250

ENCLOSURES FOR ELECTRICAL EQUIPMENT (1000 VOLTS MAXIMUM)

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NEMA STANDARDS PUBLICATION NO. 250

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Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION ■ 2101 L STREET, N.W., WASHINGTON, D.C. 20037

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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:

1. The type of enclosure appropriate for the application.
2. The features the enclosure is expected to have.
3. 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:

Manager, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, D.C. 20037

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Scope

This Standards Publication covers enclosures for electrical equipment rated at not more than 1000 volts. It provides descriptions, features, and test criteria for hazardous (classified) and nonhazardous location enclosures. Definitions are given for general terms and specifically for each enclosure type. Descriptions are given of the more common types of enclosures used by the electrical industry to provide protection to personnel against incidental contact with the enclosed equipment and to provide protection to the enclosed equipment against specific environmental conditions.

This Standards Publication does not cover: enclosures for rotating apparatus; the protection of devices against conditions such as condensation, icing, corrosion, or contamination which may occur within the enclosure or enters via the conduit or unsealed openings, or; means to prevent attempted entry or operation by unauthorized personnel. This standards publication does not cover requirements for wire and cable.

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ENCLOSURES FOR ELECTRICAL EQUIPMENT (1000 VOLTS MAXIMUM)

Section 1

REFERENCED STANDARDS

Below is a complete listing of the titles and publication numbers of all standards referenced, in part or in full, in this standard. The mailing address of each referenced organization is also provided.

American National Standards Institute
1430 Broadway
New York, NY 10018

ANSI/NFPA 70-1987 *National Electrical Code*

ANSI/NFPA 496-1986 *Purged Enclosures for Electrical Equipment in Hazardous Locations*

ANSI/NFPA 497M-1983 *Classification of Gases, Vapors and Dusts for Electrical Equipment in Hazardous (Classified) Locations*

ANSI/UL 698-1973 *Industrial Control Equipment for Use in Hazardous Locations*

ANSI/UL 877-1975 *Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G*

ANSI/UL 886-1977 *Outlet Boxes and Fittings for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G*

ANSI/UL 894-1977 *Switches for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G*

International Electrotechnical Commission
Copies available from:
American National Standards Institute
1430 Broadway
New York, NY 10018

IEC 529-1976 *Classification of Degrees of Protection Provided by Enclosures*

Mine Safety and Health Administration
U.S. Department of Labor
4015 Wilson Boulevard
Arlington, VA 22203

Copies available from:
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

30 C.F.R., Part 18 (1984) *Electric Motor Driven Mine Equipment and Accessories*

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National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

(See also ANSI/NFPA Standards listed above).

NFPA 493-1978 *Intrinsically Safe Apparatus in Division 1 Hazardous Locations*

Underwriters Laboratories Inc.
333 Pfingsten Road
Northbrook, IL 60062

(See also ANSI/UL Standards listed above).

Ul 50-1985 *Cabinets and Boxes*

UL 508-1984 *Industrial Control Equipment*

UL 913-1982 *Intrinsically Safe Electrical Circuits and Equipment for Use in Hazardous Locations*

Ul Bulletin of Research
#23, September 1941 *Rain Tests of Electrical Equipment*

American Iron and Steel Institute
1000 16th Street, N.W.
Washington, DC 10036

Steel Products Manual on Stainless and Heat-Resisting Steels, 1974

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Section 2

DEFINITIONS

2.1 INTRODUCTION

An enclosure is a surrounding case constructed to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection to the enclosed equipment against specified environmental conditions.

A brief description of the more common types of enclosures used by the electrical industry relating to their environmental capabilities follows. Refer to the appropriate sections of this Standards Publication for more information regarding applications, features, and design tests.

NEMA Standard 3-8-1985.

Individual NEMA product Standards Publications or third party certification standards may contain additional requirements for product testing and performance.

Authorized Engineering Information 3-8-1985.

2.2 DEFINITIONS PERTAINING TO NONHAZARDOUS LOCATIONS

Type 1 Enclosures are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment.

NEMA Standard 1-10-1979.

Type 2 Enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.

NEMA Standard 1-10-1979.

Type 3 Enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, sleet, and external ice formation.

NEMA Standard 1-10-1979.

Type 3R Enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain, sleet, and external ice formation.

NEMA Standard 1-10-1979.

Type 3S Enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, sleet, and to provide for operation of external mechanisms when ice laden.

NEMA Standard 1-10-1979.

Type 4 Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose-directed water.

NEMA Standard 1-10-1979.

Type 4X Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water.

NEMA Standard 1-10-1979.

Type 5 Enclosures are intended for indoor use primarily to provide a degree of protection against settling airborne dust, falling dirt, and dripping non-corrosive liquids.

NEMA Standard 5-25-1988.

Type 6 Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during occasional temporary submersion at a limited depth.

NEMA Standard 1-10-1979.

Type 6P Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during prolonged submersion at a limited depth.

NEMA Standard 1-10-1979.

Type 11 Enclosures are intended for indoor use primarily to provide, by oil immersion, a degree of protection to enclosed equipment against the corrosive effects of liquids and gases.

NEMA Standard 1-10-1979.

Type 12 Enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping noncorrosive liquids.

NEMA Standard 1-10-1979.

Type 12K Enclosures with knockouts are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids other than at knockouts.

NEMA Standard 1-10-1979.

Type 13 Enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and noncorrosive coolant.

NEMA Standard 1-10-1979.

2.3 DEFINITIONS PERTAINING TO HAZARDOUS (CLASSIFIED) LOCATIONS

Type 7 Enclosures are for use indoors in locations classified as Class I, Groups A, B, C, or D, as defined in the *National Electrical Code*.

NEMA Standard 1-10-1979.

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Type 8 Enclosures are for indoor or outdoor use in locations classified as Class I, Groups A, B, C, or D, as defined in the *National Electrical Code*.

NEMA Standard 1-10-1979.

Type 9 Enclosures are for use in indoor locations classified as Class II, Groups E, F, or G, as defined in the *National Electrical Code*.

NEMA Standard 5-19-1986.

Type 10 Enclosures are constructed to meet the applicable requirements of the Mine Safety and Health Administration.

NEMA Standard 1-10-1979.

2.4 GENERAL DEFINITIONS PERTAINING TO ENCLOSURES

Apparatus is the enclosure, the enclosed equipment, and the attached protruding accessories.

NEMA Standard 1-10-1979.

Design Tests demonstrate performance of a product designed to applicable standards; they are not intended to be production tests.

NEMA Standard 1-10-1979.

Flush Mounting means so constructed as to have a minimal front projection when set into a recessed opening and secured to a flat surface.

NEMA Standard 1-10-1979.

Hazardous (Classified) Locations are those areas which may contain hazardous (classified) materials in sufficient quantity to create an explosion. See Article 500 of the *National Electrical Code*.

NEMA Standard 3-8-1985.

Hazardous Materials are those gases, vapors, combustible dusts, fibers, or flyings which are explosive under certain conditions.

NEMA Standard 1-10-1979.

Indoor Locations are those areas which are protected from exposure to the weather.

NEMA Standard 1-10-1979.

Knockout is a portion of the wall of an enclosure so fashioned that it may be removed readily by a hammer, screwdriver, and pliers at the time of installation in order to provide a hole for the attachment of an auxiliary device or raceway, cable, or fitting.

NEMA Standard 1-10-1979.

Nonventilated means so constructed as to provide no intentional circulation of external air through the enclosure.

NEMA Standard 1-10-1979.

Oil-Resistant Gaskets are those made of material which is resistant to oil or oil fumes.

NEMA Standard 1-10-1979.

Outdoor Locations are those areas which are exposed to the weather.

NEMA Standard 1-10-1979.

Surface Mounting means so constructed as to be secured to, and projected from a flat surface.

NEMA Standard 1-10-1979.

Ventilated means so constructed as to provide for the circulation of external air through the enclosure to remove excess heat, fumes, or vapors.

NEMA Standard 1-10-1979.

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Section 3

GENERAL

3.1 PURPOSES OF ENCLOSURES

Enclosures provide protection to personnel against incidental contact with the electrical devices and protect electrical devices against specified environmental conditions.

Enclosures do not normally protect devices against conditions such as condensation, icing, corrosion, or contamination which may occur within the enclosure or enter via the conduit or unsealed openings. These internal conditions require considerations beyond the scope of this standard, and the apparatus manufacturer should be consulted.

The electrical devices operate in air unless otherwise specified.

NEMA Standard 1-10-1979.

3.2 TYPE DESIGNATIONS

Enclosures should be designated by the type number which is intended to indicate the environmental conditions for which they are suitable. See Sections 4 and 5, and Tables 3-1 and 3-2. Enclosures which meet the requirements for more than one type enclosure may be designated by a combination of type numbers, the lower number being given first.

Authorized Engineering Information 3-8-1985.

3.3 MATERIALS

All enclosures shall be made of materials which will not support combustion in air. Consult the manufacturer if application conditions are more severe than those represented by the applicable design test.

NEMA Standard 1-10-1979.

