



INGRESS PROTECTION (IP) RATING ON LINEAR ACTUATORS, ALL YOU NEED TO KNOW

What does it mean that a device is waterproof, airtight or sealed? Are these adjectives clear enough to determine if you can safely operate a device under harsh conditions? Unfortunately they actually aren't. Professional and technical applications need clear-cut information, and this is the reason the Ingress Protection Rating (or Degrees of protection) was established by the IEC (International Electrotechnical Commission) in their standard 60529. Together with critical tests such as the safety testing, the electromagnetic compatibility, and the stress testing; the Ingress Protection testing is indispensable as it provides the user with precise information about the product's resistance to dust, liquids, sand, dirt and other foreign agents.

The weak point of linear actuators regarding the Ingress Protection (IP)

Linear actuators may need different levels of Ingress Protection since they are applied in vastly different fields; whereas outdoor applications that require higher protection are becoming more and more usual. IP rating protection has become a key point in the mechanical development of the linear actuators.

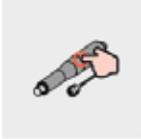
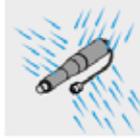
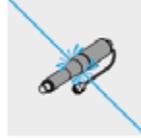
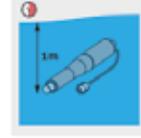
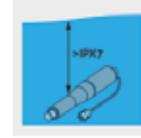
The housing of high-tech linear actuators are made of anodized aluminum –with more structural rigidity and durability than plastic ones- so they have no waterproofing problems here. With the use of high-quality cables and sealed connectors, only one weak point remains in the whole assembly: the seams. Seals and gaskets are the responsible for keeping the liquids and solid agents out of the actuator.



Gaskets from REGNER[®] motion control equipment.

At REGNER[®] we work together with one of the leading gaskets manufacturers in Europe to guarantee high Ingress Protection for years. Depending on the potential application, rigid (high structural stability and better protection) or flexible (better adaptability and functionality) gaskets are used, made of state-of-the-art materials, and, when required, combining different substances and technologies.

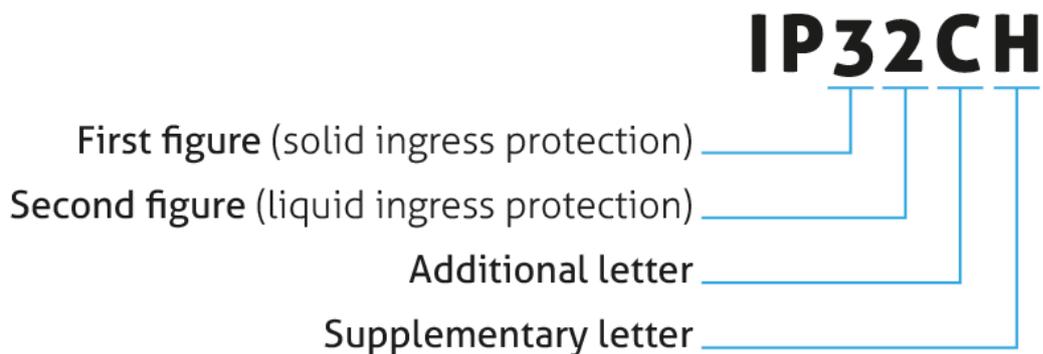
Ingress Protection Quick Guide

Solids						Codification example	
1	2	3	4	5	6	IP 54	Ingress Protection Solids Liquids
 <p>Solid objects greater than 50 mm, such as the back of a hand.</p>	 <p>Solid objects greater than 12.5 mm, such as a finger.</p>	 <p>Solid objects greater than 2.5 mm, such as a screwdriver.</p>	 <p>Solid objects greater than 1 mm, such as a wire.</p>	 <p>Limited ingress of dust. It must not interfere with the actuator operation.</p>	 <p>No ingress of dust.</p>		
Liquids							
1	2	3	4	5	6	7	8
 <p>Vertically falling drops.</p>	 <p>Vertically falling drops over an actuator tilted 15°.</p>	 <p>Sprays of water at any angle up to 60° from the vertical.</p>	 <p>Sprays of water at any angle.</p>	 <p>Water jets.</p>	 <p>Powerful water jets.</p>	 <p>15cm-100 cm immersion during 30 min.</p>	 <p>Immersion under harder conditions than in IPX7.</p>

How to read the IP (Ingress Protection) code

The IEC defines the degree of protection of an enclosure as the protection of persons against access to dangerous parts of the device, the protection of the equipment and materials located inside the enclosure and the penetration of foreign solid bodies, and the protection of the inner parts of the device of harmful effects caused by the ingress of water.

