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Coating Innovations
for Electronics

TI TECHNICAL INFORMATION

TI 15/21: IP Classification

The IP Code (International Protection Code) classifies and rates the degree of protection provided against contact, foreign objects and water by enclosures / devices.

Several German and international standards have been published on IP coding.

- DIN EN 60529 (VDE 0470-1):2014-09 Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989 + A1 :1999 + A2:2013); German version EN 60529:1991 + A1:2000 + A2:2013, formerly VDE 0470-1
- DIN 40 050-9:1993-05 entitled road vehicles; Degrees of protection; Protection against foreign objects, water and access; Electrical equipment, issue date: 1993-05. As indicated by its title, this standard is mainly related to road vehicles.
- ISO 20653:2013 Road vehicles – Degrees of protection (IP-Code) – Protection of electrical equipment against foreign objects, water and access; describes the current status for road vehicles with extended protection level coding as compared to former DIN standards.

All standards are valid, yet differing by the revision status and certain details. When indicating an IP code, it is necessary to mention the standard referred to in order to ensure a clear coding.

Moreover, since the significations of protection levels have changed within the respective standards as compared to former revisions, it is necessary, for the sake of a clear reference, to state the number and the publishing date of the standard.

Two digits (generally no space in between) are indicated as suffix to the letters IP which are always included in the IP code. These digits show the scope of protection provided by an enclosure against contact/foreign objects (first digit) and moisture/water (second digit).

If one of the two digits shall not be indicated, it is substituted by the letter X (e.g. “IPX1”). Where necessary, this combination of digits can be followed by one or more defined letters describing the degree of protection. For example, DIN 40 050 part 9 specifies the letter K to be stated with individual codes for characterising equipment used in road vehicles.

This means that it is not possible to classify casting compounds and conformal coatings in accordance with IP codes. All you can do is discuss which IP class can be reached by certain electronics/electrics when provided with a particular casting compound or conformal coating, and mounted in an enclosure. Since processing methods / impurities / adhesion to the enclosure etc. are also of importance, the code indicated can only be an assessed value, for which the device manufacturer will finally be responsible.

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The codes follow the pattern: IP XXXX

The letters IP indicate the degree of protection while XXXX can be substituted as follows:

1st digit: protection against contact / ingress of objects
2nd digit: protection against water
3rd digit: additional protection against contact
4th digit: supplementary letters

(The 3rd and 4th digits are optional)
Where the 1st or 2nd digit of the code is of no relevance, it is substituted by X.

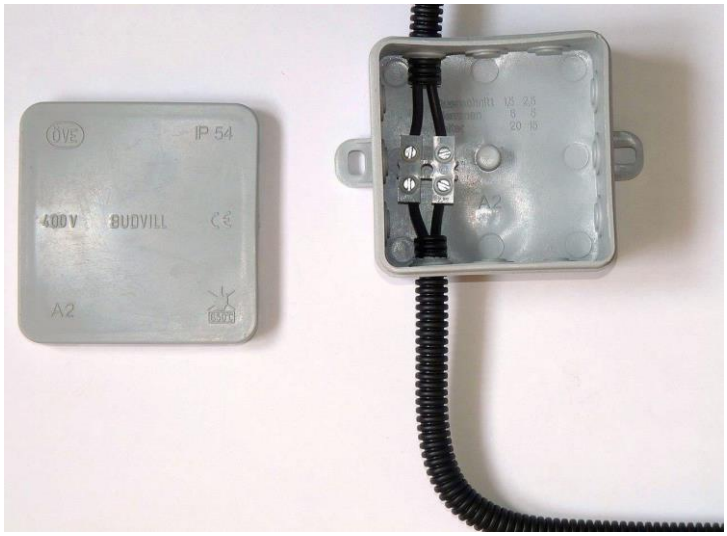
Codes of protection against contact

IP0X	No protection against contact or ingress of objects
IP1X	back-of-hand protection protection against ingress of objects with a diameter > 50 mm.
IP 2X	keeping away of fingers protection against ingress of objects > 12 mm diameter
IP 3X	protection against contact with tools (specimen: diameter 12 mm, length 100 mm) protection against ingress of objects with diameter > 2.5 mm
IP 4X	keeping away of tools and the like protection against ingress of objects > 1 mm diameter
IP 5X	complete protection against contact protection against harmful dust depositing inside
IP 6X	complete protection against contact protection against ingress of dust (dust tight)

Codes of protection against water

IP X0	Not protected against ingress of water
IP X1	protected against dripping water / vertically falling drops
IP X2	protected against dripping water / drops falling at an angle of 15° from the vertical
IP X3	protected against spraying water / drops falling at an angle of up to 60° from the vertical
IP X4	protected against splashing water
IP X5	protected against water jets (from any direction)
IP X6	protected against ingress of water in case of temporary flooding
IP X7	protected against ingress of water when immersed
IP X8	protected against ingress of water when immersed continuously
IP X9 K	protected against ingress of water from any direction even in case of a high pressure against the enclosure (high-pressure/steam cleaner, 80-100 bar)

Typically, IP54 is mounted in industrial plants, while IP20 is used for control cabinets. In the motor vehicle sector, IP55 makes sense where devices are mounted in the dry area of the vehicle (maybe with mounting position specified to create an „umbrella" setup). For construction site equipment, in disaster management, for defence engineering, open mounting positions and in the engine compartment of road vehicles, IP6K6K, IP6K7, IP6K8 and IP6K9K is generally chosen, according to DIN 40 050 part 9. In some cases, combinations of different classes are used.



Example: Enclosure classified IP 54
(Source: Wikipedia, GNU Free Documentation License, author Dimitry G)

Many times, for example for operating controls in public transportation or on lifts, one would have to consider vandalism amongst other risks. Here IP5X is a good choice, even if the actuating currents operate on low voltage and there is no high risk of contamination.

A complete protection against contact is ensured by IP5X or higher, as these degrees of protection prevent unintentional ingress.

Estimated IP codes assigned to our products:

	Possible IP class
ELPEGUARD® conformal coatings (thin film coatings) such as SL 1301 ECO-FLZ, SL 1307	IP X4
ELPEGUARD® thick film coatings of the series Twin-Cure® DSL 1600 E-FLZ	IP X4 – IP X6
ELPEGUARD® silicone thick film coatings DSL 170# FLZ	IP X4 or IP X6
ELPECAST® casting compounds Wepuran VU 44## and VU 45##	IP 66
ELPECAST® casting compound Wepesil VU 46##	
ELPECAST® casting compound Wepesil VT 3602 KK	IP 68
ELPECAST® casting compounds of the series Wepox VU 4085	
ELPECAST® casting compound Wepuran VU 4453/101 WR (water resistant)	
ELPECAST® casting compounds of the series Wepuran VT 3402 KK-NV	IP 69

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Lackwerke Peters GmbH & Co. KG
Hooghe Weg 13, 47906 Kempen, Germany

Internet: www.peters.de
E-Mail: peters@peters.de

Phone +49 2152 2009-0
Fax +49 2152 2009-70

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