterling, MA
Thomas & Betts, a Member of ABB Group	Memphis, TN

< This page left blank intentionally. >

Section 1
General

1.1 Scope

This Standard covers enclosures for electrical equipment rated not more than 1000 Volts and intended to be installed and used as follows:

a. enclosures for indoor locations, Types 1, 2, 5, 12, 12K, and 13; and
b. enclosures for indoor or outdoor locations, Types 3, 3X, 3R, 3RX, 3S, 3SX, 4, 4X, 6, and 6P; and
c. enclosures for hazardous (classified) locations Types 7 and 9

This Standard covers the requirements to provide protection to the enclosed equipment against specific environmental conditions. The requirements of this Standard mandate that enclosures and equipment shall be installed and used in accordance with manufacturer's instructions and 110.3(B) of the *National Electrical Code*®, ANSI/NFPA 70.

This Standard covers the requirements for enclosures that are installed and ready for use in non-hazardous (unclassified) locations.

This Standard additionally covers the requirements for dust-tight enclosures that are installed and ready for use where permitted by *National Electrical Code*® (NEC) in Class II, Division 2; Class III, Division 1; Class III, Division 2; and Zone 22 hazardous (classified) locations as defined by the NEC*, ANSI/NFPA 70*, or by *Nonincendive Electrical Equipment for use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*, ANSI/ISA 12.12.01. Where dust-tight enclosures are integral to or incorporate separable electrical connections (e.g., plug and receptacle, plug and connector body, inlet and connector body) for use in Class II, Division 2; Class III, Division 1; Class III, Division 2; and Zone 22 hazardous (classified) locations, the combination shall be designed to ensure that current cannot be ruptured at the separable electrical connections while energized parts are exposed.

This Standard also references requirements for Class I; Division 1 explosion-proof enclosures marked Type 7 and Class II, Division 1 dust-ignition-proof enclosures marked Type 9. The reference requirements are in accordance with *ANSI/UL 1203* with the associated area classifications and installation requirements in accordance with *ANSI/NFPA 70*/NEC.

This Standard supplements requirements for enclosures that are contained in the individual product Standards.

This Standard does not cover the requirements for protection of the enclosed equipment against conditions such as condensation, gas vapor ignition, thermal damage, icing, corrosion, or contamination, which may occur within the enclosure or which may enter via conduit or unsealed openings.

This Standard does not cover protection of personnel from contact with enclosed electrical equipment where the enclosures or equipment are incompletely installed or where enclosed electrical equipment has been rendered accessible for servicing, maintenance, testing, troubleshooting, internal measurements, or calibration or by damage.

A product that contains features, characteristics, components, materials, or systems new or different from those in use when the Standard was developed, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the level of safety for the user of the product as originally anticipated by the intent of this Standard.