3.4 CONDUCTOR ENTRY

Enclosures should be used with the appropriate conductor entry fittings which maintain the specified environmental capability after proper installation.

Authorized Engineering Information 1-10-1979.

3.5 OPERATING MECHANISMS

External operating mechanisms, such as those for disconnects, pilot devices, and resetting, when mounted on or through the enclosure, shall pass the applicable test for the enclosure, unless otherwise specified.

NEMA Standard 1-10-1979.

3.6 ENCLOSURE APPLICATIONS

Tables 3-1 and 3-2 are guides for comparing specific applications of enclosures. It is possible that, because of various local code requirements or unusual conditions, a different or modified type of enclosure may be required, in which case the manufacturer should be consulted. Special care should be used in selecting enclosures for hazardous (classified) locations, and the advice of competent authorities should be solicited.

Authorized Engineering Information 3-8-1985.

3.7 NONVENTILATED AND VENTILATED ENCLOSURES

Enclosures covered by this standard are nonventilated, except that Type 1, 2, and 3R enclosures may be either nonventilated or ventilated.

The entrance of dust into ventilated enclosures can be minimized by the addition of a filter system. However, when considerable air contamination exists and forced ventilation is required, filters may fail rapidly, and it may be necessary to bring in air from a remote location.

Authorized Engineering Information 1-10-1979.

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Table 3-1
COMPARISON OF SPECIFIC APPLICATIONS OF ENCLOSURES FOR INDOOR NONHAZARDOUS LOCATIONS

Provides a Degree of Protection Against the Following Environmental Conditions	Type of Enclosure										
	1*	2*	4	4X	5	6	6P	11	12	12K	13
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X	X	X	X	X
Falling dirt	X	X	X	X	X	X	X	X	X	X	X
Falling liquids and light splashing	...	X	X	X	...	X	X	X	X	X	X
Circulating dust, lint, fibers, and flyings†	...	...	X	X	...	X	X	...	X	X	X
Settling airborne dust, lint, fibers, and flyings†	...	...	X	X	X	X	X	...	X	X	X
Hosedown and splashing water	...	...	X	X	...	X	X	...	...	...	...
Oil and coolant seepage	...	...	...	...	...	...	...	...	X	X	X
Oil or coolant spraying and splashing	...	...	...	...	...	...	...	...	...	...	X
Corrosive agents	...	...	...	X	...	...	X	X	...	...	...
Occasional temporary submersion	...	...	...	...	...	X	X	...	...	...	...
Occasional prolonged submersion	...	...	...	...	...	...	X	...	...	...	...

*These enclosures may be ventilated. However, Type 1 may not provide protection against small particles of falling dirt when ventilation is provided in the enclosure top. Consult the manufacturer. See 3.7.
†These fibers and flyings are nonhazardous materials and are not considered the Class III type ignitable fibers or combustible flyings. For Class III type ignitable fibers or combustible flyings see the *National Electrical Code*, Section 500-6(a).

(Notes approved as Authorized Engineering Information 5-25-1988.)

Table 3-2
COMPARISON OF SPECIFIC APPLICATIONS OF ENCLOSURES FOR OUTDOOR NONHAZARDOUS LOCATIONS

Provides a Degree of Protection Against the Following Environmental Conditions	Type of Enclosure						
	3	3R†	3S	4	4X	6	6P
Incidental contact with the enclosed equipment	X	X	X	X	X	X	X
Rain, snow, and sleet*	X	X	X	X	X	X	X
Sleet**	...	...	X	...	...	...	...
Windblown dust	X	...	X	X	X	X	X
Hosedown	...	...	...	X	X	X	X
Corrosive agents	...	...	...	...	X	...	X
Occasional temporary submersion	...	...	...	...	...	X	X
Occasional prolonged submersion	...	...	...	...	...	...	X

* External operating mechanisms are not required to be operable when the enclosure is ice covered.
**External operating mechanisms are operable when the enclosure is ice covered. See 6.6.2.1.
†These enclosures may be ventilated.

(Notes approved as Authorized Engineerng Information 1-10-1979.)

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Section 4

DESCRIPTIONS, FEATURES, AND TEST CRITERIA OF ENCLOSURES FOR NONHAZARDOUS LOCATIONS

4.1 TYPE 1 ENCLOSURES

4.1.1 Description and Test Criteria

Type 1 enclosures are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment in locations where unusual service conditions do not exist. The enclosures shall meet the rod entry and rust-resistance design tests.

4.1.2 Features and Test Criteria

4.1.2.1 NONVENTILATED ENCLOSURES. When completely and properly installed, Type 1 nonventilated enclosures:

1. Shall provide a degree of protection against limited amounts of falling dirt; however, they are not required to prevent the entry of dust or liquids.
2. Shall prevent the insertion of the end portion of a straight rod of the specified diameter into the equipment cavity of the enclosure.
3. Shall not rust when subjected to a salt spray test for 24 hours.

4.1.2.2 VENTILATED ENCLOSURES. When completely and properly installed, Type 1 ventilated enclosures shall have the same features and test criteria as nonventilated enclosures except that they shall have ventilated openings with different rod diameter requirements.

4.1.3 Design Tests

Type 1 enclosures shall be tested and evaluated by the following:

1. Rod entry test described in 6.2.
2. Rust-resistance test described in 6.8.

4.2 TYPE 2 ENCLOSURES

4.2.1 Description and Application

Type 2 enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt. These enclosures shall meet rod entry, drip, and rust-resistance design tests. They are not intended to provide protection against conditions such as dust or internal condensation.

4.2.2 Features and Test Criteria

4.2.2.1 NONVENTILATED ENCLOSURES. When completely and properly installed, Type 2 nonventilated enclosures:

1. Shall provide a degree of protection against limited amounts of falling water and dirt; however they are not required to prevent the entry of dust. They shall have provisions for drainage.
2. Shall prevent the insertion of the end portion of a straight rod of the specified diameter into the equipment cavity of the enclosure.
3. Shall restrict the entrance of dripping water.
4. Shall not rust when subjected to a salt spray test for 24 hours.

4.2.2.1 VENTILATED ENCLOSURES. When completed and properly installed, Type 2 ventilated enclosures shall have the same features and test criteria as nonventilated enclosures except that they shall have ventilated openings with different rod diameter requirements.

4.2.3 Design Tests

Type 2 enclosures shall be tested and evaluated by the following:

1. Rod entry test described in 6.2.
2. Drip test described in 6.3 (evaluated per 6.3.2.1).
3. Rust-resistance test described in 6.8.

NEMA Standard 7-12-1983.

4.3 TYPE 3 ENCLOSURES

4.3.1 Description and Application

Type 3 enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, and sleet; and to be undamaged by the formation of ice on the enclosure. They shall meet rain, external icing, dust, and rust-resistance design tests. They are not intended to provide protection against conditions such as internal condensation or internal icing.

4.3.2 Features and Test Criteria

When completely and properly installed, Type 3 enclosures:

1. Shall be permitted to have a conduit hub or equivalent provision to exclude water at the conduit entrance.
2. If mounting means are provided, these means shall be external to the equipment cavity.
3. Shall require the use of a tool to gain access to the equipment cavity or have provisions for locking.
4. Shall exclude water when subjected to a simulated heavy rainfall for 1 hour.
5. Shall exclude dust under test conditions which are intended to simulate windblown dust.

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6. Shall be undamaged after being encased in ice under test conditions.
7. Shall have suitable corrosion protection.

4.3.3 Design Tests

Type 3 enclosures shall be tested and evaluated by the following:

1. Rain test described in 6.4 (evaluated per 6.4.2.2).
2. Outdoor dust test described in 6.5.1.1.
3. External icing test described in 6.6 (evaluated per 6.6.2.2).
4. Corrosion protection described in 6.9.

NEMA Standard 5-19-1986.

4.4 TYPE 3R ENCLOSURES

4.4.1 Description and Application

Type 3R enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain; and to be undamaged by the formation of ice on the enclosure. They shall meet rod entry, rain, external icing, and rust-resistance design tests. They are not intended to provide protection against conditions such as dust, internal condensation, or internal icing.

4.4.2 Features and Tests Criteria

4.4.2.1 NONVENTILATED ENCLOSURES. When completely and properly installed, Type 3R nonventilated enclosures:

1. Shall not permit water to enter the equipment cavity at a level higher than the lowest live part except if constructed to divert water from live parts, insulation, and wiring; and shall have provisions for drainage.
2. Shall be undamaged after being encased in ice under test conditions.
3. Shall be permitted to have a conduit hub or equivalent provision to exclude water at the conduit entrance if the entrance is above the lowest live part.
4. Shall require the use of a tool to gain access to the equipment cavity or have provisions for locking.
5. Shall prevent the insertion of the end portion of a straight rod of the specified diameter into the equipment cavity of the enclosure.
6. Shall have suitable corrosion protection.

4.4.2.2 VENTILATED ENCLOSURES. When completely and properly installed, Type 3R ventilated enclosures shall have the same features and test criteria as nonventilated enclosures except that they shall have ventilated openings with different rod diameter requirements.

