





















Maintaining Ingress Protection

What is Ingress Protection?

Ingress protection is the ability of a product, or joint between two products, to keep water and dusts or solid objects out of the internals of the product. This is normally achieved through conventional sealing methods such as O-rings, gaskets or thread sealant.

Ingress protection ratings are clearly defined in IEC EN 60529 and are summarized below.

Solids		Liquids	
X	There is no available data	0	No Protection 
0	No Protection against ingress or contact of solids 	1	Protection against Dripping water 
1	Protection against objects larger than 50mm 	2	Protection against Dripping water at a 15-degree angle 
2	Protection against objects larger than 12.5mm 	3	Protection against Spraying Water 
3	Protection against objects larger than 2.5mm 	4	Protection against Splashing Water 
4	Protection against objects larger than 1mm 	5	Protection against water jets 
5	Protection against Dust 	6	Protection against Powerful water jets 
6	The unit is dust-tight 	6K	Protection against water jets with higher pressure 
IP	6	5	7
Ingress Protection	Solids (Dust etc.)	Liquids (Water etc.)	Protection against being Immersed in 1 meter of water 
			8
			Protection against being Immersed in at least 1 meter of water (or more) 
			9
			Protection against Powerful water jets with high temperature 

The IP rating code consists of two numbers where the first number is the ability of the product to protect against solid objects, and the second is the ability to protect against liquid ingress.

One common inaccuracy is the assumption that as the number increases, the difficulty of the test increases and the performance of the product is better. With the liquid tests, protection against jets with high temperature for example does not give any indication of the capability of the product when immersed. These tests are significantly different, one is not more onerous than the other. This needs to be considered when specifying for applications based on IP rating.

How does Ingress Protection apply to Hawke products?

Hawke products carry ingress protection ratings based on the testing which has been performed on the product. This testing is reflective of the product only, and not around the joint between equipment. For example, a cable gland rated to IP66 does not automatically assume the joint between the cable gland and the enclosure is rated to IP66. The installer should take appropriate precautions to ensure the required level of ingress protection is maintained, in line with the requirements of EN/IEC 60079-14, when the equipment is installed in hazardous areas.

Ingress Protection and hazardous areas

The minimum level of ingress protection required to maintain the Ex protection of a product or installation is dependent on the protection concepts used. Two well known examples are called over the next two pages. Note that often the ingress protection levels required for a site or application are more onerous than those defined by the hazardous area standards, and this should be taken into consideration when specifying products.

IP Requirement for Exi. Extract from EN/IEC 60079-11 6.1.2.3

Apparatus meeting the Separation requirements of Tables F.1 or F.2 shall be provided with protection to achieve pollution degree 2. this can be achieved by one of the following

- a) An enclosure meeting the requirements of IP54 or greater according to the intended use and environmental conditions in accordance with IEC 60529. For such enclosures the clauses of IEC 60079-0 identified in table 1 additionally apply.
- b) An enclosure meeting the requirements of IP20 or greater according to the intend use and environmental conditions in accordance with IEC 60529 provided that separations are obtained by using coating type 1 or type 2 or casting compound or through solid insulation. The enclosure does not need to be subjected to the tests for enclosures in IEC 60079-0; however, for portable apparatus, the drop test of IEC 60079 still applies
- c) An enclosure meeting the requirements of IP20 and by restricted installation, provided that the restricted installation requirements shall be specified as Specific Conditions of Use and the certificate number shall include the “X”suffix in accordance with the markings

IP Requirement for Exe. Extract from EN/IEC 60079-7 4.10

4.10.1 The degrees of protection as defined in tests of enclosures of IEC 60079-0, as applicable, shall be as prescribed in a),b), or c) unless otherwise specified in 4.10.2, 4.10.3 or Clause 5. for level of protection “ec”, the tests of enclosure requirements of IEC 60079-0 are modified for the thermal endurance to heat preconditioning test to replace the 20 K above the service temperature (Ts + 20 k) with 10 K above the service temperature (Ts + 20 k)