The IP code is usually formed by two numbers; however, there is the possibility to include two letters. The first digit of the figure (from 0 to 6) establishes the protection of persons and the ingress of solid bodies. The second digit (from 0 to 9) is related to the penetration of liquids in the enclosure. When the code only indicates one of these two types of protection, the remaining type is represented with an "X". This does not mean that the device has no protection, it only points out that this information is not relevant, necessary or it has not been tested. For example, a linear actuator with IPX7 protection means that the actuator can be submerged in the water but the protection against solid objects it is not represented.



Disposition of the IP code.

THE INTERPRETATION OF THE FIRST NUMBER OF THE INGRESS PROTECTION (IP) CODE IS THE FOLLOWING:

NUMBER	EFFECTIVE AGAINST	DESCRIPTION	TEST CONDITIONS
X	–	Not tested / not applicable.	–
0	None	No protection.	–
1	>50 mm back of the hand.	Protected against the ingress of any large surface of the body, such as the back of a hand, and solid foreign objects that are greater than 50 mm.	A 50 mm probe is pushed with a force of 50N. The probe has to keep an adequate clearance from hazardous parts and doesn't fully penetrate the item.
2	>12.5 mm finger.	Protected against the ingress of a finger or solid objects greater than 12.5 mm.	An articulated test finger of 12 mm diameter and 80 mm long, which can perform angles of 90 degrees and using a force of 30N, has to keep an adequate clearance from hazardous parts and doesn't fully penetrate the item.
3	>2.5 mm tool.	Protected against the ingress of foreign objects greater than 2.5 mm and tools such as a screwdriver.	A 2.5 mm probe is pushed with a force of 3N. The probe has to keep an adequate clearance from hazardous parts and doesn't fully penetrate the item.
4	>1 mm wire.	Protected against the ingress of a wire or foreign objects greater than 1.0 mm.	A 1 mm width and 100 mm length probe is pushed with a force of 1N. The probe has to keep an adequate clearance from hazardous parts and doesn't fully penetrate the item.
5	Dust protected.	Protected against the ingress of a wire and the ingress of dust is not entirely prevented, but it must not enter in sufficient quantity to interfere with the satisfactory operation of the equipment.	Protection tested with a probe like on the IP4X. Furthermore, a dust chamber is used in a test that can last up to 8 hours; the talcum powder used in the test cannot interfere with the satisfactory operation of the equipment.
6	Dust tight.	Protected against the ingress of a wire and complete protection against the ingress of dust.	Protection tested with a probe like on the IP4X. Furthermore, a dust chamber is used in a test that can last up to 8 hours; the talcum powder used in the test cannot enter in the equipment.

THE INTERPRETATION OF THE SECOND NUMBER OF THE INGRESS PROTECTION (IP) CODE IS THE FOLLOWING:

NUMBER	EFFECTIVE AGAINST	DESCRIPTION	TEST CONDITIONS
X	–	Not tested / not applicable.	–
0	None	No protection.	–
1	Dripping water	Vertically falling drops of water shall have no harmful effect on the equipment.	Equipment mounted in an upright position onto a turntable and rotated at 1 RPM. Water flow: 1 mm/min. Duration: 10 min.
2	Dripping water at 15°	Vertically dripping water shall have no harmful effect when the equipment is tilted at an angle of 15°.	Equipment mounted in four different positions tilted 15° angle. Water flow: 3 mm/min. Duration: 2.5 minutes for every position.
3	Spraying water	Water falling as a spray at any angle up to 60° from the vertical shall have no harmful effect on the equipment.	The test can be performed using an oscillating fixture or a spray nozzle. With the oscillating fixture, the test lasts for 10 min with a water volume of 0.07 l/min per hole. With the spray nozzle, the test lasts for 1 minute for square meter, with a minimum of 5 min with a total water volume of 10 l/min.
4	Spraying water 360°	Water falling as a spray at any angle shall have no harmful effect on the equipment.	Same conditions as the IPX3 test, but the water is projected from 360°.
5	Water jets	Water projected by a 6.3 mm nozzle from any direction shall have no harmful effects.	Test duration: 1 min/m ² and at least 3 min. Water volume: 12.5 l/min. Pressure: 30 kPa at 3m.