4.4.3 Design Tests

Type 3R enclosures shall be tested and evaluated by the following:

1. Rod entry test described in 6.2.
2. Rain test described in 6.4 (evaluated per 6.4.2.1).
3. External icing test described in 6.6 (evaluated per 6.6.2.2).
4. Corrosion protection described in 6.9.

NEMA Standard 5-19-1986.

4.5 TYPE 3S ENCLOSURES

4.5.1 Description and Application

Type 3S enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, and sleet, and to provide for operation of external mechanisms when ice laden. They shall meet rain, dust, external icing, and rust-resistance design tests. They are not intended to provide protection against conditions such as internal condensation or internal icing.

4.5.2 Features and Test Criteria

When completely and properly installed, Type 3S enclosures:

1. Shall exclude water under test conditions which are intended to simulate a heavy rainfall for 1 hour.
2. Shall exclude dust under test conditions which are intended to simulate windblown dust.
3. Shall be permitted to have a conduit hub or equivalent provisions to exclude water at the conduit entrance.
4. If mounting means are provided, they shall be external to the equipment cavity.
5. Shall require the use of a tool to gain access to the equipment cavity or have provisions for locking.
6. Shall have external operating mechanisms with the ability to withstand removal of ice by a hand tool. Auxiliary means shall be permitted to be provided to break the ice and permit operation of the external mechanisms.
7. Shall have suitable corrosion protection.

4.5.3 Design Tests

Type 3S enclosures shall be tested and evaluated by the following:

1. Rain test described in 6.4 (evaluated per 6.4.2.2).
2. Outdoor dust test described in 6.5.1.1.
3. External icing test described in 6.6 (evaluated per 6.6.2.1).
4. Corrosion protection described in 6.9.

NEMA Standard 5-19-1986.

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4.6 TYPE 4 ENCLOSURES

4.6.1 Description and Application

Type 4 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose directed water; and to be undamaged by the formation of ice on the enclosure. They shall meet hosedown, external icing, and rust-resistance design tests. They are not intended to provide protection against conditions such as internal condensation or internal icing.

4.6.2 Features and Test Criteria

When completely and properly installed, Type 4 enclosures:

1. Shall exclude water under test conditions which are intended to simulate a hosedown condition.
2. Shall be undamaged after being encased in ice under test conditions.
3. Shall be permitted to have a conduit hub or equivalent provisions to exclude water at the conduit entrance.
4. If mounting means are provided, these means shall be external to the equipment cavity.
5. Shall have suitable corrosion protection.

4.6.3 Design Tests

Type 4 enclosures shall be tested and evaluated by the following:

1. External icing test described in 6.6 (evaluated per 6.6.2.2).
2. Hosedown test described in 6.7.
3. Corrosion protection described in 6.9

NEMA Standard 5-19-1986.

4.7 TYPE 4X ENCLOSURES

4.7.1 Description and Application

Type 4X enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water; and to be undamaged by the formation of ice on the enclosure. They shall meet hosedown, external icing, and corrosion-resistance design tests. They are not intended to provide protection against conditions such as internal condensation or internal icing.

4.7.2 Features and Test Criteria

When completely and properly installed, Type 4X enclosures:

1. Shall exclude water under test conditions which are intended to simulate a hosedown condition.
2. Shall be undamaged after being encased in ice under test conditions.
3. Shall be permitted to have a conduit hub or equivalent provisions to exclude water at the conduit entrance.
4. If mounting means are provided, these means shall be external to the equipment cavity.
5. Shall be manufactured of American Iron and Steel Institute Type 304 Stainless steel, polymerics, or materials with equivalent corrosion resistance, to provide a degree of protection against specific corrosive agents.

4.7.3 Design Tests

Type 4X enclosures shall be tested and evaluated by the following:

1. External icing test described in 6.6 (evaluated per 6.6.2.2).
2. Hosedown test described in 6.7.
3. Corrosion-resistance test described in 6.9.

NEMA Standard 5-19-1986.

4.8 TYPE 5 ENCLOSURES

4.8.1 Description and Application

Type 5 enclosures are intended for indoor use primarily to provide a degree of protection against settling airborne dust, falling dirt, and dripping non-corrosive liquids. They shall meet drip, settling airborne dust, and rust resistance design tests. They are not intended to provide protection against internal condensation.

4.8.2 Features and Test Criteria

When completely and properly installed, Type 5 enclosures:

1. Shall provide a degree of protection for the enclosured equipment against dirt, settling airborne dust, lint, non-ignitable fibers or non-combustible flyings, light splashes, seepage, and dripping of non-corrosive liquids.
2. Shall be permitted to have holes for the purpose of mounting devices, the entrance or exit of bussing, wiring, and operating mechanisms, provided they are closed in such a way as to meet the requirements of paragraph 1 above.
3. When doors are provided, they shall have provisions for locking or shall require the use of a tool to gain entry. All closing hardware shall be captive.
4. A floor mounted enclosure shall prevent the entrance of dust from below.
5. Shall prevent the entrance of falling water.
6. Shall exclude dust under test conditions that are intended to simulate settling airborne dust in an indoor industrial environment.
7. Shall not rust when subjected to a salt spray test for 24 hours.

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4.8.3 Design Tests

Type 5 enclosures shall be tested and evaluated by the following:

1. Drip test described in 6.3 (evaluated per 6.3.2.2).
2. Settling airborne dust test described in 6.5.1.2 (3) or 6.5.1.2 (4).
3. Rust-resistance test described in 6.8.

NEMA Standard 5-25-1988.

4.9 TYPE 6 ENCLOSURES

4.9.1 Description and Application

Type 6 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during temporary submersion at a limited depth; and to be undamaged by the formation of ice on the enclosure. They shall meet submersion, external icing, and rust-resistance design tests. They are not intended to provide protection against conditions such as internal condensation, internal icing, or corrosive environments.

4.9.2 Features and Test Criteria

When completely and properly installed, Type 6 enclosures:

1. Shall exclude water under test conditions that are intended to simulate temporary submersion at a limited depth. For enclosures that must withstand greater pressures or longer periods of time, or both, than those specified in the submersion test, the manufacturer should be consulted. (This sentence is approved as Authorized Engineering Information).
2. Shall exclude water under test conditions which are intended to simulate a hosedown condition.
3. Shall be undamaged after being encased in ice under test conditions.
4. If mounting means are provided, these means shall be external to the equipment cavity.
5. Shall have suitable corrosion protection.

4.9.3 Design Tests

Type 6 enclosures shall be tested and evaluated by the following:

1. Submersion test described in 6.10.
2. External icing test described in 6.6 (evaluated per 6.6.2.2).
3. Hosedown test described in 6.7.
4. Corrosion protection described in 6.9.

NEMA Standard 5-19-1986.

4.10 TYPE 6P ENCLOSURES

4.10.1 Description and Application

Type 6P enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during prolonged submersion at a limited depth; and to be undamaged by the formation of ice on the enclosure. They shall meet air pressure, external icing, and corrosion-resistance design tests. They are not intended to provide protection against conditions such as internal condensation or internal icing.

4.10.2 Features and Test Criteria

When completely and properly installed, Type 6P enclosures:

1. Shall exclude water under test conditions which are intended to simulate prolonged submersion at a limited depth. For enclosures which must withstand greater pressures or longer period of time, or both, than those specified in the air pressure test, the manufacturer should be consulted. (This sentence is approved as Authorized Engineering Information).
2. Shall exclude water under test conditions which are intended to simulate a hosedown condition.
3. Shall prevent dust, lint, splashing, seepage or external condensation of noncorrosive liquids, and falling water from entering the enclosure.
4. Shall have provision to seal against the loss of air pressure at any conduit entrance.
5. Shall be undamaged after being encased in ice under test conditions.
6. If mounting means are provided, these means shall be external to the equipment cavity.
7. Shall have suitable corrosion protection.

4.10.3 Design Tests

Type 6P enclosures shall be tested and evaluated by the following:

1. Air pressure test described in 6.11.
2. External icing test described in 6.6 (evaluated per 6.6.2.2).
3. Hosedown test described in 6.7.
4. Corrosion protection described in 6.9.

NEMA Standard 5-19-86.

4.11 TYPE 7, 8, 9, and 10 ENCLOSURES

These enclosures are for use in hazardous (classified) locations. See Section 5.

NEMA Standard 1-10-1979.

4.12 TYPE 11 ENCLOSURES

4.12.1 Description and Application

Type 11 enclosures are intended for indoor use primarily to provide a degree of protection against the corrosive effects of liquids and gases. In addition, they protect the enclosed equipment against the corrosive effects of fumes and gases by providing for immersion of the equipment in oil. They shall meet the drip and corrosion-resistance design tests. They are not intended to provide protection against conditions such as internal condensation or internal icing.

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4.12.2 Features and Test Criteria

When completely and properly installed, Type 11 enclosures:

1. Shall provide a degree of protection for the enclosure and also protect the enclosed equipment against dripping, seepage, and external condensation of corrosive liquids.
2. Shall protect the enclosed equipment against corrosive effects of fumes and gases by providing for immersion of the equipment in oil.
3. Shall have conduit hubs or equivalent provisions to exclude water at the conduit entrance.
4. If mounting means are provided, these means shall be external to the equipment cavity.
5. Shall have suitable corrosion protection.

