INGRESS PROTECTION RATIO "IP"

This technical note is made for giving a brief explanation about the meaning and utilization of the classification system established by the IP code and IP ratings in general, and set recommendations for use of these codes for the load cells and weighing systems.

Definitions

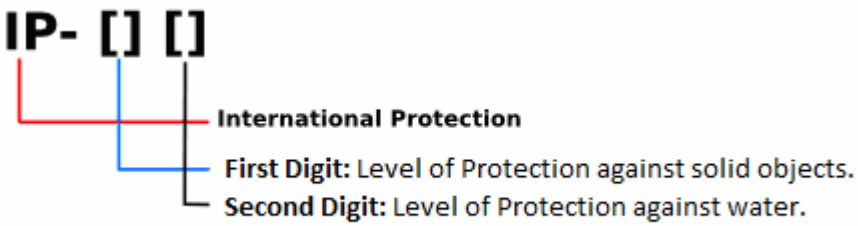
Obteined from the International Electrotechnical Vocabulary (IEV 826-03-12):

Ingress Protection Ratio*: The level of protection provided by an enclosure against access to hazardous parts, against the penetration of solid foreign bodies, against the penetration of water or against external mechanical impacts, and also takes place by standardized test methods.*

Enclosure: *This element provides protection against the effects of external material in any direction and protects against direct contact.*

The IP protection degrees are described in the European Standard EN 60529 as well as in other equivalent and/or complementary standards as UNE 20324, IEC 529, ISO 29653 and DIN 40050-9.

IPXX CODE



This code constists of 2 numbers placed inmediately after the letters IP,
called first and second digit, and sometimes features a third chacarter appears further, optionally in order to provide additional information on the degree of protection.

Explanation of the first characteristic numeral IP<u>X</u>X

The first characteristic numeral indicates the protection of equipment against the penetration of solid foreign objects.

First Numeral	IP Degree of Protection	
	Brief Description	**Brief indication on the objects should not enter the enclosure**
0	Non-Protected	No particular protection

1	Protected against bodies 50mm and greater	Solid objects with 50mm diameter or greater, for example, human hand.
2	Protected against bodies 12mm and greater	Solid objects with 12mm diameter or greater, for example, human fingers.
3	Protected against bodies 2,5mm and greater	Solid objects with 12mm diameter or greater, for example, tools, etc.
4	Protected against bodies 1mm and greater	Solid objects with 1mm diameter or greater, for example, wires.
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	Completely dust-protected	No ingress of dust .

Explanation of the second characteristic numeral IPX<u>X</u>

The second characteristic numeral indicates the protection of equipment against the penetration of water.

Second Numeral	**IP Degree of Protection**	
	Brief Description	**Type of protection provided by the encolsure**
0	Non-Protected	No particular protection
1	Protected vertically falling water drops	Vertically falling drops of water from 200mm height above the device during 10 minutes (falling 3-5 mm^3 per minute), shall have no harmfull effects.
2	Protected vertically falling water drops when the enclosure is tilted up to 15º	Vertically falling drops of water, when the enclosure is tilted at any angle up to 15º on either side of the vertical, during 10 minutes (falling 3-5 mm^3 per minute), shall have no harmfull effects.
3	Protected against spraying water	Water sprayed at an angle of up to 60º on either side of the vertical, averaging of 10 liters/minute with a 80-100kN/m^2 pressure, during a period under to 5 minutes, shall have no harmful effects.
4	Protected against splashing water	Water splashed against the enclosure will enclosure from any direction, averaging of 10 liters/minute with a 80-100kN/m^2 pressure, during a period under to 5 minutes, shall have no harmful effects.
5	Protected against water jets	Water projected by a 6,3mm. nozzle in jets against the enclosure from any direction, averaging of 12,5 liters/minute with a 30kN/m^2 pressure during a period NO under 5 minutes, shall have no harmful effects.

6	Protected against powerful water jets and seaway	Water projected by a 12,5mm. nozzle in jets against the enclosure from any direction, averaging of 10 liters/minute with a 100kN/m^2 pressure during a period NO under 3 minutes and a distance NO under 3m, shall have no harmful effects.
7	Protected against the effects of temporary immersion in water	When totally immersed the encolusre in water, in a depth up to 1m and no longer to 30minutes, shall have no harmful effects
8	Protected against the effects of continous immersion in water	Enclosure totally and continously immersed in a depth and time specified by the manufacturer and always in worse conditions than value 7. The common specification is 1m depth and 100h time.
9K	Protected against high-presure jets	The device is suitable to be used in aplications with high pressure jets, from any direction with 100 bar pressure, 80°C temperature, 15l/min. caudal and a distance no under 10cm.

