

Technical Appendix

Approvals And Standards

Standards and ratings have been developed in cooperation with specific industries, insurance groups, companies and official certification agencies.

ANSI *American National Standards Institute*

ANSI is the U.S. representative of the two major non-treaty international standards organizations, ISO (International Organization for Standardization) and, through the U.S. National Committee, the IEC.

ANSI—American National Standards Institute
11 West 42nd Street
New York, NY 10036

ASTM *American Society for Testing and Materials*

Organized in 1898, ASTM provides a forum for producers, users, consumers, government representatives and others to develop standards for materials, products, systems and services. More than 32,000 volunteer members, comprising 131 committees, develop the 10,000-plus standards published by ASTM each year.

ASTM—American Society for Testing & Materials
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
610-832-9585
www.astm.org

CSA *Canadian Standards Association*

CSA is an independent, not-for-profit organization which operates nationally and internationally in standards development, product certification, and quality registration.

CSA—Canadian Standards Association
178 Rexdale Blvd
Etobicoke, Ontario
M9W 1R3
1-800-463-6727
416-747-4044

IEC *International Electrotechnical Commission*

The IEC is the global organization that prepares and publishes international standards for all electrical, electronic, and related technologies. It also operates worldwide schemes for assessing conformity to those standards. The IEC membership includes all the world's major trading nations (including the USA) and a growing number of industrializing countries.

IEC—International Electrotechnical Commission
3, rue de Varembe', 1211 Geneva 20, Switzerland
Telephone: 41-22-919-0211
Fax: 41-22-919-0300
www.iec.ch

NEC *National Electrical Code*

Sponsored by the National Fire Protection Association (NFPA), the NEC is purely advisory as far as NFPA and ANSI are concerned. However, many local electrical inspectors and enforcement officers use the NEC to strict interpretation.

NEC—National Electrical Code
7310 West McNab Road, Suite 201
Tamarac, FL 33321
1-888-NEC-CODE
www.mikeholt.com

NEMA *National Electrical Manufacturers Association*

Developed to standardize electrical wiring and controls in U.S. manufacturing. NEMA sets specific areas, goals, and ratings that are aimed directly at improving safety.

NEMA—National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, VA 22209
703-841-3200
703-841-3300 Fax

SAE International *Society of Automotive Engineers*

SAE publishes many books, technical papers, and standards on a wide variety of subjects related to the automotive and aerospace industries.

SAE—Society of Automotive Engineers
400 Commonwealth Drive
Warrendale, PA 15096-0001
412-776-4970
412-776-0790 Fax
www.sae.org

TÜV Rheinland

TÜV Rheinland is an independent testing and quality certification organization with over 6,000 employees worldwide and offices in more than 30 countries. TÜV Rheinland's services focus on providing safety and reliability for people, technology and the environment.




TÜV Rheinland of North America
12 Commerce Road
Newtown, CT 06470
1-TUV-WRLD-WID (1-888-975-3945)

UL *Underwriters Laboratories*

UL was originally formed out of the need for uniform supervision and standards found to be lacking during the rise of the electrical industry at the turn of the century. Today UL has developed into one of the largest and most respected testing organizations in the world. (CUL—Canadian Underwriters Labs)