4.12.3 Design Tests

Type 11 enclosures shall be tested and evaluated by the following:

1. Drip test described in 6.3 (evaluated per 6.3.2.2).
2. Corrosion protection test described in 6.9.

NEMA Standard 5-19-1986.

4.13 TYPE 12 ENCLOSURES

4.13.1 Description and Application

Type 12 enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping noncorrosive liquids. They shall meet drip, dust, and rust-resistance design tests. They are not intended to provide protection against conditions such as internal condensation.

4.13.2 Features and Test Criteria

When completely and properly installed, Type 12 enclosures:

1. Shall provide a degree of protection for the enclosed equipment against dirt, dust, lint, light splashes, seepage, dripping of noncorrosive liquids, nonignitable fibers, or noncombustible flyings.
2. Shall have no holes through the enclosure and no conduit knockouts or conduit openings, except that an operating mechanism, that prevents the entrance of oil or dust, shall be permitted to be mounted through holes in the enclosure when provided with oil-resistant gaskets. Doors shall be provided with oil-resistant gaskets and shall have provisions for locking or shall require the use of a tool to gain entry.
3. When intended for wall mounting, shall have mounting means external to the equipment cavity. When intended for floor mounting, they shall have closed bottoms. All closing hardware shall be captive.
4. Shall prevent the entrance of falling water which drips from spouts, one for each 129 square centimeters (20 square inches), at the rate of 20 drops of water per minute for a period of 30 minutes.
5. Shall exclude dust under test conditions which are intended to simulate an indoor industrial environment.
6. Shall not rust when subjected to a salt spray test for 24 hours.

4.13.3 Design Tests

Type 12 enclosures shall be tested and evaluated by the following:

1. Drip test described in 6.3 (evaluated per 6.3.2.2).
2. Indoor dust test described in 6.5.1.2.
3. Rust-resistance test described in 6.8.

NEMA Standard 5-19-1986.

4.14 TYPE 12K ENCLOSURES

4.14.1 Description and Application

Type 12K enclosures with knockouts are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping noncorrosive liquids other than at knockouts. They shall meet drip, dust, and rust-resistance design tests. Knockouts shall be provided only in the top or bottom walls, or both. After installation of the enclosure, the knockout areas shall meet the environmental characteristics listed above. They are not intended to provide protection against conditions such as internal condensation.

4.14.2 Features and Test Criteria

The provisions for Type 12K enclosures shall be the same as for Type 12 enclosures. Dirt, dust, lint, light splashes, nonignitable fibers, and non-combustible flyings shall not enter the enclosure at the knockout locations after properly installed fittings are used.

4.14.3 Design Tests

Type 12K enclosures shall be tested and evaluated by the following:

1. Drip test described in 6.3 (evaluated per 6.3.2.2).
2. Indoor dust test described in 6.5.1.2.
3. Rust-resistance test described in 6.8.

NEMA Standard 5-19-1986.

4.15 TYPE 13 ENCLOSURES

4.15.1 Description and Application

Type 13 enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying

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of water, oil, and noncorrosive coolant. They shall meet oil exclusion and rust-resistance design tests. They are not intended to provide protection against conditions such as internal condensation.

4.15.2 Features and Test Criteria

When completely and properly installed, Type 13 enclosures:

1. Shall provide a degree of protection against limited amounts of lint, dust, seepage, external condensation and spraying of water, oil, or noncorrosive coolant.
2. Shall have oil-resistant gaskets.
3. When intended for wall or machine mounting, shall have mounting means external to the equipment cavity.
4. Shall have no conduit knockouts or unsealed openings providing access into the equipment cavity. All conduit openings shall have provision for the exclusion of oil.
5. Shall exclude a test liquid (water plus wetting agent) under test conditions which are intended to simulate spraying water, oil and noncorrosive coolant.
6. Shall not rust when subjected to a salt spray test for 24 hours.
7. To assure against entry of liquid via the conduit, it is recommended that during installation, the conduit and the wiring in it be tightly sealed at the point of entry to the enclosure by an oil- and coolant-resistant compound or equivalent means. The compatibility of the gasket with other sealing materials and liquids to which it is exposed may have to be determined by tests. (These two sentences are approved as Authorized Engineering Information.)

4.15.3 Design Tests

Type 13 enclosures shall be tested and evaluated by the following:

1. Rust-resistance test described in 6.8.
2. Oil exclusion test described in 6.12.

NEMA Standard 3-8-1985.

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Section 5

DESCRIPTIONS, FEATURES, AND TEST CRITERIA OF ENCLOSURES FOR HAZARDOUS (CLASSIFIED) LOCATIONS

5.1 GENERAL

Type 7 and 10 enclosures, when properly installed and maintained, are designed to contain an internal explosion without causing an external hazard. Type 8 enclosures are designed to prevent combustion through the use of oil-immersed equipment. Type 9 enclosures are designed to prevent the ignition of combustible dust.

Hazardous locations (other than in mines) are classified according to the flammability or combustibility of the materials which may be present and also according to the likelihood that a flammable or combustible concentration is present. (For definitions and classifications see the *National Electrical Code*, Article 500, and ANSI/NFPA 497M, *Classification of Gases, Vapors and Dust for Electrical Equipment in Hazardous (Classified) Locations.* Descriptions and tests in this standards publication cover equipment which is suitable for installation in locations classed as Division 1 or Division 2. In Division 2 locations, other types of protection and enclosures for nonhazardous locations may be installed if the equipment does not constitute a source of ignition under normal operating conditions. (See the specific sections of Articles 501 through 503 of the *National Electrical Code*.)

Enclosures for nonhazardous locations described in Section 4, which have met the requirements of the dust test described in 6.5, may be used in Class II, Group G, Division 2, and Class III, Division 1 and 2 locations.

Hazards may be reduced or eliminated and equipment installed in enclosures suitable for nonhazardous locations by adequate positive pressure ventilation from a source of clean air in conjunction with effective safeguards against ventilation failure. See NFPA 496, *Purged and Pressurized Enclosures for Electrical Equipment*, for detailed requirements.

Authorized Engineering Information 5-19-1986.

5.2 TYPE 7 ENCLOSURES

5.2.1 Description and Application

Type 7 enclosures are for indoor use in locations classified as Class I, Groups A, B, C, or D, as defined in the *National Electrical Code*.

Type 7 enclosures shall be capable of withstanding the pressures resulting from an internal explosion of specified gases, and contain such an explosion sufficiently that an explosive gas-air mixture existing in the atmosphere surrounding the enclosure will not be ignited. Enclosed heat generating devices shall not cause external surfaces to reach temperatures capable of igniting explosive gas-air mixtures in the surrounding atmosphere. Enclosures shall meet explosion, hydrostatic, and temperature design tests.

5.2.2 Features and Test Criteria

When completely and properly installed, Type 7 enclosures:

1. Provide a degree of protection to a hazardous gas environment from an internal explosion or from operation of internal equipment.
2. Do not develop surface temperatures which exceed prescribed limits for the specific gas corresponding to the atmospheres for which the enclosure is intended, when internal equipment is operated at rated load.
3. Withstand a series of internal explosion design tests which determine:
   (a) The maximum pressure effects of the gas mixture.
   (b) Propagation effects of the gas mixtures.
4. Withstand, without rupture or permanent distortion, an internal hydro-static design test based on the maximum internal pressure obtained during explosion tests and on a specified safety factor.
5. Are marked with the appropriate Class and Group(s) for which they have been qualified.

5.2.3 Design Tests

Type 7 enclosures shall be tested and evaluated in accordance with the applicable portions of:

1. ANSI/UL 698, *Industrial Control Equipment for Use in Hazardous Locations*.
2. ANSI/UL 877, *Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G.*
3. ANSI/UL 886, *Outlet Boxes and Fittings for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G.*
4. ANSI/UL 894, *Switches for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G.*

NEMA Standard 1-10-1979.

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5.3 TYPE 8 ENCLOSURES

5.3.1 Description and Application

Type 8 enclosures are for indoor or outdoor use in locations classified as Class I, Groups A, B, C, and D, as defined in the *National Electrical Code*.

Type 8 enclosures and enclosed devices are arranged such that all arcing contacts, connections, and so forth, are immersed in oil. Arcing is confined under the oil such that it will not ignite an explosive mixture of the specified gases in internal spaces above the oil or in the atmosphere surrounding the enclosure. Enclosed heat generating devices shall not cause external surfaces to reach temperatures capable of igniting explosive gas- air mixtures in the surrounding atmosphere. Enclosures shall meet operation and temperature design tests. Enclosures intended for outdoor use shall also meet the rain test.

5.3.2 Features and Test Criteria

When completely and properly installed, Type 8 enclosures:

1. Provide, by oil immersion, a degree of protection to a hazardous gas environment from operation of internal equipment.
2. Do not develop surface temperatures which exceed prescribed limits for the specific gas corresponding to the atmospheres for which the enclosure is intended, when internal equipment is at rated load.
3. Withstand a series of operation design tests, with oil levels arbitrarily reduced and with flammable gas-air mixtures introduced above the oil.
4. When intended for installation outdoors, exclude water when subjected to a water spray design test simulating a beating rain.
5. Are marked with the appropriate Class and Group(s) for which they have been qualified.