Special recommendations for weighing systems

- **Solid bodies and/or dust:** Althought most of the load cells, and associated electronic equipment, have their electronics protected enought against dust and solid bodies intrusions, we consider the weighing system must remain clean of dirt and dust to be able to move, in vertical and horizontal axis, with sufficient freedom to measure with high repeatability and accuracy, and, at the same time, we must consider to use external limitators to assure the stability and the safety suitable for the application. For that, the designers of the weighing systems must consider use aditional barriers, enclosures, shields, etc. as well as leaving enought space to avoid accrued dust will difficult correct measurements. Also we have to adopt a maintenance plan allowing a regular verification and cleaning, for example yearly, or whatever necessary according the specifications of the instalation.
- **Water and moisture/humidity:** In general the weighing equipment and load cells in particular, are very sensitive to moisture, due to handle signals of very few microvolts, produced by very small changes on the ohmic values in their extensiometric gauges. This circumstance makes that when load cells will be used in potentially moisture conditions we should extreme the ingress protection at maximum and we should prepare the instalation to ensure good drainage and water evacuation. Special attention should be taken on the instalation of cables and the conexion boxes ubication, to avoid floods and encouraging drainage and ventilation. Is also essencial a maintenance plan to verify and clean the dirt that accumulate humidity and prevent the proper drainage. In all of cases we must avoid prolongated immersions, whatever the degree of protection of the chosen equipment.

- **IP selection guide to chose the apropiate load cell according to their application enviroment:** Despite of the codes indicating the IP protection, and because their classification is based on relatively short-term test, we will always select our equipment by using the principle of oversizing and maximize protection against water, considering a

reliable and durable long-term use. For this reason, the following recomendatios, even being oversized, are a good practice:

- **Indoor applications, always in dry places, with low ambiental humidity and without condensation** (Offices, stores, wharehouses, etc.) : Without any particular protection.
- **Indoor applications with sporadic water projections** (Workshops, factories with normal cleaning with water, but not at high pressure, machines with no moisture/condesation inside, etc.): IP65 or higher.
- **Outdoor applications, under cover and potential splashes of water and/or rain** (outdoor machinery with load cells protected under covers or housings, installations in buildings/floors with open sides exposed to rain, etc.): IP66 or higher.
- **Outdoor applications, opened to the wheather conditions, directly exposed to rain without protection covers** (Outdoor tanks and silos, chemical or food industry without direct high pressure cleans and good drain, etc): IP67 or higher.
- **Applications in-pit and/or places with high moisture and/or highly probable presence of water and/or sporadic and short floods** (in-pit pallet scales, in-pit truck scales, etc.): IP68.
- **Applications with direct high pressure water jet cleaning** (food/ chemical/pharmaceutical scales, on-board vehicle scales with high pressure jets cleaning): IP69K.

• Comments, hot spots and other recommendations

- The IP protection degree tests only includes the detrimental effect of the intrusion of solids and water in the enclosure of the equipment, but do not guarantee anything about the protection against the corrosion of the device, either internally or externally, for which we should complement their choice with other concepts, such as choosing the right construction materials and/or other applicable recommendations to each environment and use.
- The hot spot to be protected against the malfunction of the load cell is preserve the moisture in their internal circuit, for this reason the most suitable cells are the fully made in stainless steel and hermetically sealed by welding metallic covers. There are manufacturers that specifies cells as IP68 and they are only protected with a silicon pot and a metal enclosures that are not hermetically welded, they will probably fail at medium/long term under high moisture conditions.
- The end of external load cell cable and wires should be always preserved from the intrusion of water, for this reason we should connect them into a good quality junction box.
- All “good practices” of the sector and application of use will be kept.
- The quality and reliability of the equipment in general is inside the details, in the design and in the manufacturing of the product, and it is very important as well to make a good installation.

From Utilcell we hope that this technical note can be of help to know and understand the IP ratings. It is done only as a guideline and will not serve as a contractual specification. The specifications of each product should be consulted on his data-sheet as well as in the standards to

which reference is made. We reserve the right to change the content of this technical note at any time without previous notice.

We will remaining at your disposal for any further information.