Underwriters Laboratories
33 Pfingston Road
Northbrook, IL 60062

NEMA, UL And CSA Standards

Enclosure rating	NEMA National Electrical Manufacturers Association (NEMA 250) 	UL Underwriters Laboratories, Inc. (UL 50 and 508) 	CSA Canadian Standards Association (C22.2 No.94-M91) 
Type 1	Enclosures are intended for indoor use primarily to provide a degree of protection against the contact with the enclosed equipment.	Indoor use primarily to provide protection against contact with the enclosed equipment and against a limited amount of falling dirt.	General purpose enclosure. Protects against accidental contact with live parts.
Type 2	Enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.	Indoor use to provide a degree of protection against contact with the enclosed equipment and against a limited amount of falling dirt.	Indoor use to provide a degree of protection against dripping and light splashing of noncorrosive liquids, and falling dirt.
Type 3	Enclosures are intended for outdoor use primarily to provide a degree of protection against rain, sleet, windblown dust, and damage from external ice formation.	Outdoor use to provide a degree of protection against windblown dust and windblown rain; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use to provide a degree of protection against rain, snow, and windblown dust; undamaged by the external formation of ice on the enclosure.
Type 3R	Enclosures are intended for outdoor use primarily to provide a degree of protection against rain, sleet, and damage from external ice formation.	Outdoor use to provide a degree of protection against falling rain; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use to provide a degree of protection against rain, snow; undamaged by the external formation of ice on the enclosure.
Type 4	Enclosures are intended for indoor and outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, hose-directed water, and damage from external ice formation.	Indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use to provide a degree of protection against rain, snow, and windblown dust, splashing and hose-directed water; undamaged by the external formation of ice on the enclosure.
Type 4X	Enclosures are intended for indoor and outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, hose-directed water, and damage from external ice formation.	Indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure; resists corrosion.	Indoor or outdoor use to provide a degree of protection against rain, snow, and windblown dust, splashing and hose-directed water; undamaged by the external formation of ice on the enclosure; resists corrosion.
Type 6	Enclosures are intended for indoor and outdoor use primarily to provide a degree of protection against hose-directed water, the entry of water during occasional temporary submersion at a limited depth, and damage from external ice formation.	Indoor or outdoor use to provide a degree of protection against entry of water during temporary submersion at a limited depth; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use to provide a degree of protection against entry of water during temporary submersion at a limited depth; undamaged by the formation of ice on the enclosure.
Type 12	Enclosures are intended for indoor use primarily to provide a degree of protection against circulating dust, falling dirt, and dripping non-corrosive liquids.	Indoor use to provide a degree of protection against dust, dirt, fiber flyings, dripping water, and external condensation of non-corrosive liquids.	Indoor use primarily to provide a degree of protection against circulating dust, lint, fibers, and flyings; dripping and light splashing of noncorrosive liquids; not provided with knockouts.
Type 13	Enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying water, oil and non-corrosive liquids.	Indoor use to provide a degree of protection against lint, dust seepage, external condensation and spraying of water, oil, non-corrosive liquids.	Indoor use primarily to provide a degree for protection against circulating dust, lint, fibers, and flyings; seepage and spraying of noncorrosive liquids including oils and coolants.

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For more information, contact the Rittal Technical Hotline  1-800-637-4425.

IEC 529/IP Environmental Ratings

Degrees Of Protection Against Solid Objects			Degrees Of Protection Against Water		
Description	Definition	First characteristic numeral	Second characteristic numeral	Description	Definition
Non-protected		0	0	No protection	
Protected against solid foreign objects of 50mm diameter and greater	The object probe, sphere of 50mm diameter shall not fully penetrate	1	1	Protected against vertically falling water drops	Vertically falling water drops shall have no harmful effects
Protected against solid foreign objects of 12.5mm diameter and greater	The object probe sphere of 12.5mm diameter shall not fully penetrate	2	2	Protected against vertically falling water drops when enclosure tilted up to 15 degrees	Vertically falling water drops shall have no harmful effects when the enclosure is tilted at any angle up to 15 degrees on either side of the vertical axis
Protected against solid foreign objects of 2.5mm diameter and greater	The object probe of 2.5mm diameter shall not penetrate at all	3	3	Protected against spraying water	Water sprayed at an angle up to 60 degrees on either side of the vertical shall have no harmful effects
Protected against solid foreign objects of 1.0mm diameter and greater	The object probe of 1.0mm diameter shall not penetrate	4	4	Protected against splashing water	Water splashed against the enclosure from any direction shall have no harmful effects
Dust protected	Ingress of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety	5	5	Protected against water jets	Water protected in jets against the enclosure from any direction shall have no harmful effects
Dust tight	No ingress of dust	6	6	Protected against powerful water jets	Water protected in powerful water jets against the enclosure from any direction shall have no harmful effects
			7	Protected against the effects of temporary immersion in water	Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under standardized conditions
			8	Protected against the effects of continuous immersion in water	Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under conditions which shall be agreed between manufacturer and user but which are more severe than for numeral 7

Conversion of NEMA, UL and CSA Type Ratings To IEC/IP Classification

NEMA Type rating	UL Type rating	CSA Type rating	Apprx. IEC/IP classification
1	1	1	IP23
2	2	2	IP30
3	3	3	IP64
3R	3R	3R	IP32
4	4	4	IP66
4X	4X	4X	IP66
6	6	6	IP67
12	12	12	IP55
13	13	13	IP65

NOTE: Cannot be used to convert IEC/IP classification to NEMA, UL, and CSA Type ratings.

The degree of protection provided by an enclosure is indicated by the IP code in the following way:

1st characteristic numeral—
e.g. protection against solid foreign objects of 12.5mm diameter and greater

2nd characteristic numeral—
e.g. protected against spraying water

I P 2 3