- a) Enclosures containing bare conductive live parts shall provide at least the degree of protection IP54
- b) Enclosures containing only insulated conductive live parts as in 4.6 shall provide at least the degree of protection IP44
- c) Enclosures for containing only insulated conductive live parts in 4.6 can provided a reduced degree of protection of IP23 for Group I, or IP20 for Group II, if solid foreign bodies are prevented from falling vertically through any opening into enclosure, for this equipment, the certificate number shall include the “X” suffix in accordance with the marketing requirements of IEC 60079-0 and the specific conditions of use listed on the certificate shall detail the degree of protection provided by enclosure and provided guidance on the protection by location that is required. An example of an application where this reduced degree of protection could be suitable is a clean environment

For level of protection “ec”, opening of the enclosure for maintenance purpose, is not considered normal operation, and the opening times requirement of IEC 60079-0 does not apply

NOTE: The degree of protection requirements from general industrial standards are not applied directly for the evaluation of the explosion protection for Ex Equipment

The bars and rings or the roter cages are not considered to be bare live parts when determining the degree of protection

The Flameproof Exd protection concept (as defined in EN/IEC 60079-1) does not have a mandatory IP requirement. By design, Exd products often have flamepaths - gaps with controlled clearances to the outer environment designed to quench a flame following an internal ignition. In Exd applications often a parallel threaded joint between the gland and enclosure is considered a flamepath, and the threads are not permitted to be sealed with tape or solid setting sealant. The extract below from 60079-14 10.2 confirms that so long as the defined conditions are met, the threaded joint is expected to maintain IP54. If IP66 is required, our recommendation is to utilise either a sealing washer or a non-setting thread sealant. The suitability of either method is dependent on the end user application

Extract from EN/IEC 60079-14 10.2

To meet the ingress protection requirement, it may also be necessary to seal between cable glands, adapter and blanking elements and the enclosure (for example by means of a sealing washer or thread sealant)

Note 2: In order to meet the minimum requirement of IP54, threaded cable entry devices in to threaded cable entry plates or enclosures of 6 mm or greater thickness need no additional sealing between the cable entry device and the entry plate or enclosure provided the axis of the cable entry device is perpendicular to the external surface of the cable entry plate or enclosure

How to maintain IP between gland and enclosure

The diagrams on the following pages are recommendations for maintaining Ingress Protection at the joint between gland and enclosure. The recommendations are based on testing and years of experience in applications, but are not blanket applicable to all applications. The end user should ensure that the joint is appropriate to the installation and, if in doubt test the equipment with the product.

It is often noted in the special conditions of use on the cable gland certificate that in order to maintain ingress protection when using a sealing washer:

- The surface of the enclosure should be smooth (to ensure good washer sealing contact)
- The entry hole in the enclosure should be perpendicular to the external wall of the enclosure (there have been instances where the performance of the IP washer is compromised due to draft angle on a moulded enclosure for example).

In many instances, particularly in Exe, the cable entry device will be mounted onto a thinwalled stainless steel or polymer enclosure, and secured with a locknut. In these cases, a sealing washer may be used in order to maintain IP66 and IP67. Hawke recommends a hole diameter of +0.3mm clearance above nominal thread size. E.g M25 should use a 25.3mm clearance hole. Be aware that the enclosure will often have a limitation of absolute maximum clearance hole size to maintain the IP rating. Typically Hawke enclosures have an absolute maximum of +0.7mm diametric clearance from the nominal thread outer diameter.

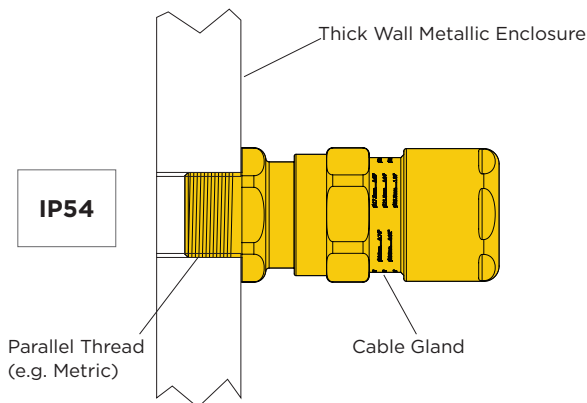
When fitting cable entry devices, the wall thickness of an enclosure and the accessories used can sometimes limit the number of thread engagement a locknut will achieve. Hawke International recommends that the entry thread comes completely through the locknut to ensure full thread engagement. Where this is not possible, an absolute minimum of 1 full thread of engagement should be acceptable.

