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Technical application guide
IP codes in accordance with IEC 60529

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OSRAM

What are IP codes?

Depending on their potential exposure to foreign objects, electrical devices (e.g. luminaires, LED modules and operational equipment) must, according to IEC 60529, belong to a specific type of protection. The types of protection are also called IP codes. The abbreviation IP stands for “ingress protection”.

The IP codes refer only to protection against contact and the penetration of solid foreign objects and dust (marked by the first characteristic numeral of the IP code) and against the damaging ingress of water (marked by the second characteristic numeral of the IP code).

The IP codes make no reference to the effect of external influences. In addition, the types of protection must not be confused with the electrical protection classes that refer to safety measures aimed at the prevention of electric shock.

The lowest type of protection is IP00, i.e. the electrical equipment is neither protected against solid foreign objects nor against the damaging penetration of water. The IP code IPXX means that the type of protection is not defined because the electrical equipment has not been subjected to testing. If the IP code is not stated, then the electrical equipment is protected in accordance with IP20.

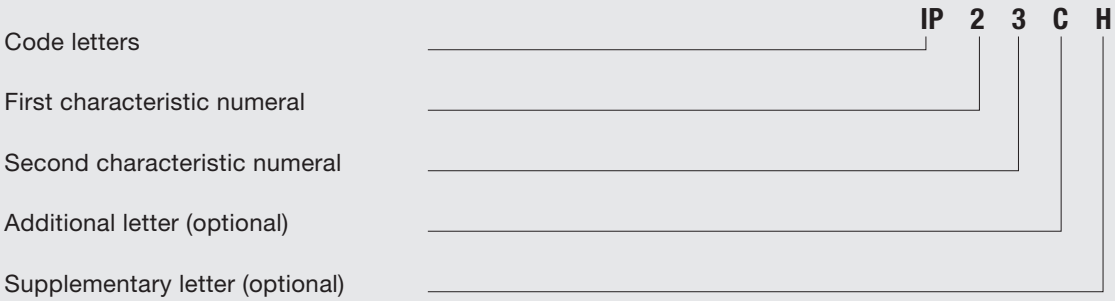
Important note:
In addition to the type of protection, you always need to take into account external influences and conditions (see page 7)!

The IP codes refer only to:

Solid foreign objects and dust

Water and moisture

Arrangement of the IP code



If one or both numerals are stated as “X”, the product could not be subjected to the relevant test. The statement “X” cannot, however, be used to signify any random IP rating.

First characteristic numeral

The first characteristic numeral of the IP code has two meanings. On the one hand, it determines how the electrical equipment is protected against the ingress of solid foreign objects (including dust). On the other hand, it also states the level of protection of persons against access to hazardous parts.

Degrees of protection against solid foreign objects indicated by the first characteristic numeral			
First characteristic numeral		Degree of protection	
		Brief description	Definition
0		Non-protected	–
1		Protected against solid foreign objects of 50 mm diameter and greater	The object probe, sphere of 50 mm diameter, shall not fully penetrate[1)]
2		Protected against solid foreign objects of 12.5 mm diameter and greater	The object probe, sphere of 12.5 mm diameter, shall not fully penetrate[1)]
3		Protected against solid foreign objects of 2.5 mm diameter and greater	The object probe of 2.5 mm diameter shall not penetrate at all[1)]
4		Protected against solid foreign objects of 1 mm diameter and greater	The object probe of 1 mm diameter shall not penetrate at all[1)]
5		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
6		Dust-tight	No ingress of dust

[1)] The full diameter of the object probe shall not pass through an opening of the enclosure.

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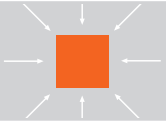
Second characteristic numeral
The second characteristic numeral of the IP code determines the protection of the electrical equipment against damaging effects caused by the ingress of water.

Degrees of protection against water indicated by the second characteristic numeral			
Second characteristic numeral		Degree of protection	
		Brief description	Definition
0		Non-protected	–
1		Protected against vertically falling water drops	Vertically falling drops shall have no harmful effects
2		Protected against vertically falling water drops when enclosure tilted up to 15°	Vertically falling drops shall have no harmful effects when the enclosure is tilted at any angle up to 15° on either side of the vertical
3		Protected against spraying water	Water sprayed at an angle up to 60° on either side of the vertical shall have no harmful effects
4		Protected against splashing water	Water splashed against the enclosure from any direction shall have no harmful effects
5		Protected against water jets	Water projected in jets against the enclosure from any direction shall have no harmful effects
6		Protected against powerful water jets	Water projected in powerful 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 temporarily immersed in water under standardized conditions of pressure and time
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
Cleaning processes carried out by professionals are not covered by the IP rating data. If necessary, manufacturers are advised to provide relevant cleaning process information. This is in accordance with the recommendations on professionally executed cleaning processes as stated in IEC 60529.			

