

Understanding IP Ratings: IP Ratings Chart Explained!

Introduction

Across almost every industry, there's a need for electrical control products. From the building and construction sector to commercial retail entities, everything requires power to run.

Purchasing these components is one step, but protecting them is another.

On one side, the [cables and relays](#) themselves require protection against environmental conditions, as they're carrying a significant amount of electricity. Then, there are the operators and controllers who need to protect themselves from accidental exposure.

It sounds simple, but in reality, this step can be challenging, even for those well-versed in the electrical industry. This is where the IP Ratings Chart, which details such levels of protection, comes in.

Does it make your head spin? That's why we're here!

Today, we're taking an in-depth look at this chart and breaking it down into simple categories. Though this data can be complex, it's critical to safeguarding your system and important to learn.

Ready to get started? Let's go!

Why is Protection Against Exposure Important?

Any time someone comes into contact with energized electrical equipment, there is an inherent danger. One of the most common risks associated with this environment is [an arc flash](#).

Also called a flashover, this phenomenon occurs when low impedance connections form within an electrical system. This moves an electrical discharge through the air, which can travel between voltage phases or to the ground.

When this happens, it causes the air pressure and temperature between the electrical conductors to rise, leading to an arc blast. Temperatures soar to up to [35,000 degrees Fahrenheit](#) in less than one-thousandth of a second and a sound wave (160-decibel or higher) forms.

During the blast, molten metal and shrapnel hurl out at speeds of up to 700 miles per hour. The event lasts mere milliseconds but can lead to death, severe burns, or hearing loss. In fact, up to 80% of all electrical burns are arc blast-related, most of which require a hospital stay of two to four months.

In addition to worker injuries, arc blasts also damage or ruin equipment and halt production.

Electrical Industry Safety Standards and Regulations

To help mitigate these accidents, the government relies on strict industry standards for labeling all electrical components. For instance, under the National Electrical Code (NEC), Article 110.16, electrical inspectors must require that all systems include a label that details their [potential incident energy](#) associated with an arc flash event.

In addition, the International Electrotechnical Commission (IEC) put forth [Standard 60529](#). This classifies the level of protection each component offers against accidental human contact and exposure to live parts. It also lists how protected the component is from solid parts entering into it.

In this case, the grading scale is an IP rating.

What is the IP Ratings Chart?

Short for Ingress Protection or International Protection, an IP rating details how protected an [electrical enclosure](#) or cabinet is from external elements, including dust, debris, human contact, and moisture.

When you're looking for a new enclosure for your workplace, it's vital to understand IP ratings and know which ones are most appropriate for your environment.

For the full scope of the ratings, you can refer to international standard EN 60529 (British BS EN 60529:1992, European IEC 60509:1989). Today, we're giving an overview of what the ratings chart looks like and what it means.

The International Electrotechnical Commission (IEC) established a multi-part labeling system to denote how protected each component is. The IP rating includes three to four elements, including:

- The words "IP" at the beginning
- A first number that describes how protected people are from the component's moving parts, along with how protected the component is from the environment and foreign bodies.
- A second number that describes how well-protected the electrical enclosure is from liquids and moisture, including sprays, dips, and submersions.

What Does IPX Mean?

The IEC 60529 standard grades each electrical enclosure on those two numbers listed above. Manufacturers will place an "X" in the place of one (or both) of the two numbers if a particular enclosure isn't graded for that category.

Need an example?

Take an electrical socket that's rated IP2X. This rating protects it against someone inserting their fingers inside of it (Hence, the first "2"). However, it doesn't require protection against liquid, as it will function fine when exposed to vertically dripping water.

As such, it's written as IP2X, with the "2" standing for the solid protection only.

On the other hand, IPX2 may signify that a component has no definite protection against foreign bodies. However, it has protection in an environment where water flows at a 15-degree angle.

Likewise, a component rated IP5X can handle moderate amounts of dust but has no moisture protection.

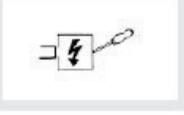
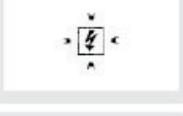
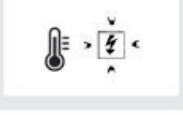
When you understand how to read these codes, you can ensure that your equipment will remain in top operating condition. For instance, you wouldn't install an electrical cabinet in snowy Minnesota without first checking to make sure the components feature an IP rating that ensures environmental protection.

Ingress Protection (IP) Ratings Guide

EXAMPLE:

Ingress Protection

IP 65

SOLIDS			WATER		
0		No protection.	0		No protection.
1		Full penetration of 50mm diameter sphere not allowed. Contact with hazardous parts not permitted.	1		Protected against vertically falling drops of water. Limited ingress permitted.
2		Full penetration of 12.5mm diameter sphere not allowed. The jointed test finger shall have adequate clearance from hazardous parts.	2		Protected against vertically falling drops of water with enclosure tilted 15° from the vertical. Limited ingress permitted.
3		The access probe of 2.5mm diameter shall not penetrate.	3		Protected against sprays to 60° from the vertical. Limited ingress permitted.
4		The access probe of 1.0mm diameter shall not penetrate.	4		Protected against water splashed from all directions. Limited ingress permitted.
5		Limited ingress of dust permitted (no harmful deposit).	5		Protected against jets of water. Limited ingress permitted.
6		Totally protected against ingress of dust.	6		Protected against strong jets of water. Limited ingress permitted.
X		Protection level not formally tested.	7		Protected against the effects of immersion between 15cm and 1m.
			8		Protected against long periods of immersion under pressure.
			9k		Protection from close-range, powerful, high-temperature water jets.
			X		Protection level not formally tested.