When the cable gland entry is being fitted into a threaded hole in the enclosure, the installer may prefer to utilise a thread sealant as opposed to IP washers. As the cable gland manufacturer, Hawke International does not make specific recommendations around type or grade of thread sealant as this is dependent on the application, environment and enclosure. Hawke International recommends that in cases where thread sealant is desired then testing of the gland, sealant and enclosure arrangement is performed to ensure the required IP ratings are achieved. A key consideration around the use of sealant is when used for Exd flameproof applications, the thread sealant may not be "solid setting." The entry thread is considered a flamepath when installed in Exd and solid setting material may adversely affect the ability of the enclosure to dissipate explosive forces. This requirement is called out in IEC EN 60079-14 installation standard, see below extract.

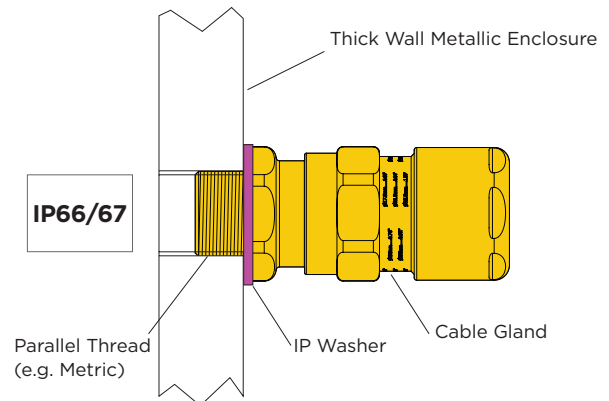
Extract from EN/IEC 60079-14 10.6.1

Flameproof cable glands, adapters or blanking elements, having parallel threads may be fitted with a sealing washer between the entry device and the flameproof enclosure provided that, after the washer has been fitted, the applicable thread engagement is still achieved. Thread engagement shall be at least five full threads. Suitable grease may be used provided it is nonsetting, non-metallic and non-combustible and any earthing between the two is maintained.

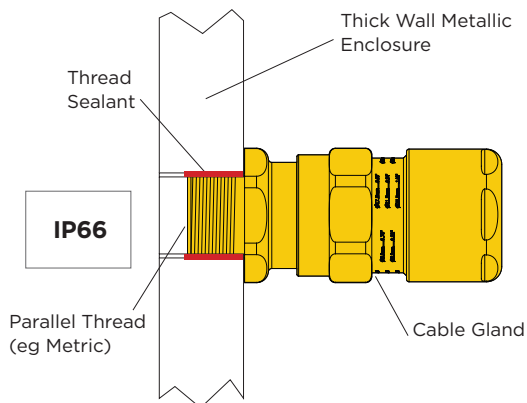
Common examples of cable entry installations



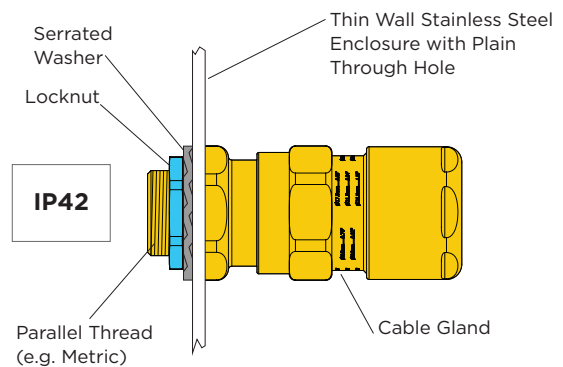
Parallel threaded metric joint with no additional sealing
 - This may be expected to maintain IP54 in line with EN 60079-14 Clause 10.6.2 (min 6mm wall thickness)



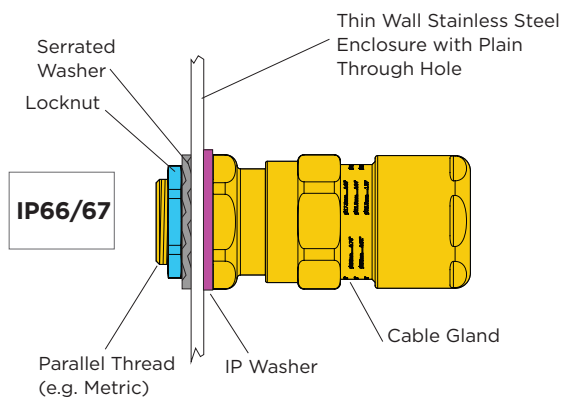
Parallel threaded metric joint with Hawke IP washer - This may be expected to maintain IP66 and IP67. Note the conditions of the enclosure mentioned earlier in this document.