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An enclosure designated with the second characteristic numeral 7 or 8 is only considered unsuitable for exposure to water jets (designated by the second characteristic numeral 5 or 6) and doesn't need to comply with the requirements for numeral 5 or 6 unless it is dual-coded as follows:

Enclosure passes test for:			
Water jets, second characteristic numeral	Temporary/continuous immersion, second characteristic numeral	Designation and marking	Range of application
5	**7**	IPX5/IPX7	Versatile*
6	**7**	IPX6/IPX7	Versatile*
5	**8**	IPX5/IPX8	Versatile*
6	**8**	IPX6/IPX8	Versatile*
–	**7**	IPX7	Restricted**
–	**8**	IPX8	Restricted**

* Enclosures for "versatile" application indicated in the last column shall meet the requirements for exposure to both water jets and temporary or continuous immersion.

** Enclosures for "restricted" application indicated in the last column are considered suitable only for temporary or continuous immersion and unsuitable for exposure to water jets.

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Additional letter (optional)
An additional letter can stipulate the protection of persons against access to hazardous parts of the electrical equipment (contact protection). Quoting of the additional letter is voluntary.

Supplementary letter (optional)
A supplementary letter after the second characteristic numeral or the additional letter can provide supplementary information. Thus far, the letters listed below have been defined. If more than one supplementary letter is used, they must be quoted alphabetically. Quoting of the supplementary letter is voluntary.

Additional letter	Degree of protection
A	Protected against access with the back of the hand
B	Protected against access with a finger
C	Protected against access with a tool
D	Protected against access with a wire

Supplementary letter	Significance
H	High-voltage apparatus
M	Tested for harmful effects due to the ingress of water when the movable parts of the equipment (e.g. the rotor of a rotating machine) are in motion
S	Tested for harmful effects due to the ingress of water when the movable parts of the equipment (e.g. the rotor of a rotating machine) are stationary
W	Suitable for use under specified weather conditions and provided with additional protective features or processes

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What are external influences?

When planning and implementing electrical installations, the external influences, to which the electrical equipment is exposed during operation, must be taken into account. This involves individual consideration of each application before realization in order to define and implement corresponding safety measures.

We differentiate between various types of external influences:
- Environmental influences
- Influences resulting from use
- Influences resulting from construction
- Influences resulting from cleaning and maintenance

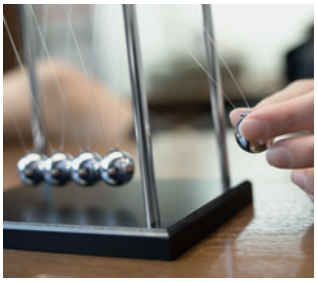
Important note:
OSRAM products must never be directly exposed to external influences. Always provide adequate protection for relevant outdoor applications (covers, housings etc.) and never operate the products in or under water, otherwise any warranty claim will be invalid.

Examples of external influences:


Chemical influences (e.g. acids)


Formation of ice


Corrosion


Mechanical impacts


Air moisture
(e.g. from condensation)


Flammable or explosive atmospheres


Aggressive constituents of rainwater (e.g. heavy metals)


Contamination from birds, insects etc.


Micro-organisms (e.g. mold, moss and fungi)


Solar radiation (e.g. UV radiation) and extreme temperatures


Salt spray


Environmental influences such as air pollution

Provide the necessary protection!

The selection of suitable OSRAM products and potentially necessary additional safety measures requires careful and detailed assessment of all external conditions that apply at the site of operation.

We recommend proceeding as follows:

Assessment of all external conditions at the site of operation

How much dust, solid foreign objects and water (see pages 3 to 6) are there?


What external influences (see page 7) are there?


Selection of suitable products with suitable IP codes (see product data sheet or product label)

Selection of safety measures that will be required in addition to the type of protection (covers, housings etc.)

Adequate protection by suitable products and additional safety measures

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