



Ingress Protection (IP) Rated Sealed Switches by CW Industries

Rockers - Push Button -Toggles



An ISO Company That Delivers World Class Quality



Overview

- What does an IP Rating Mean?
- What is the IP Code?
- IP Rating Chart review
- Scope of IEC 60529
- IP Ratings Vs NEMA
- IP Testing requirements and methodology
- Overview of CW Industries Sealed / IP Rated product line
- Summary



What does an IP Rating mean?

- IP stands for Ingress Protection
- These ratings are usually assigned to enclosures such as circuit boxes that hold automation controls and electronics.
- Numbers following the letters represent levels of sealing and can range from none at all to “protection against dust and continuous immersion in water.”
- The ratings were established by the International Electrotechnical Commission and can be found in IEC Publication 529.



What is the IP Code?

- The IP Code quantifies various levels of resistance to liquids and particulates rather than a vague description such as "waterproof" or "dustproof",
- The numbers following the letters "IP" represent the specific degree of protection provided by the enclosure.
- The first digit indicates the ingress of dust at a level that will not have a harmful effect on the operation of the unit.
- The second digit indicates that water sprayed from all directions will not compromise the operation of the unit.

Higher numbers indicate a higher tolerance to dust and water.



IP Rating Chart

OBJECTS

Level	Object size protected against	Effective against
0	—	No protection against contact and ingress of objects
1	>50 mm	Any large surface of the body, such as the back of a hand, but no protection against deliberate contact with a body part
2	>12.5 mm	Fingers or similar objects
3	>2.5 mm	Tools, thick wires, etc.
4	>1 mm	Most wires, screws, etc.
5	Dust protected	Ingress of dust is not entirely prevented, but it must not enter in sufficient quantity to interfere with the satisfactory operation of the equipment; complete protection against contact
6	Dust tight	No ingress of dust; complete protection against contact

MOISTURE

Level	Protected against	Details
0	Not protected	—
1	Dripping water	Dripping water (vertically falling drops) shall have no harmful effect.
2	Dripping water when tilted up to 15°	Vertically dripping water shall have no harmful effect when the enclosure is tilted at an angle up to 15° from its normal position.
3	Spraying water	Water falling as a spray at any angle up to 60° from the vertical shall have no harmful effect.
4	Splashing water	Water splashing against the enclosure from any direction shall have no harmful effect.
5	Water jets	Water projected by a nozzle against enclosure from any direction shall have no harmful effects.
6	Powerful water jets	Water projected in powerful jets against the enclosure from any direction shall have no harmful effects.
7	Immersion up to 1 m	Ingress of water in harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time (up to 1 m of submersion).
8	Immersion beyond 1 m	The equipment is suitable for continuous immersion in water under conditions specified by the manufacturer. Normally, this will mean that the equipment is hermetically sealed. However, with certain equipment, it can mean that water can enter but only in such a manner that produces no harmful effects.



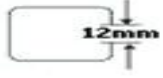

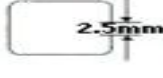
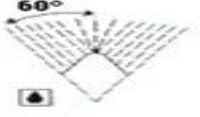






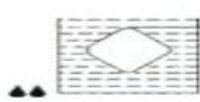

Degrees of Protection - First Digit

The first digit of the IP code indicates the degree that equipment is protected against solid foreign bodies intruding into an enclosure.

Degrees of Protection - Second Digit

The second digit indicates the degree of protection of the equipment inside the enclosure against the harmful entry of various forms of moisture (e.g. dripping, spraying, submersion, etc.)

IP RATING SYMBOLS

1st Digit	Protection from solid objects	2nd Digit	Protection from moisture
0	Non protected	0	Non protected
1	 Protected against solid objects greater than 50mm	1	 Protected against dripping water
2	 Protected against solid objects greater than 12mm	2	 Protected against dripping water when tilted up to 15°
3	 Protected against solid objects greater than 2.5mmØ	3	 Protected against spraying water
4	 Protected against solid objects greater than 1.0mmØ	4	 Protected against splashing water
5	 Dust protected	5	 Protected against water jets
6	 Dust tight	6	 Protected against heavy seas
		7	 Protected against immersion up to 1.5m - 1m Protected against the effects of immersion
		8	 Protected against submersion for more than 1m+

Another way IP Ratings are presented are with these symbols classifying a certain degree of protection



Many assume that an IP rating allows a device to operate while submersed under water for the time specified by rating. This is not correct. The IP rating only ensures the device will work properly **AFTER** being removed from water.



Scope of IEC 60529

- IEC 60529 outlines an international classification system for the sealing effectiveness of enclosures utilizing the letters "IP" followed by two digits which represents ingress of solid objects and liquids respectively
- While rare, a third digit is sometimes used and represents protection against mechanical impact damage.
- An "x" also may be used for one of the digits if there is only one class of protection; i.e. IPX5 which addresses moisture resistance only.