5.3.3 Design Tests

Type 8 enclosures shall be tested and evaluated in accordance with the applicable portions of:

1. ANSI/UL 698, *Industrial Control Equipment for Use in Hazardous Locations*.
2. ANSI/UL 877, *Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous Locations, Class I, Groups A, B, D, and D, and Class II, Groups E, F, and G.*
3. Rain test described in 6.4 (evaluated per 6.4.2.2).

NEMA Standard 1-10-1979.

5.4 TYPE 9 ENCLOSURES

5.4.1 Description and Application

Type 9 enclosures are intended for indoor use in locations classified as Class II, Groups E or G, as defined in the *National Electrical Code*.

Type 9 enclosures shall be capable of preventing the entrance of dust. Enclosed heat generating devices shall not cause external surfaces to reach temperatures capable of igniting or discoloring dust on the enclosure or igniting dust-air mixtures in the surrounding atmosphere. Enclosures shall meet dust penetration and temperature design tests, and aging of gaskets (if used).

5.4.2 Features and Test Criteria

When completely and properly installed, Type 9 enclosures:

1. Provide a degree of protection to a hazardous dust environment from operation of internal equipment.
2. Do not develop surface temperatures which exceed prescribed limits for the Group corresponding to the atmospheres for which the enclosure is intended, when internal equipment is operated at rated load.
3. Withstand a series of operation design tests while exposed to a circulating dust-air mixture, to determine that dust does not enter the enclosure and that operation of devices does not cause ignition of the surrounding atmosphere.
4. Are marked with the appropriate Class and Group(s) for which they have been qualified.

5.4.3 Design Tests

Type 9 enclosures shall be tested and evaluated in accordance with the applicable portions of:

1. ANSI/UL 698, *Industrial Control Equipment for Use in Hazardous Locations*.
2. ANSI/UL 877, *Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G.*
3. ANSI/UL 886, *Outlet Boxes and Fittings for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G.*
4. ANSI/UL 894, *Switches for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G.*

NEMA Standard 3-8-1985.

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5.5 TYPE 10 ENCLOSURES (MSHA)

5.5.1 Nonventilated Enclosures

Type 10 enclosures shall be capable of meeting the requirements of the Mine Safety and Health Administration, *30 C.F.R.*, Part 18.

5.5.2 Design Test

The design Test for this type of enclosure shall be in accordance with the Mine Safety and Health Administration, *30 C.F.R.*, Part 18.

NEMA Standard 1-10-1979.

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Section 6

DESIGN TESTS

6.1 GENERAL

The following design tests shall be used to demonstrate conformance with these standards. These design tests do not necessarily duplicate environmental conditions and are not contemplated in normal production. To assure realistic testing, the enclosure and its enclosed equipment shall be mounted as intended for use in service.

NEMA Standard 1-10-1979.

6.2 ROD ENTRY TEST

6.2.1 Method

6.2.1.1 NONVENTILATED ENCLOSURES. This test shall be made by attempting to insert a rod having a diameter of 3.175 millimeters (0.125 inch), except that, if the distance between the opening and nearest live parts is greater than 101.6 millimeters (4 inches), a rod having a diameter greater than 3.175 millimeters (0.125 inch) shall be permitted to enter the opening, but a rod having a diameter greater than 12.7 millimeters (½ inch) shall not be permitted to enter the opening.

6.2.1.2 VENTILATED ENCLOSURES. This test shall be made by attempting to insert a rod having a diameter of 12.7 millimeters (½ inch), except that, if the distance between the openings and the nearest live part is greater than 101.6 millimeters (4 inches), a rod having a diameter greater than 12.7 millimeters (½ inch) shall be permitted to enter the opening, but a rod having a diameter greater than 19 millimeters (¾ inch) shall not be permitted to enter the opening.

6.2.2 Evaluation

The enclosure shall be considered to have met the requirements of this test if the rod cannot enter the enclosure.

NEMA Standard 7-12-1983

6.3 DRIP TEST

6.3.1 Method

The enclosure shall be mounted beneath a drip pan which extends beyond all exposed sides of the enclosure and which produces both splashing and dripping. The bottom of the drip pan shall be equipped with uniformly distributed spouts, one for each 129 square centimeters (20 square inches) of pan area. Each spout shall have a drip rate of approximately 20 drops of water per minute. The enclosure shall be subjected to continuously dripping water for 30 minutes.

6.3.2 Evaluation

The enclosure shall be considered to have met the requirements of this test if the evaluation is either 6.3.2.1 or 6.3.2.2 below:

6.3.2.1 There is no significant accumulation of water within the enclosure and no water has entered the enclosure at a level higher than the lowest live part, except that water shall be permitted to enter above live parts if the equipment is so constructed that no water is visible on the live parts, insulating material, or mechanism parts and no water has entered any space above the live parts within the enclosure in which wiring may be present under any proper installation conditions.

6.3.2.2 No water has entered the enclosure.

NEMA Standard 7-12-1983.

6.4 RAIN TEST

6.4.1 Method

The complete enclosure shall be mounted with the conduit connected but without using pipe thread sealing compound. Rigid conduit shall be threaded into the opening in the enclosure and tightened with torques as specified in Table 6-1.

A continuous water spray, using as many nozzles as required, shall be applied against the entire top and all exposed sides of the enclosure for 1 hour at a rate of at least 457 millimeters (18 inches) per hour at an operating pressure of 0.352 kilograms per square centimeter (5 pounds per square inch). The rate shall be determined by measuring the rise of water in a straight-sided pan which has been placed horizontally and completely within the area covered by the falling water. A rain test which is performed in accordance with UL Bulletin of Research #23, *Rain Tests of Electrical Equipment*, shall be considered to be equivalent to this test.

Table 6-1
TORQUE VALUES

Torque Kilogram-Centimeters (Pound-inches)	Nominal Size of Conduit (inches)
922 (800)	¾ and smaller
1152 (1000)	1, 1¼ and 1½
1844 (1600)	2 and larger

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6.4.2 Evaluation

The enclosure shall be considered to have met the requirements of this test if the evaluation is either 6.4.2.1 or 6.4.2.2 below:

6.4.2.1 There is no significant accumulation of water within the enclosure and no water has entered the enclosure at a level higher than the lowest live part, except that water shall be permitted to enter above live parts if the equipment is so constructed that no water is visible on the live parts, insulating material, or mechanism parts and no water has entered any space above the live parts within the enclosure in which wiring may be present under any proper installation conditions.

6.4.2.2 No water has entered the enclosure.

NEMA Standard 3-8-1985.

6.5 DUST TEST

6.5.1 Methods

6.5.1.1 Outdoor Dust Test

1. *Dust-Blast Method*. The enclosure shall be subjected to a blast of compressed air mixed with dry Type 1 general-purpose Portland cement,† using a suction-type sand blast gun which is equipped with a 4.76-millimeter (3/16 inch) diameter air jet and a 9.52-millimeter (3/8 inch) diameter nozzle. The air shall be dry and at a pressure of 16.07 to 17.86 kilograms per square centimeter (90 to 100 pounds per square inch). The cement shall be supplied by a suction feed.

   Not less than 5.95 kilograms of cement per linear meter (4 pounds of cement per linear foot) of test length* of the test specimen shall be applied at a rate of 2.27 kilograms (5 pounds) per minute. The nozzle shall be held from 305 to 381 milimeters (12 to 15 inches) away from the enclosure, and the blast of air and cement shall be directed at all points of potential dust entry, such as seams, joints, external operating mechanisms, and so forth. A conduit shall be permitted to be installed to equalize the internal and external pressures.
2. *Hose Method (Alternate to Dust-Blast Method)*. The enclosure and its external mechanisms shall be subjected to a stream of water from a hose which has a 25.4-millimeter (1 inch) nozzle and which delivers at least 170 liters (45 gallons) per minute. The water shall be directed at all joints, from all angles, from a distance of 3.05 to 3.65 meters (10 to 12 feet) for a period of time equal to 48 seconds times the test length* or a minimum of 5 minutes. A conduit shall be permitted to be installed to equalize internal and external pressures but shall not serve as a drain.

6.5.1.2 Indoor Dust Test

1. *Circulating Dust Method*. The enclosure shall be placed in its intended mounting position in an air-tight chamber having an internal volume not less than 0.17 cubic meters (6 cubic feet), and dimensions not less than 150 percent of the dimensions of the enclosure under test (length, width, and height). The test chamber is to be maintained at ambient room temperature and 20–50 percent relative humidity.