6	Powerful water jets	Water projected by a 12.5mm nozzle from any direction shall have no harmful effects.	Test duration: 1 min/m ² and at least 3 min. Water volume: 100 l/min. Pressure: 100 kPa at 3m.
6K (DIN 40050)	Powerful water jets with increased pressure	Water projected by a 6.3 mm nozzle, under elevated pressure, shall have no harmful effects.	Test duration: 1 min/m ² and at least 3 min. Water volume: 75 l/min. Pressure: 1000 kPa at 3m.
7	1m immersion	A 1m immersion in water shall have no harmful effects.	Test duration: 30 min. Tested with the lowest point of the equipment 1 meter below the surface of the water,

Furthermore, up to two letters can accompany the two digits in the code: the additional letters (A, B, C, D) and the supplementary letters (f, H, M, S, W).

The additional letter (A, B, C, D) indicates the degree of protection of the persons against the accesses to the dangerous parts of the device. They only can be displayed if the real protection against access to dangerous parts is higher than indicated by the first number of the figure or only when protection against dangerous parts is mentioned. In that case, the first number of the code must be replaced by an "X". Then, the supplementary letters (f, H, M, S, W) provide complementary information.

ADDITIONAL LETTER DESCRIPTION

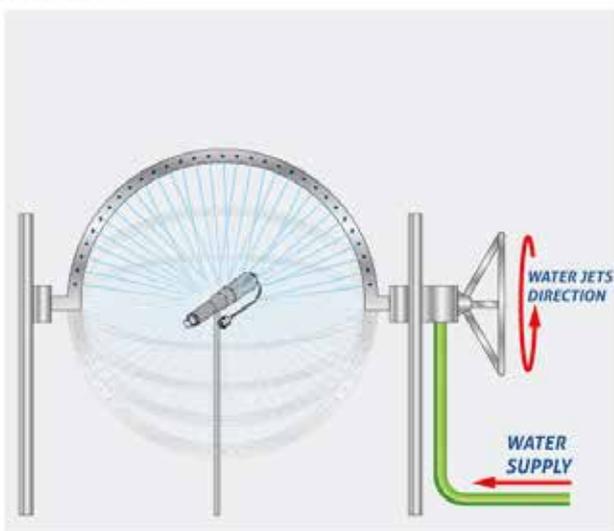
LETTER	DESCRIPTION
A	Protected against access to hazardous parts with back of hand
B	Protected against hazardous parts with fingers
C	Protected against tools interfering with hazardous parts
D	Protection against wire from entering hazardous parts

SUPPLEMENTARY LETTER DESCRIPTION

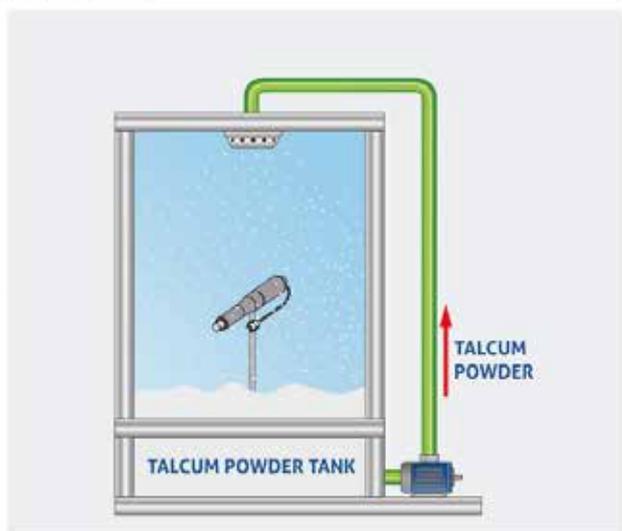
LETTER	DESCRIPTION
f	Oil resistant
H	High voltage device
M	Device moving during water test
S	Device standing still during water test
W	Weather conditions

For example, a linear actuator with an IP code of IP54 means that it will possibly work properly in an outdoor environment since it is protected against spraying water and dust, and it went through the dust chamber and the water tests illustrated below.

IP5X TESTING



IPX4 TESTING



Thus, the IP code provides the user with exact information about the conditions the product has been tested under and makes the actuators' operation safer.

In the past, the IP code has been also used to determine the resistance of the equipment to mechanical impact. In this case, a third IP number indicates this impact resistance, nevertheless, in the present, the IK rating (EN 62262) is the European standard for this property:

IK rating	IK00	IK01	IK02	IK03	IK04	IK05	IK06	IK07	IK08	IK09	IK10
Impact energy (joules)	Not protected	0.15	0.20	0.35	0.50	0.70	1	2	5	10	20

While the IP rating is a European standard, at the US the standard is the NEMA. This rating disposes of very similar tests for the equipment, whereas, the IP and NEMA are not equivalent as the American standard requires additional product features and tests.

NEMA	IP Code
1	IP20
2	IP22
3, 3X, 3S, 3SX	IP55
3R, 3RX	IP24
4, 4X	IP66
5	IP53
6	IP67