Scope of IEC 60529

- The IP ratings are defined in the International Electrotechnical Commission (IEC) standard 60529.
- IEC 60529 defines an enclosure as, "a part providing protection of equipment against certain external influences and in any direction protection against direct contact."
- IEC 60529 does not include corrosion resistance, construction requirements, and the effects of icing and coolants.
- These are addressed in the NEMA 250 product standard, developed by the National Electrical Manufacturers Association.



IP Ratings - NEMA

- NEMA publishes protection ratings for enclosures similar to the IP rating system published by IEC.
- An IP rating only considers protection against ingress of solid foreign objects and ingress of water. NEMA considers these but also consider other items such as corrosion resistance, ice formation, gasket aging and construction practices.
- IP ratings are much more limited and should be regarded as a supplement to a NEMA rating, but not as its equivalent.

NEMA Rating	IP Rating*	NEMA Definition	IP Definition Foreign Objects	IP Definition Liquids
1	IP10	Enclosures constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection against falling dirt	1 = Protected against solid foreign objects of 50mm in diameter and greater	0 = Not Protected
2	IP11	Enclosures constructed for indoor used to provide a degree of protection to personnel against incidental contact with the enclosed equipment, to provide a degree of protection against falling dirt, and to provide a degree of protection against dripping and light splashing of liquids	1 = Protected against solid foreign objects of 50mm in diameter and greater	1 = Protected against vertically falling water drops
3	IP54	Enclosures constructed for either indoor or outdoor used to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, and windblown dust; and that will be undamaged by external formation of ice on the enclosure	5 = Protected against dust - Limited to ingress (no harmful deposit)	4 = Protected against water sprayed from all directions - Limited to ingress permitted.
3R	IP14	Enclosures constructed for either indoor or outdoor used to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, and snow; and that will be undamaged by external formation of ice on the enclosure	1 = Protected against vertically falling water drops	4 = Protected against water sprayed from all directions - Limited to ingress permitted.
3S	IP54	Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, and windblown dust; and in which the external mechanism(s) remain operable when ice laden.	5 = Protected against dust - Limited to ingress (no harmful deposit)	4 = Protected against water sprayed from all directions - Limited to ingress permitted.
4	IP 56	Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water; and that will be undamaged by the external formation of ice on the enclosure	5 = Protected against dust - Limited to ingress (no harmful deposit)	6 = Protected against strong jets of water from all directions - Limited to ingress permitted.

*IP rating is similar to NEMA, not equivalent.

NEMA Rating	IP Rating*	NEMA Definition	IP Definition Foreign Objects	IP Definition Liquids
4X	IP56	Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, hose-directed water, and corrosion; and that will be undamaged by the external formation of ice on the enclosure	5 = Protected against dust - Limited to ingress (no harmful deposit)	6 = Protected against strong jets of water from all directions - Limited to ingress permitted.
5	IP52	Enclosures constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against settling airborne dust, lint, fibers, and flyings; and to provide a degree of protection against dripping and light splashing of liquids.	5 = Protected against dust - Limited to ingress (no harmful deposit)	2 = Protected against direct sprays of water up to 15° from the vertical.
6	IP67	Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against hose-directed water and the entry of water during occasional temporary submersion at a limited depth; and that will be undamaged by the external formation of ice on the enclosure.	6 = Totally protected against dust	7 = Protected against the effects of temporary immersion between 15cm and 1m. Duration of test 30 minutes.
6P	IP67	Enclosures constructed for either indoor or outdoor use to provide a degree of protection to the personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against hose-directed water and the entry of water during prolonged submersion at a limited depth; and that will be undamaged by the external formation of ice on the enclosure	6 = Totally protected against dust	7 = Protected against the effects of temporary immersion between 15cm and 1m. Duration of test 30 minutes.
12 and 12K	IP52	Enclosures constructed (without knockouts) for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against circulating dust, lint, fibers, and flying; and against dripping and light splashing of liquids	5 = Protected against dust - Limited to ingress (no harmful deposit)	2 = Protected against direct sprays of water up to 15° from the vertical.
13	IP54	Enclosures constructed for indoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt; against circulating dust, lint, fibers, and flyings; and against the spraying, splashing, and seepage of water, oil, and noncorrosive coolants.	5 = Protected against dust - Limited to ingress (no harmful deposit)	4 = Protected against water sprayed from all directions - Limited to ingress permitted.

*IP rating is similar to NEMA, not equivalent.



IP Rated Switches

Although IP standards were developed for enclosures, they are also applicable to interconnect products such as switches and connectors and many of these components are IP rated and protected inside enclosures.





Why does a Product need to be IP Tested ?

IP testing is designed to certify a product's suitability and sealing effectiveness of enclosures of electrical equipment against the intrusion of external influences such as water or dust ingress as defined IEC 60529.



