Understanding the IP Code

Although the IP Code has been in use for many years, NICEIC still receives questions about the meanings of the degrees of protection, such as IPXXB, marked on equipment enclosures or called for by BS 7671

Table 1: The first two characteristic numerals

International Protection (IP) Code

FIRST NUMERAL		SECOND NUMERAL	
a PROTECTION OF PERSONS AGAINST CONTACT WITH HAZARDOUS PARTS INSIDE ENCLOSURE b PROTECTION OF EQUIPMENT AGAINST INGRESS OF SOLID BODIES AND DUST		PROTECTION OF EQUIPMENT AGAINST INGRESS OF WATER	
No./ SYMBOL	**DEGREE OF PROTECTION**	**No./ SYMBOL**	**DEGREE OF PROTECTION**
0	a No special protection. b No special protection.	**0**	No special protection.
1	a Protection against accidental or inadvertent contact by a large surface of the body, e.g. hand, but not against deliberate access. b Protection against ingress of large solid objects of 50mm diameter and greater.	**1**	Protection against drops of water. Drops of water falling on enclosure shall have no harmful effect.
2	a Protection against contact by standard finger (12mm in diameter and 80mm in length). b Protection against ingress of solid objects of 12.5mm diameter and greater.	**2**	**Drip Proof**:- Protection against water. Vertically dripping water shall have no harmful effect when the enclosure is tilted at any angle up to 15° from the vertical.
3	a Protection against contact by tools, wires or suchlike of 2.5mm diameter. b Protection against ingress of solid objects of 2.5mm diameter and greater.	**3**	**Rain Proof**:- Water falling as rain at any angle up to 60° from vertical shall have no harmful effect.
4	a As 3 above but against contact by wires of 1 mm diameter. b Protection against ingress of small foreign bodies of 1mm diameter and greater.	**4**	**Splash Proof**:- Water splashed from any direction shall have no harmful effect.
5	a As 4 above. b DUSTPROOF:- Protection against harmful deposits of dust. Dust may enter but not in amount sufficient to interfere with satisfactory operation.	**5**	**Jet Proof**:- Water projected by a nozzle from any direction (under stated conditions) shall have no harmful effect.
6	a As 4 above. b DUST-TIGHT No ingress of dust.	**6**	**Watertight Equipment**:- Protection against conditions on ships decks, etc. Water from heavy seas or power jets shall not enter the enclosures under prescribed conditions.
IP CODE NOTES - Degree of protection is stated in form IPXX. - Protection against contact or ingress of water respectively is specified by replacing first or second X by digit number tabled e.g. -IP2X defines an enclosure giving protection against finger contact but without any specific protection against ingress of water or liquid.		**7**	**Protection Against Immersion in Water**:- It shall not be possible for water to enter the enclosure under stated conditions of pressure and time.
		8	**Protection Against Indefinite Immersion in Water Under Specified Pressure**:- It shall not be possible for water to enter the enclosure, to harmful effect.

Notes:

1) The information in Table 1 should be used for general guidance only. Refer to BS EN 60529 for full information.
2) Where the first or second numeral is not required to be specified, it is replaced by the letter 'X'.

This article gives an overview of the IP Code and provides examples of where it is referred to in BS 7671. A fuller explanation of the IP Code is given in BS EN 60529 – *Degrees of protection provided by enclosures (IP code).*

Overview

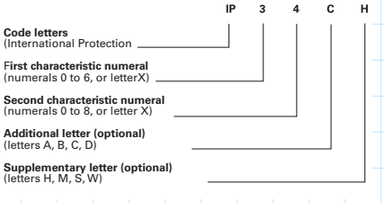
The IP Code indicates the degrees protection afforded by equipment enclosures against:

(1) access to hazardous parts inside the enclosure; and
(2) ingress of solid foreign objects; and
(3) ingress of water.

The term 'hazardous part' in (1) covers both hazardous live parts and hazardous moving parts. However, where BS 7671 makes use of the IP Code, this generally relates to access to live parts rather than moving parts.

The degrees of protection provided by an enclosure are indicated by the letters 'IP' followed by two characteristic numerals and up to one additional letter and one supplementary letter, as indicated in the following diagram.

As shown in Table 1, the first numeral denotes the degrees of protection against both access to



live parts and the ingress of solid foreign objects, and the second numeral denotes the degree of protection against the ingress of water. Where the first or second numeral is not required to be specified, it is replaced by the letter 'X'.