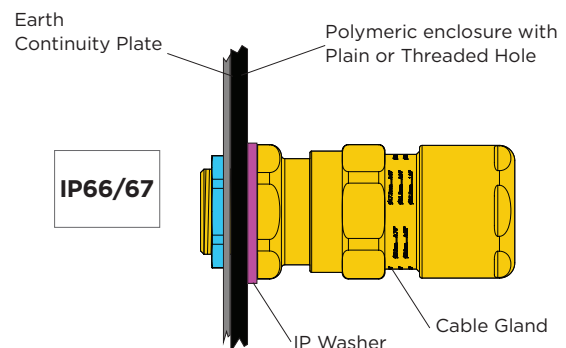
Parallel threaded metric joint utilising a thread sealant would be expected to achieve IP66 (more ratings may be achievable with testing). Note the entry thread is considered a flamepath in Exd applications and therefore a non solid setting compound must be used.



Thin walled stainless steel enclosure with a plain clearance hole, no additional sealing and secured with a locknut and serrated washer - This will be expected to maintain IP42.

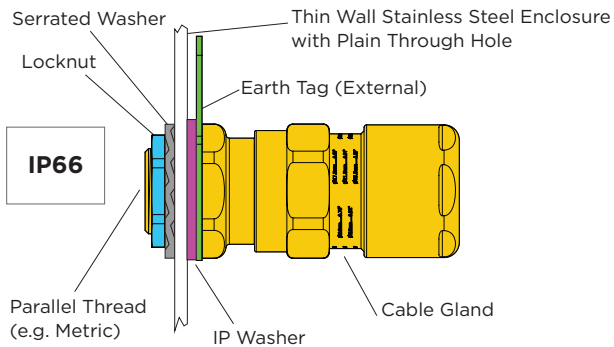


Thin walled stainless steel enclosure with a plain clearance hole, sealed with an IP washer and secured with a locknut and serrated washer
 - This will be expected to maintain IP66 and IP67.
 Be aware of limitations regarding maximum hole size. This normally forms part of the special conditions of use of the enclosure.

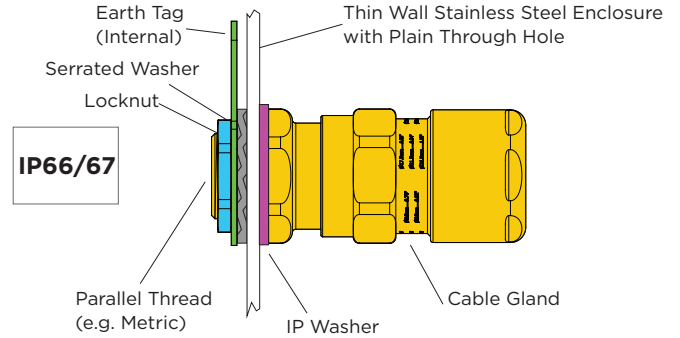


Thinwalled polymeric enclosure with a plain clearance hole, fitted with a nylon sealing washer and secured with a locknut
 - This will be expected to maintain IP66 and IP67.
 Be aware of limitations regarding maximum hole size. These normally form part of the special conditions of use of the enclosure.

Maintaining IP when using earth tags



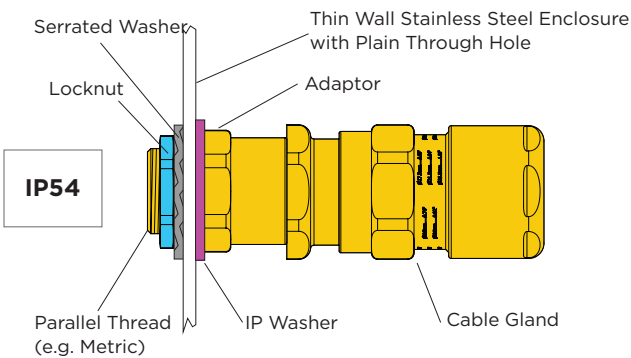
So long as the earth tag is flat, does not bow away from the compression face of the entry and the mounting holes are perpendicular then this arrangement may be expected to meet IP66.



