



ANSI/NEMA 250-2020

American National Standard for Enclosures for Electrical Equipment (1000 Volts Maximum)



National Electrical Manufacturers Association
1300 North 17th Street, Suite 900 • Rosslyn, VA 22209
www.NEMA.org





Approved as an American National Standard
ANSI Approval Date: December 8, 2020

ANSI/NEMA 250-2020

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

© 2021 National Electrical Manufacturers Association. All rights, including translation into other languages, reserved under the Universal Copyright Convention, the Berne Convention for the Protection of Literary and Artistic Works, and the International and Pan American copyright conventions.

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.

American National Standards Institute, Inc., (ANSI) Standards and guideline publications, of which the document contained herein is one, are developed through a voluntary consensus 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. While NEMA administers the process to promote fairness in the development of consensus, it does not write the document and it does not 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 Types 3X, 3RX, 3SX, 4X, and 6P Enclosures	12
3.6	Openings	13
3.6.1	Equipment Openings	13
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	14
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	19
5.1.3	Protection against Solid Foreign Objects	20
5.1.4	Degrees of Protection against Ingress of Water	22
5.1.5	Additional Protection Offered by Enclosure Types.....	24

5.2	Test for Protection against Access to Hazardous Parts	25
5.2.1	Nonventilated Enclosures Test Method	25
5.2.2	Ventilated Enclosures Test Method	25
5.2.3	Evaluation	25
5.3	Test for Protection against Ingress of Water (Dripping and Light Splashing)	25
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)	26
5.4.1	Method	26
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
5.6.1	Test Method	34
5.6.2	Evaluation	34
5.7	Test for Protection against Ingress of Water (Hosedown)	34
5.7.1	Test Method	34
5.7.2	Evaluation	35
5.8	Indoor Corrosion Protection (Rust-Resistance Test (24-Hour Salt Spray Test))	35
5.8.1	Test Equipment	35
5.8.2	Salt Solution	35
5.8.3	Air Supply	35
5.8.4	Temperature	35
5.8.5	Test Procedure	35
5.8.6	Evaluation	36
5.9	Outdoor Corrosion Protection	36
5.9.1	600-Hour Salt Spray Test	36
5.9.2	Evaluation	36
5.9.3	1200-Hour Moist Carbon Dioxide—Sulfur Dioxide—Air Test	36
5.10	Corrosion Protection—Type 3X, 3RX, 3SX, 4X, or 6P Enclosures	37
5.10.1	Evaluation	37
5.11	Test for Protection against Ingress of Water (Temporary Submersion)	37
5.11.1	Test Method	37
5.11.2	Evaluation	37
5.12	Test for Protection against Ingress of Water (Prolonged Submersion)	37
5.12.1	Alternate Tests	38
5.13	Oil Exclusion Test	38
5.13.1	Test Method	38
5.13.2	Evaluation	39
5.14	Gasket Material Tests	39
5.14.1	Evaluation	39
5.14.1.1	Alternate Evaluation (Foam-In-Place Gaskets, O-Rings, Plastic Gaskets)	39
5.14.2	Aging Test	39
5.14.3	Compression Test	39
5.14.4	Oil Immersion Test	40
Section 6	Field Modifications	48
6.1	Painting of Enclosure Exteriors (Excluding Types 7 and 9)	48
Annex A Comparison Between NEMA 250 Enclosure Type Numbers and IEC 60529 Enclosure Classification Designations		51
A.1	General	51

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 <i>NEMA 250</i> Enclosure Type Ratings to <i>IEC 60529</i> 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 Test device to verify protection against dust (dust chamber)	28
Figure 5-4 Gasket compression test specimen.....	37
Figure 5-5 Fan Jet nozzle dimensions	37
Figure 5-6 Fan Jet nozzle resulting dimensions of spraying hole for checking purpose	38
Figure 5-7 Example of different quality achievements of the surface finish of the fan jet nozzle	39
Figure 5-8 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.....	40
Figure 5-9 Impact force distribution	40
Figure 5-10 Test set-up for determining the protection against high-pressure and temperature water jet; degree of protection against ingress of water 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 are equal to 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:

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

NEMA 250-2020 revises and supersedes NEMA 250-2018.

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 *ANSI/NFPA 70, National Electrical Code® (NEC®)*.

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 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®, or by *ANSI/UL 121201, Nonincendive Electrical Equipment for use in Class I and II, Division 2, and Class III, Divisions 1 and 2 Hazardous (Classified) Locations (UL 121201)*. 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 ExplosionProof and Dust-IgnitionProof Electrical Equipment for Use in Hazardous (Classified) Locations (UL 1203)* with the associated area classifications and installation requirements in accordance with NEC®.

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

This Standard does not cover the requirements for the 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.