Table 1 also shows symbols sometimes found on the enclosures of older equipment that is not IP coded and which is graded by the designation such as 'Drip proof' or 'Rainproof'. The equivalents between the symbols and the numerals in the table are not exact. The electrical installation designer and installer should satisfy themselves that the equipment selected for an application is suitable for the intended surroundings.

As shown in Table 2, an additional letter, where used, denotes the degree of protection against access to hazardous parts, and as shown in Table 3, a supplementary letter, where used, gives additional information about the equipment.

Enclosures suitable for immersion in water

An enclosure designated with a second characteristic numeral of 7 (protection against temporary immersion in water) or 8 (continuous immersion in water) is unsuitable for exposure to water jets (designated by characteristic numerals 5 or 6) unless it is dual coded as shown in Table 4.

Table 2: Additional letters – denoting the degree of protection against access to hazardous parts

Additional letter	Brief description	Definition
A	Protected against access with the back of the hand	The access probe, a sphere of 50 mm diameter, is required to have adequate clearance from hazardous parts
B	Protected against access with a finger	The jointed test finger of 12 mm diameter and 80 mm length is required to have adequate clearance from hazardous parts
C	Protected against access with a tool	The access probe of 2.5 mm diameter and 100 mm in length is required to have adequate clearance from hazardous parts
D	Protected against access with a wire	The access probe of 1.0 mm diameter and 100 mm in length is required to have adequate clearance from hazardous parts

Table 3: The most commonly used supplementary letters

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[a]	Suitable for use under specified weather conditions and provided with additional protective features and processes

[a] In the first edition of international standard *IEC 529* the letter 'W' with the same meaning was placed immediately after the code letters 'IP'.

Table 4: Dual coding of enclosures suitable for immersion in water

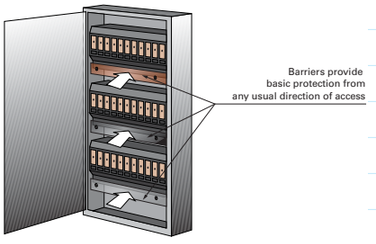
Enclosure passes test for:		Designation and marking	Range of application
water jets second characteristic numeral	temporary/ continuous immersion second characteristic numeral		
5	7	IPX5/IPX7	Versatile
6	7	IPX6/IPX7	Versatile
5	8	IPX5/IPX8	Versatile
6	8	IPX6/IPX8	Versatile
-	7	IPX7	Restricted
-	8	IPX8	Restricted

Notes:
1 Enclosures for 'versatile' application meet the requirements for exposure to both water jets and temporary or continuous immersion in water.
2 Enclosures for 'restricted' application are considered suitable only for temporary or continuous immersion and unsuitable for exposure to water jets.

Examples of the use of the IP Code

IP2X and IPXXB are two ways of coding a barrier or enclosure that protects against access to live parts with a finger, such as would be required for barriers in a distribution board, as illustrated in Figure 1. IP2X also denotes protection against the ingress of solid foreign bodies 12.5 mm in diameter or greater.

1 Distribution board having live parts placed behind barriers



A barrier or enclosure that protects against access to live parts with wires or strips 1.0 mm thick or greater could be coded IP4X or IPXXD. IP4X also denotes protection against the ingress of solid foreign bodies 1.0 mm in diameter or greater.

An IPX4 enclosure protects against water splashed against the enclosure from any direction.

An IP55 enclosure protects against access to live parts with wires or strips 1.0 mm thick or greater and the ingress of harmful deposits of dust (as denoted by the first characteristic numeral) and jets of water under stated conditions (as denoted by the second characteristic numeral).

References to IP coded equipment in BS 7671

Table 5 identifies some of the parts of the 2001 and 2008 editions of BS 7671 where the IP Code is used to specify degrees of protection to be afforded by equipment to be installed.

Table 5: References to the IP Code in the 16th & 17th Editions of BS 7671

Application	BS 7671: 2001 (16th Edition)	BS 7671: 2008 (17th Edition)
Electric shock protection	Ch 41	Ch 41
Locations containing a bath or shower	Section 601	Section 701
Locations containing a swimming pool (or other basin)	Section 602	Section 702
Locations containing hot air saunas	Section 603	Section 703
Agricultural and horticultural premises	Section 605	Section 705
Restrictive conductive locations	Section 606	Section 706
Caravans and motor caravans	Section 608 Division 1	Section 721
Caravan parks and similar locations	Section 608 Division 2	Section 708
Marinas and similar locations		Section 709
Highway installations	Section 611	
Exhibitions, shows and stands		Section 711
Mobile or transportable units		Section 717
Fairground, amusement parks and circuses		Section 740
Floor and ceiling heating systems		Section 753