   Approximately 0.04 kilograms (1.5 ounces) of dry Type 1 general-purpose Portland cement per cubic foot of test chamber is to be circulated by means of a blower suction unit for five minutes so as to completely envelop the enclosure under test. The air velocity at the outlet of the blower is to be maintained at approximately 5m/s (1000 ft/min).
2. *Atomized-Water Method (Alternate to Circulating Dust Method)*. The enclosure shall be subjected to a spray of atomized water, using a nozzle which produces a round pattern 76 to 102 millimeters (3 to 4 inches) in diameter when measured 305 millimeters (12 inches) from the nozzle. The air pressure shall be 2.11 kilograms per square centimeter (30 pounds per square inch). The water shall be supplied by a suction feed with a siphon height of 102 to 203 millimeters (4 to 8 inches).

†Type 1 general-purpose Portland cement is readily available and has a controlled maximum particle size. The analysis of a typical sample is given below. (This footnote and table are approved as Authorized Engineering Information):

*Test length is the summation of the height plus the width plus the depth, for example, test length = H + W + D (in feet).

PARTICLE SIZE

Mesh	Millimeters (Inches)	Percent Content
Coarser than 200	Larger than 0.0736 (0.0029)	3
200	0.0736 (0.0029)	8
325	0.0432 (0.0017)	7
400	0.0381 (0.0015) or smaller	82

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Not less than 4.85 milliliters per linear centimeter (5 ounces per linear foot) of test length* of the test specimen shall be applied at a rate of 11.35 liters (3 gallons) per hour. The nozzle shall be held from 305 to 381 millimeters (12 to 15 inches) away from the enclosure, and the spray of water shall be directed at all points of potential dust entry, such as seams, joints, external operating mechanisms, etc.** A conduit shall be permitted to be installed to equalize the internal and external pressures but shall not serve as a drain.

3. *Settling Airborne Dust Method.* At least 0.029 kilograms (0.85 ounces) of Dry Type 1 General Purpose Portland cement per cubic foot of test chamber is to be circulated by means of a blower suction unit so as to completely envelop the enclosure under test. The air velocity at the outlet of the blower is to be 304.8 meters/minute (1000 ft./minute), with the blower cycled for 15 seconds on and 30 seconds off, for seven complete cycles.
4. *Atomized-Water Method (Alternate for Settling Airborne Dust Method.* The enclosure shall be subjected to a spray of atomized water, using a nozzle that produces a round pattern 76 to 102 millimeters (3 to 4 inches) in diameter when measured 305 millimeters (12 inches) from the nozzle. The air pressure shall be 1.76 kilograms per square centimeter (25 pounds per square inch). A quantity of 2.91 milliliters (3 ounces) of water shall be applied over each 305 linear millimeters (12 inches) of seam being tested in 28 seconds at a flowrate of 11.35 liters per hour (3 gallons per hour).

   The nozzle shall be held from 457 to 533 millimeters (18 to 21 inches) away from the enclosure and the spray of water shall be directed at all points of potential settling airborne dust entry such as seams, joints, external operating mechanisms, and such. A conduit shall be permitted to be installed to equalize the internal and external pressure, but shall not serve as a drain.

   The test specimen shall have at least one seam representative of each of the types of seams of the enclosure(s). A seam is the junction of, or the joint between, two pieces. When two covers or doors are adjacent, their common edges shall be considered a single seam.

6.5.2 Evaluation

The enclosure shall be considered to have met the requirements of this test if no dust or water has entered the enclosure.

NEMA Standard 5-25-1988.

6.6 EXTERNAL ICING TEST

The enclosure shall be mounted in a room which can be cooled to −7 °C (20 °F). A metal test bar which is 25.4 millimeters (1 inch) in diameter and 610 millimeters (2 feet) long shall be mounted in a horizontal position in a location where it will receive the same general water spray as the enclosure under test.

Provision shall be made for spraying the entire enclosure from above with water at an angle of approximately 45 degrees from the vertical. The water shall be between 0 °C (32 °F) and 3 °C (37 °F). [As a guide, spraying facilities which provide between 40.74 and 81.5 liters per hour per square meter (1 and 2 gallons per hour per square foot) of area to be sprayed have been found effective. (This sentence is approved as Authorized Engineering Information.)

The room temperature shall be lowered to 2 °C (35 °F). The spray of water shall be started and continued for at least 1 hour, maintaining the room temperature between 1 °C (33 °F) and 3 °C (37 °F).

At the end of this time, the room temperature shall be lowered to between −7 °C (20 °F) and −3 °C (27 °F) without discontinuing the water spray. (The rate of change in the room temperature is not critical and shall be whatever is obtainable with the cooling means employed.) The water spray shall be controlled so as to cause ice to build up on the bar at a rate of approximately 6.35 millimeters (¼ inch) per hour and shall be continued until 19 millimeters (¾ inch) of ice has formed on the top surface of the bar. The spray shall then be discontinued, but the room temperature shall be maintained between −7 °C (20 °F) and −3 °C (27 °F) for 3 hours to assure that all parts of the enclosure and ice coatings have been equalized to a constant temperature.

6.6.2 Evaluation

The enclosure and its external mechanisms shall be considered to have met the requirements of this test if:

6.6.2.1 While ice laden, they can be manually operated by one person without any damage to the enclosure, the enclosed equipment, or mechanism. When an auxiliary mechanism is provided to break the ice, it shall be included and utilized in the test. A separate test is required for each maintained position of each external operator. If necessary, it shall be possible to gain access to the enclosure interior using an appropriate hand tool without causing functional damage to the enclosure.

6.6.2.2 They are found to be undamaged after the ice has melted. Enclosures which have no external cavities to trap water when mounted in the normal position shall be considered to be acceptable and need not be tested.

NEMA Standard 7-12-1983.

*Test length is the summation of the height plus the width plus the depth, for example, test length = H + W + D (in feet).

**Metal-to-metal joints with a ground contact surface meeting the requirements for a Type 9 enclosure shall not be tested. Ungasketed shaft openings that have a length-of-path not less than 12.7 millimeters (½ inch) shall not be tested if the total (diametric) clearance between the shaft and the opening is not more than 0.127 millimeters (0.005 inch) per 12.7-millimeter (½-inch) length-of-path. These joints and openings shall be protected by external means during the atomized-water test.

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6.7 HOSEDOWN TEST

6.7.1 Method

The enclosure and its external mechanisms shall be subjected to a stream of water from a hose which has a 25.4-millimeter (1 inch) nozzle and which delivers at least 246 liters (65 gallons) per minute. The water shall be directed at all joints from all angles from a distance of 3.05 to 3.65 meters (10 to 12 feet) for a period of time equal to 48 seconds times the test length* for a minimum of 5 minutes.** A conduit shall be permitted to be installed to equalize internal and external pressures but shall not serve as a drain.

6.7.2 Evaluation

The enclosure shall be considered to have met the requirements of this test if no water has entered the enclosure.

An enclosure complying with the hosedown test complies with the dust test described in 6.5 without further testing.

NEMA Standard 5-19-1986.

6.8 RUST-RESISTANCE TEST

The rust-resistance test shall apply to all enclosures incorporating external ferrous parts. Nonferrous enclosures with no external ferrous parts need not be tested.

The enclosures or representative parts of enclosures shall be subjected to salt spray (fog) as described below:

6.8.1 Method

1. *Test Apparatus.* The test apparatus shall:
   a. Consist of a fog chamber, a salt-solution reservoir, a supply of compressed air, atomizing nozzles, support for the enclosure, provision for heating the chamber, and means of control.
   b. Not permit drops of solution which accumulate on the ceiling or cover of the chamber to fall on the enclosure being tested.
   c. Not permit drops of solution which fall from the enclosure to be returned to the solution reservoir for respraying.
   d. Be constructed of materials which will not affect the corrosiveness of the fog.
2. *Salt Solution.* The salt solution shall be prepared by dissolving 5 + 1 parts by weight of salt in 95 parts of either distilled water or water containing not more than 200 parts per million of total solids. The salt shall be sodium chloride which is substantially free of nickel and copper and which contains, when dry, not more than 0.1 percent of sodium iodide and not more than 0.3 percent of total impurities.
3. *Air Supply.* The compressed air supply to the nozzle(s) for atomizing the salt solution shall be free of oil and dirt and maintained between 0.7 and 1.76 kilogram per square centimeter (10 and 25 pounds per square inch).
4. *Condition in the Salt Spray Chamber.* The temperature of the salt spray chamber shall be maintained at 35 °C (95 °F), plus 1.1 °C (2 °F) or minus 1.66 °C (3 °F). The nozzle(s) shall be directed or baffled so that none of the spray can impinge directly on the enclosure being tested.
5. *Continuity of Test.* The test shall be run continuously for 24 hours; for example, the chamber shall be closed and the spray operated continuously except for the short daily interruption necessary to inspect, rearrange, or remove the test specimens, to check and replenish the solution in the reservoir, and to make necessary recordings.
6. *Cleaning and Inspection of Tested Enclosure.* At the end of the test, the specimens shall be removed from the chamber and washed in clean running water which is not warmer than 37.7 °C (100 °F) to remove salt deposits from their surface, and then dried immediately. Corrosion products, other than rust, shall be permitted to be removed by light brushing if required, to observe the condition of the underlying stratum.

6.8.2 Evaluation

The enclosure shall be considered to have met the requirements of this test if there is no rust except at those points where protection is impractical, such as machined and mating surfaces of cast enclosures and sliding surfaces of hinges, shafts, and so forth.