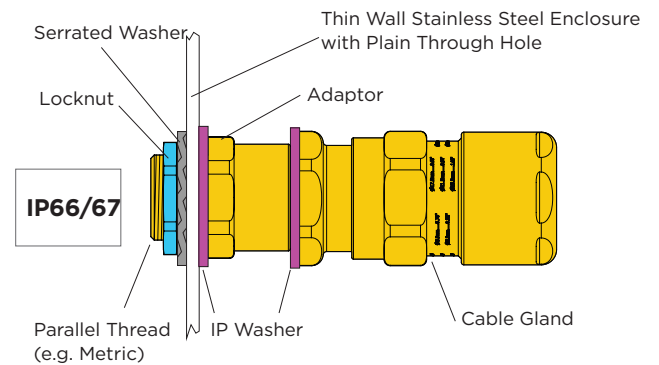
If the earth tag is fitted internally to the enclosure, it will not have any impact on IP, therefore this arrangement may be expected to achieve IP66 and IP67.

Maintaining IP when adaptor is fitted

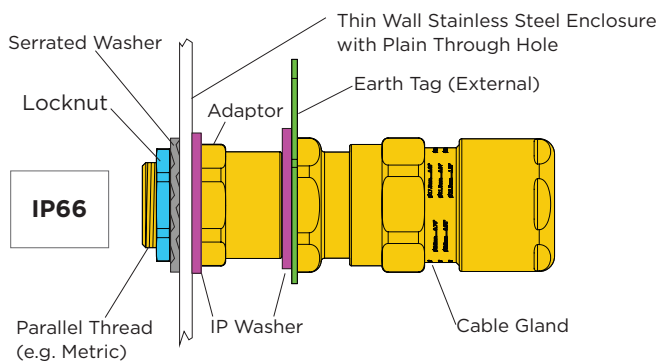
When using an threaded adaptor between the cable gland and the enclosure, steps should be taken to ensure that the threaded joints maintain the appropriate level of ingress protection.



As there is no additional sealing between the adaptor and the gland entry, the threaded joint can be expected to maintain IP54.

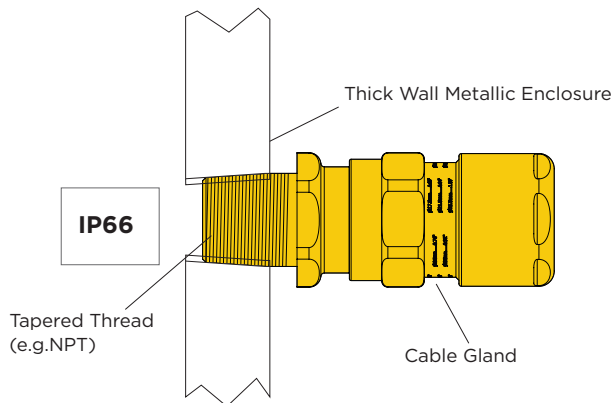


By adding a sealing washer between the adaptor and gland entry, the arrangement will be expected to meet IP66 and IP67. Choose suitable locknut, for example NPSL for NPT fittings.



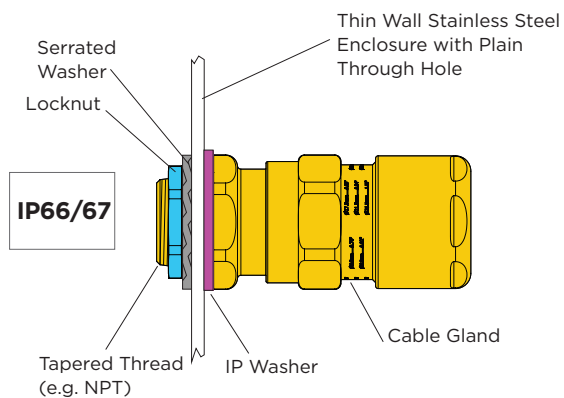
If an earth tag is fitted between the nylon washer and the cable gland, so long as the earth tag is flat and does not bow away from the compression face of the entry then this arrangement may be expected to meet IP66.