What Do These Numbers Mean?

Starting at the IP Ratings Chart and feeling like you're back in high school calculus class all of a sudden? That's normal! If you've never seen it before, it's easy to get confused.

A chart can help you break the data down into easy categories. Let's take a look.

Protection from Solids

You'll find your enclosure's level of solids protection right after the letters "IP." This number will range from 1 to 6, with 6 offering the strongest level of protection.

If yours has a zero here, that means the component in question offers no protection against object contact. Here's a breakdown of the levels, moving from 1-6.

Level 1: Greater Than 50mm

A large part of the body, such as a hand, can touch or graze the component. There is no protection against direct and deliberate handling. The object must be greater than 50 millimeters.

Level 2: Greater Than 12mm

This rating protects against the intrusion of fingers or small objects. Each object must be less than or equal to 80mm in length and 12mm in diameter.

Level 3: Greater Than 2.5mm

This rating protects against most tools and heavy-duty wires. The object must be greater than 2.5 millimeters.

Level 4: Greater Than 1mm

This rating protects against small tools and tiny equipment such as screws and wires. Each object must be greater than 1 millimeter.

Level 5: Dust Protection

This rating protects against all forms of contact and most dust. While there's no way to prevent dust from ingressing the enclosure at this level, this step helps cut down its amounts.

Level 6: Dust-Tight

The component is completely dust-tight.

Protection from Liquids

The second number in the IP rating describes how well-protected the electric component is from all kinds of liquids. These levels range from 1 to 9, with protection growing at every interval.

This will come after the words "IP" and the first number (describing solids protection). As with the first number, if there is no unique number here, you'll place an "X".

Level 1: Vertical Dripping Water

A number one on the end of an IP rating protects a component against dripping water. As long as the drops flow vertically, they should have no negative or harmful effect on the system.

Level 2: 15-Degree Tilted Water

Water doesn't always flow straight down. If it flows at a 15-degree angle from its current position and there is no risk of damage or danger when it makes contact with the component, it receives a Level 2 rating.

Level 3: Spraying Water

This rating protects against water falling as a spray. It can fall at any angle up to 60 degrees from its original vertical.

Level 4: Splashing Water

This rating notes protection against splashing water. If this water comes into contact with the enclosure from any direction, no damage will occur. Testers perform tests for 10 minutes with an oscillating spray to assess ingress.

Level 5: Low-Pressure Water Jets

This rating signifies that the component can handle low-pressure water jets (6.3 mm) with ease. If the enclosure gets sprayed down by a hose nozzle, for instance, it's protected.

Level 6: High-Pressure Water Jets

This component is safe against even the most powerful jets or streams of water, including heavy seas. It can receive the impact from any direction without a negative effect.

Level 7: Up to 1 Meter Immersion

Under defined pressure conditions, operators can submerge this component in water for up to 30 minutes in depths of 15cm to 1 meter.

Level 8: Immersion Beyond 1 Meter

These components can handle longer immersions at greater depths with limited ingress. [Each manufacturer](#) will set and advertise its own testing parameters. Depending on the equipment in question, other metrics tested may include temperature fluctuations and flow rates.

Level 9: (K) High Water Pressures and Temperatures

This component is protected against high-pressure and high-temperature jet sprays, steam-cleaning processes or wash-downs. This standard is most common in road vehicle applications. For more information, see Standard ISO 20653:2013 Road Vehicles - Degrees of Protection.

Most Common IP Ratings

You'll see any or all of these IP ratings depending on your specific trade. However, there are a few that tend to appear more often than others. Let's take a look at some labels you'll see on common enclosures.

IP65 Rating

This IP rates as "dust-tight" and protects against jets of water.

IP68 Rating

This IP rates as "dust-tight" and protects against submersion beyond one meter.

The ratings in the above list represent the most typical "waterproof" IP ratings. Start your search here if you know your component will be around any kind of water regularly.

Other Ratings for Electrical Enclosures

While IP ratings are the go-to standard for electrical enclosures, they aren't the only ones. The National Electrical Manufacturers Association (NEMA) also has a protection rating system in place.

You'll most often see NEMA ratings on industrial equipment manufactured in North America.

As NEMA ratings map different protection characteristics than the IEC (such as corrosion resistance and construction practices), the two charts aren't a side-by-side comparison, though they do share similarities.

The NEMA ratings range from 1 to 13. For example, you should use an electrical component with a NEMA rating of 1 in an indoor environment only, to protect it from a small amount of falling dirt.

How IP Ratings Help Comparison Efforts

Staring at two electrical components that appear so similar you're having a difficult time discerning which one you should pick? Keeping your use case scenario in mind, take a look at the IP rating of each!

Remember, the larger the value of each digit is, the more protection the component receives. For instance, a component rated IP55 is better protected than one rated as IP43.

When you're procuring industrial electrical equipment, you'll need to consider where you plan to install it. What (and who) do you need to protect it against? Are there any environmental considerations to keep in mind?

Armed with this knowledge, you can make an educated decision on which part is the best-suited for the job.

Understanding and Using the IP Ratings Chart

Though we've managed to wrangle it and manipulate it to power our homes and rev up our appliances, electricity is still a powerful and wild force.

As such, it's important that before anyone comes into contact with it, they understand what kind of environment is the safest and what conditions the specific component can handle. The IP Ratings Chart makes this step possible.

Are you looking for electrical control products for your next project? That's where we come in.

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