NEMA Standard 7-12-1983.

6.9 CORROSION PROTECTION

Sheet-steel enclosures shall be evaluated in accordance with the requirements of UL 50, Part 13 Protection Against Corrosion. Enclosures of other materials shall meet the corrosion-protection requirements of UL 508, 5.9 or 5.10.

NEMA Standard 5-19-1986.

6.10 SUBMERSION TEST

6.10.1 Method

The complete enclosure shall be mounted in a tank with the conduit connected using pipe-thread sealing compound. The conduit shall be tightened with the torque specified in Table 6-1. The tank shall be filled with water so that the highest point of the enclosure is 1.83 meters (6 feet) below the surface of the water. After 30 minutes, the enclosure shall be removed from the tank, the excess

*Test length is the summation of the height plus the width plus the depth, for example, test length = H + W + D (in feet).

**Metal-to-metal joints with a ground contact surface meeting the requirements for a Type 9 enclosure shall not be tested. Ungasketed shaft openings that have a length-of-path not less than 12.7 millimeters (½ inch) shall not be tested if the total (diametric) clearance between the shaft and the opening is not more than 0.127 millimeters (0.005 inch) per 12.7-millimeter (½-inch) length of path. These joints and openings shall be protected by external means during the atomized-water test.

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water removed from the surface of the enclosure, and the enclosure opened. The enclosure need not be submersed to a depth of 1.83 meters (6 feet) if an equivalent pressure differential between the interior and the exterior of the enclosure is maintained for the required period of time. This differential shall be permitted to be achieved either by reducing the air pressure inside the enclosure or pressurizing the water surrounding the enclosure.

6.10.2 Evaluation

The enclosure shall be considered to have met the requirements of this test if no water has entered the enclosure.

NEMA Standard 7-12-1983.

6.11 AIR PRESSURE TEST

6.11.1 Method

1. *Internal Pressurization Test (Alternate to External Pressurization Test).* The complete enclosure with conduit connected shall be pressure tested with an internal air pressure of 0.422 kilogram per square centimeter (6 psig) for a 24-hour period without permanent deformation. The conduit shall be connected using pipe-thread sealing compound and shall be tightened with the torque specified in Table 6-1.
2. *External Pressurization Test (Alternate to Internal Pressurization Test).* When the enclosure to be tested does not have connections for pressurizing the interior, the enclosure shall be permitted to be qualified by submersing the complete enclosure, connected as intended for use, in water so that the highest point of the enclosure is 1.83 meters (6 feet) below the surface for a period of 24 hours. The enclosure need not be submersed to a depth of 1.83 meters (6 feet) if the equivalent pressure differential between the interior and exterior of the enclosure is maintained for the required period of time. This differential shall be permitted to be achieved by pressurizing the water around the enclosure to simulate a depth of 1.83 meters (6 feet).

6.11.2 Evaluation

1. *Evaluation of Internal Pressurization Test.* The enclosure shall be considered to have met the requirements of this test if the pressure drop does not exceed 0.14 kilogram per square centimeter (2 psig).
2. *Evaluation of External Pressurization Test.* The enclosure shall be considered to have met the requirements of this test if no water has entered the enclosure.

NEMA Standard 7-12-1983.

6.12 OIL EXCLUSION TEST

6.12.1 Method

The enclosure shall be subjected to a stream of test liquid through a nozzle which has a 9.5-millimeter (⅜ inch) diameter opening and which delivers at least 7.57 liters (2 gallons) per minute. The test liquid shall consist of water to which has been added a wetting agent to a concentration of approximately 0.1 percent by weight (or by volume if the wetting agent is liquid).

The stream shall be directed upon the enclosure from all angles from a distance of 305 to 457 millimeters (12 to 18 inches) for 30 minutes. If the enclosure houses an externally operated device, the device shall be operated at a rate of approximately 30 operations per minute for the duration of the test. A conduit shall be permitted to be installed to equalize internal and external pressures but shall not serve as a drain.

6.12.2 Evaluation

The enclosure shall be considered to have met the requirements of this test if no test liquid has entered the enclosure.

NEMA Standard 7-12-1983.

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Section 7

ENCLOSURE CONSTRUCTION REQUIREMENTS

For manufacturing standards of enclosures, see the appropriate NEMA product standards publications for enclosures for specific products. Refer to the most current NEMA Standards Publications Catalog for a complete listing of all NEMA product publications on enclosures.

NEMA Standard 1-10-1979.

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Appendix A

COMPARISON BETWEEN NEMA ENCLOSURE TYPE NUMBERS AND IEC ENCLOSURE CLASSIFICATION DESIGNATIONS

IEC Publication 529 *Classification of Degrees of Protection Provided by Enclosures* provides a system for specifying the enclosures of electrical equipment on the basis of the degree of protection provided by the enclosure. IEC 529 does not specify degrees of protection against mechanical damage of equipment, risk of explosions, or conditions such as moisture (produced for example by condensation), corrosive vapors, fungus, or vermin. NEMA Standards Publication 250 does test for environmental conditions such as corrosion, rust, icing, oil, and coolants. For this reason, and because the tests and evaluations for other characteristics are not identical, the IEC Enclosure Classification Designations cannot be exactly equated with NEMA Enclosure Type Numbers.

The IEC designation consists of the letters IP followed by two numerals. The first characteristic numeral indicates the degree of protection provided by the enclosure with respect to persons and solid foreign objects entering the enclosure. The second characteristic numeral indicates the degree of protection provided by the enclosure with respect to the harmful ingress of water.

Table A-1 provides an equivalent conversion *from* NEMA Enclosure Type Numbers *to* IEC Enclosure Classification Designations. The NEMA Types meet or exceed the test requirements for the associated IEC Classifications; *for this reason Table A-1 cannot be used to convert from IEC Classifications to NEMA Types.*

Table A-1
CONVERSION OF NEMA TYPE NUMBERS TO IEC CLASSIFICATION DESIGNATIONS
(Cannot be used to convert IEC Classification Designations to NEMA Type Numbers)

NEMA Enclosure Type Number	IEC Enclosure Classification Designation
1	IP10
2	IP11
3	IP54
3R	IP14
3S	IP54
4 and 4X	IP56
5	IP52
6 and 6P	IP67
12 and 12K	IP52
13	IP54

NOTE: This comparison is based on tests specified in IEC Publication 529.

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Appendix B

LIST OF MEMBER COMPANIES OF THE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION WHO PARTICIPATED IN THE DEVELOPMENT OF PUBLICATION NO. 250-1985

CONDUIT FITTINGS SECTION

Adalet-PLM
Div. of Scott & Fetzer Co.
Cleveland, OH 44135

American Electric
Construction Materials Group
FL Industries Inc.
Pittsburgh, PA 15230

Appleton Electric Company
Chicago, IL 60657

Arlington Industries, Inc.
Miami, FL 33166

Burger Industries, Inc.
Maspeth, NY 11378

Bridgeport Fittings, Inc.
Bridgeport, CT 06601

Challenger Electrical Materials, Inc.
Parkersburg, WV 26101

Crouse-Hinds Distribution Equipment
Division of Cooper Industries, Inc.
Syracuse, NY 13221

Dynacast Company
Yorktown Heights, NY 10598

Electroline Manufacturing Company
Cleveland, OH 44128

O-Z Gedney Company
Unit of General Signal Corp.
Teryville, CT 06786

Greenlee Tool Company
Rockford, IL 61109-2988

The Halex Company
Division of Scott & Fetzer Company
Cleveland, OH 44146

Kellems Div.
Hubbell Incorporated
Stonington, CT 06378

Killark Electric Manufacturing Co.
Subsidiary of Hubbell Inc.
St. Louis, MO 63115

Korlec, Inc.
Elk Grove, IL 60007

Minerallac Electric Company
Addison, IL 60101

M & W Electric Mfg. Company, Inc.
East Palestine, OH 44413

Myers Electric Products, Inc.
Montebello, CA 90640

Neer Manufacturing Company, Inc.
Lexington, OH 44904

Producto Electric Corp.
Orangeburg, NY 10962

Raco, Inc.
Subsidiary of Hubbell Inc.
South Bend, IN 46634

Red Dot Division
L.E. Mason Company
Boston, MA 02136

Regal Manufacturing Company
Division of Crefton
Industry, CA 91749

Robroy Industries, Inc.
Verona, PA 15147

Thepitt Manufacturing Company
Meadow Lands, PA 15347

Thomas & Betts Corp.
Bridgewater, NJ 08807-0993

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DRY-TYPE AND SPECIALTY TRANSFORMER SECTION

Acme Electric Company
Lumberton, NC 28358

BBC Brown Boveri, Inc.
Spring House, PA 19477

Challenger Electrical Equipment Corp.
Jackson, MS 39205

GE Company
Fort Wayne, IN 46801

Hevi-Duty Electric
A Unit of General Signal Corp.
Goldsboro, NC 27530

International Transformer Corp.
Montebello, CA 90640

Matra Electric Corp.
Compton, CA 90224

MGM Transformer Company
5665-A Smithway
Commerce, CA 90040

National Industri Transformers, Inc.
Hampton, VA 23661

Neco Hammond, Inc.
Baraboo, WI 53913

Niagara Transformer Corp.
Buffalo, NY 14225

Southern Transformer Company
East Point, GA 30344

Square D Company
Palatine, IL 60067

R.E. Utegraff Manufacturing Company
Scottsdale, PA 15683

Westinghouse Electric Corp.
Pittsburgh, PA 15220

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INDUSTRIAL CONTROL AND SYSTEMS SECTION OF THE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