Tapered Threads



A 'wrench tight' Tapered NPT threaded joint may be expected to achieve IP66. If being used in an application where ingress is a concern, additional thread sealant may be used so long as it is allowed by the protection concepts of the installation.

When installing taper thread entries into thickwalled enclosures, the taper should engage and lock wrench tight, before the entry flange makes contact with the enclosure face. It is normal to see a gap between the inside face of the entry flange and the enclosure wall where indicated.



NPT taper threads installed into thinwalled enclosures utilising an NPT locknut require an IP washer between the gland entry and enclosure wall to achieve IP66/67.

Recommended Clearance Holes for NPT Threadforms

NPT Thread Size	Nominal Maximum Diameter of Thread (mm)	Recommended Enclosure Clearance Hole* (+0.3mm above thread nominal)
3/8"	17.14	17.4
1/2"	21.34	21.6
3/4"	26.67	27.0
1"	33.4	33.7
1 1/4"	42.16	42.4
1 1/2"	48.26	48.6
2"	60.33	60.6
2 1/2"	70.3	73.0
3"	88.9	89.2
3 1/2"	101.6	101.9
4"	114.3	114.6
5"	141.3	141.6
6"	168.28	168.6

*+0.3mm clearance is a general recommendation of Hawke International. The Maximum clearance is often limited by the enclosure certification. We recommend clearance hole diameter is evaluated on a case by case basis by the installer.

Recommended Torques between gland entry device and enclosure

The below values have been generated in lab conditions and are intended to provide guidance as to the recommended torques when installing Hawke products. Note these values have been generated on generic installations, and should be used as guidance only. Values may vary depending on application and the enclosure.

All recommended torques below have been tested and verified to maintain IP66 and IP67 on Hawke enclosures. If there are any concerns around specific applications, we recommend that you contact Hawke for further advice.

Recommended Torque Value				
Enclosure Type	Hole Type	Thread Material	Thread Size	Recommended Torque Value (N/m)
Polymer* and Metallic	Threaded and Plain Clearance	Polymer	M16 x 1.5	5
			M20 x 1.5	5
			M25 x 1.5	10
			M32 x 1.5	15
			M40 x 1.5	18
			M50 x 1.5	18
			M63 x 1.5	20
			M75 x 1.5	20
		Metallic	M16 x 1.5	15
			M20 x 1.5	15
			M25 x 1.5	20
			M32 x 1.5	25
			M40 x 1.5	30
			M50 x 1.5	35
			M63 x 1.5	40
M75 x 1.5	50			

**The installer should be aware of the risks of stripping threads in polymer threaded enclosures. The maximum torque of the hole may be limited by the enclosure material, or the quality of the threads machined into the enclosure*

United Kingdom

Hubbell UK, Ashton Rd, Bredbury Park Industrial Estate
Bredbury, Stockport SK6 2QN
Tel: +44 (0)141 882 5555 Email: getintouchuk@hubbell.com

U.S.A.

Killark Electric, 2112 Fenton Logistics Park Blvd
Fenton, MO 63026
Tel: +1 (314) 531 0460 Email: killarkinfo@hubbell.com

Middle East

Building No. 5EA Office No. G03 Dubai Airport Free Zone
(DAFZ) Office #432, Building #6EB PO Box 23529 Dubai UAE
Tel: +971 (0)4 609 1222 Email: middle-east@chalmit.com

Asia Pacific

130 Joo Seng Road #03-02 Olivine Building Singapore 368357
Tel: +65 6282 2242 Email: asia-pacific@ehawke.com

Korea

512 Hyosung Intellian 681-3 Deungchon Dong
Kangseo-Ku Seoul 157-030 Korea
Tel: +82 2 2063 3719 Email: korea@ehawke.com

China

Room H/1 18F No. 728 Pudong Avenue
Shanghai International Ocean and Finance Building
Shanghai 200120 P.R. China
Tel: (86 21) 3392 6550 ext. 318 Email: china@ehawke.com



A proud member of the Hubbell family.