IP Testing

- Testing must be conducted by an accredited organization such as A2LA accredited.
- The test for ingress protection must satisfy NEMA, IEC 60529, MIL-STD 810, SAE or RTCA-DO-160 specifications.
- These tests are environmental tests and typically performed on enclosures to determine the level of protection needed from water, dust, ice or splash intrusion.
- Dust chambers and splash water test chambers are common equipment that is used for testing.



CW Offers a Full Range of Sealed Switches

- Toggle Switches
- Push Button Switches
- Rocker switches
 - Rated up to IP67
 - RoHS Compliance





CW Product Line

- Rated up to IP 67, CW sealed switches are ideal in applications that require high quality, reliability and functionality in the most demanding environments.
- Available in both illuminated and non-illuminated versions, these switches are rated up to 20A 125- 277VAC and available in a wide array of designs and options
- The switches are RoHS compliant and available in momentary and maintained versions in SPST and SPDT, with DP functions also available.
- Temperature ranges from -25°C to 85°C





CW Sealed Switch Features

Switch elements protected by external or internal seals

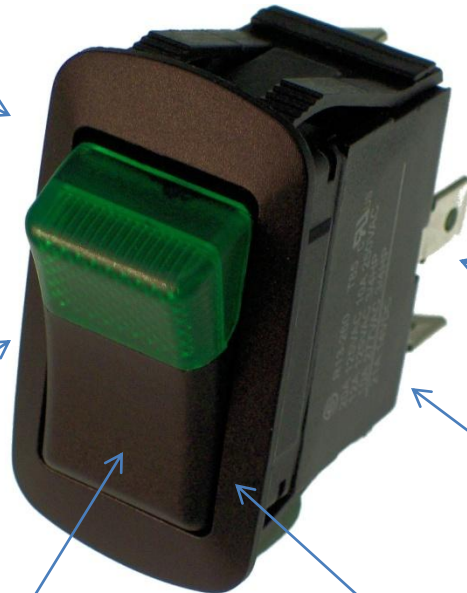
Ease of termination with various terminal options



Rubber Boot / Bellows standard on many designs



CW connector system available to provide enhanced sealing on many designs



Potting compounds used on several designs

Crisp Detent Action

Nylon Frame – UL:94V-2 / UL:94HB

CW Switches rated up to IP 67

Illuminated and non illuminated versions available





Sealed Rocker Switches



- **GRS Series Rocker** Switches are rated up to IP 67.
- Available in miniature and full sized versions.
- Momentary and maintained versions in SPST and SPDT, with DP functions also available.
- Electrical ratings up to 20A 125VAC
- Illuminated and non illuminated with many color options available
- RoHS Compliant



Sealed Toggle Switches

- **GTS Series** Toggle Switches are ideal for a wide range of applications in appliance, watercraft, off road, automotive, marine and many others.
- IP 56 and rated up to 20A@ 277V AC.
- RoHS compliant
- Momentary and maintained versions in SPST and SPDT, with DP functions also available.
- Termination options include quick connect, solder and threaded terminal.
- CW also offers metal or plastic levers, various indicator plates and rubber boots.





Sealed Push Button Switches



- **GPB Series** Push Button Switch are rated up to IP 67
- Miniature and full size versions
- Available in a wide selection of terminals, colors and illumination options.
- RoHS compliant
- Momentary and maintained versions in SPST and SPDT, with DP functions also available.
- The switch insulating materials are UL rated to 94 V2.



Summary

- IP stands for Ingress Protection
- The ratings were established by the International Electrotechnical Commission and can be found in IEC Publication 529.
- The ratings are listed as numbers followed by letters that represent levels of sealing and can range from none at all to “dust tight” protection and continuous immersion in water.”
- NEMA publishes protection ratings for enclosures similar to the IP rating system. IP ratings are much more limited and should be regarded as a supplement to a NEMA rating, but not as its equivalent.
- IP cross references to NEMA Ratings are approximate and cannot be used to convert IEC classifications to NEMA Type Numbers
- CW Industries has a long history dating back to 1904 and offers a complete product line of cost-effective, environmentally Sealed Rocker, Push Button and Toggle switches, rated up to IP 67.
- CW sealed switches are ideal in applications that require high quality, reliability and functionality in the most demanding environments.



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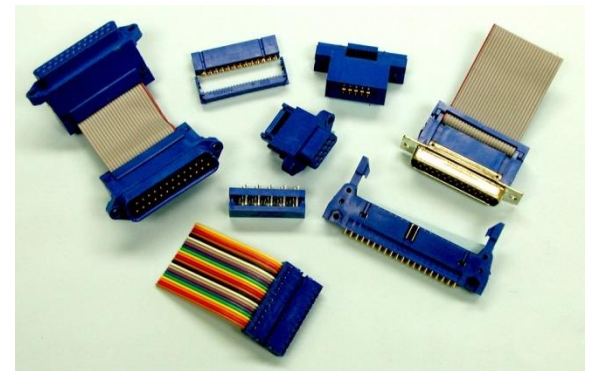
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