MEMBER COMPANIES

Allen-Bradley Company
Milwaukee, WI 53201

Alsthom International, Inc.
Entrelec Division
Spring Valley, NY 10977

Amerace Corporation
Livingston, NJ 07039

Asea Controls
Wichita Falls, TX 76302

Automatic Switch Company
Florham Park, NJ 07932

Balluff Inc.
Florence, KY 41042

Challenger Electrical Equip. Corp.
Raleigh, NC 27609

Cooper Industries, Inc.
Arrow-Hart Components Products
Hartford, CT 06105

Curtis Industries, Inc.
Milwaukee, WI 53218-0699

Custom Switchgear & Controls
Santa Clara, CA 95051

Cutler-Hammer Products
Eaton Corporation
Milwaukee, WI 53216

Delco Products Division
General Motors Corporation
Dayton, OH 45401-1042

Dialight Company
Manasquan, NJ 08736

Electrical Power Systems Inc.
Tulsa, OK 74131

Electro Switch Corporation
Weymouth, MA 02188

Elliott Control Company
Hollister, CA 95024-1329

Emerson Electric Company
Grand Island, NY 14072

Furnas Electric Company
Batavia, IL 60510

GE
Bloomington, IL 61701

GEC Automation Projects Inc.
Macon, GA 31206

General Signal Corporation
Nelson Electric Unit
Tulsa, OK 74101

G & L Electronics
Fond du Lac, WI 54935

Gould, Inc.
Industrial Automation Systems Group
North Andover, MA 01845

GTE Products Corporation
Control Device Operation
Standish, ME 04084

Harnischfeger Corporation
Milwaukee, WI 53201

Honeywell, Inc.
Industrial Programmable Control Div.
York, PA 17405-0934

Hubbell Incorporated
Industrial Controls Division
Madison, OH 44057

Joslyn Clark Controls Inc.
Lancaster, SC 29720

Klockner-Moeller Corporation
Natick, MA 01760

The Kohler Company
Kohler, WI 53044

Kulka Smith, Inc.
Manasquan, NJ 08736

McGill Manufacturing Company, Inc.
Valparaiso, IN 46383

Micro Switch
Division of Honeywell, Inc.
Freeport, IL 61032

Namco Controls Division
An Acme Cleveland Company
Mentor, OH 44060

Onan Corporation
Minneapolis, MN 55432

Pass & Seymour, Inc.
Syracuse, NY 13221

The Planum Technology Corporation
Hillside, NJ 07205

Reliance Electric Company
Athens, GA 30613-1299

Robicon Corporation
Pittsburgh, PA 15239

Russelectric Inc.
Hingham, MA 02043

Siemens Energy & Automation, Inc.
Atlanta, GA 30346-9000

Sprecher & Schuh, Inc.
S & S Controls Division
Houston, TX 77060

Square D Company
Palatine, IL 60067

R. Stahl, Inc.
Woburn, MA 01801

Telemecanique, Incorporated
Westminster, MD 21157

Texas Instruments, Inc.
Attleboro, MA 02703

Toshiba International Corporation
Houston, TX 77041

Turck Multiprox, Inc.
Minneapolis, MN 55441-0630

Underwriters Safety Device
An Allied Company
Chicago, IL 60656

Weidmuller, Inc.
Richmond, VA 23236

Westinghouse Electric Corporation
Pittsburgh, PA 15222

Zenith Controls, Incorporated
Chicago, IL 60609

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American Circuit Breaker Corporation
Albemarle, NC 28001

Challenger Electrical Equip. Corp.
Malvern, PA 19355

Electrical Distribution Products Div.
Cooper Industries, Inc.
Charlottesville, VA 22906

Eaton Corp./Cutler-Hammer Products
Milwaukee, WI 53216

GE
Plainville, CT 06062

Heinemann Electric Company
Lawrenceville, NJ 08648-0800

Klockner-Moeller Corporation
Natick, MA 01760

LCB Corp.
Miami, FL 33014

Siemens Energy & Automation
Circuit Protection Div.
Tucker, GA 30084

Square D Company
Palatine, IL 60067

Unicorn Electrical Products
Anaheim, CA 92806

The Wadsworth Electric Mfg. Co., Inc.
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Portland, OR 97223

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Santa Clara, CA 95051

Eaton Corp./Cutler-Hammer Products
Milwaukee, WI 53216

Electrical Distribution Products Div.
Cooper Industries, Inc.
Florence, KY 41042

Erickson Electrical Equipment Co.
Elk Grove Village, IL 60007

GE
Plainville, CT 06062

Hubbell, Inc.
Orange, CT 06477

Milbank Manufacturing Company
Kansas City, MO 64141-0028

Penn Panel & Box Company
Collingdale, PA 19023

Power Controls, Inc.
Commerce, CA 90040

The Pringle Electrical Mfg. Company
Fort Washington, PA 19034

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City of Industry, CA 91748

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The Wadsworth Electric Mfg. Co., Inc.
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Westinghouse Electric Corporation
Beaver, PA 15220

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Amerace-Corporation
Russellstroll Division
Livingston, NJ 07039

Appleton Electric Company
Chicago, IL 60657

Crouse-Hinds Distribution Equipment
Division of Cooper Industries, Inc.
Syracuse, NY 13221

Daniel Woodhead Company
Subsidiary of Woodhead Industries, Inc.
Northbrook, IL 60062

Hubbell Incorporated
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Malvern, PA 19355

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Florence, KY 41042

Eaton Corporation
Cutler-Hammer Products
Milwaukee, WI 53216

GE
Plainville, CT 06062

The Pringle Electrical Mfg. Company
Fort Washington, PA 19034

Siemens Energy & Automation
Circuit Protection Div.
Tucker, GA 30084

Square D Company
Palatine, IL 60067

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METER MOUNTING AND TEST EQUIPMENT GROUP

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Portland, OR 97223

Cooper Industries, Inc.
Electrical Distribution Products Div.
Florence, KY

The Eastern Specialty Company, Inc.
Phildelphia, PA 19140

General Electric Company
Somerworth, NH 03878

Landis & Gyr Metering Inc.
Lafayette, IN 47903

Meter Devices Co., Inc.
Canton, OH 44706

Milbank Manufacturing Company
Kansas City, MO 64210

Siemens Energy & Automation, Inc.
Tucker, GA 30084

Superior Technology Inc.
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NEMA STANDARDIZATION

The purpose of NEMA Standards, their classification and status, are set forth in certain clauses of the NEMA Bylaws, which are quoted below:

Purpose of Standards

National Electrical Manufacturers Association Standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining the proper product for its particular need. Existence of a National Electrical Manufacturers Association Standard does not in any respect preclude any member or nonmember from manufacturing or selling products not conforming to the standard.

(Bylaw—Art. V, Sec. 1)

Definition of a Standard

A standard of the National Electrical Manufacturers Association defines a product, process, or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, rating, testing, and the service for which they are designed.

(Bylaw—Art. V, Sec. 2, Subsection A)

Dimensions

Where dimensions are given for interchangeability purposes, alternate dimensions satisfying the other provisions of the standards publication may be capable of otherwise equivalent performance.

(NEMA Policy Memorandum 84-2, dated June 7, 1984)

Classes of Standards

National Electrical Manufacturers Association Standards are of two classes:

1. NEMA Standard, which relates to a product commercially standardized and subject to repetitive manufacture, which standard has been approved by at least 90 percent of the members of the Subdivision eligible to vote thereon;
2. Suggested Standard for Future Design, which may not have been regularly applied to a commercial product, but which suggests a sound engineering approach to future development, which standard has been approved by at least two-thirds of the members of the Subdivision eligible to vote thereon.

(Bylaw—Art. V, Sec. 6, 1st Sentence)

Authorized Engineering Information

Authorized Engineering Information consists of explanatory data and other engineering information of an informative character not falling within the classification of NEMA Standard or Suggested Standard for Future Design.

(Bylaw—Art. V, Sec. 6, 1st Sentence)

Official Standards Proposal

An Official Standards Proposal is an official draft of a proposed standard which is formally recommended to an outside organization(s) for consideration, comment, and/or approval.

(Bylaw—Art. V, Sec. 4, Subsection A)

Identification of Status

Standards in NEMA Standards Publications are identified in the foreword or following each standard as "NEMA Standard" or "Suggested Standard for Future Design." These indicate the status of the standard. These words are followed by a date which indicates when the standard was adopted in its present form by the Association.

The material identified as "Authorized Engineering Information" and "Official Standards Proposal" is designated similarly.

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