

How to Identify Fluid Ports and Connectors

A guide to North American, British, Japanese, German (DIN metric), and ISO connections



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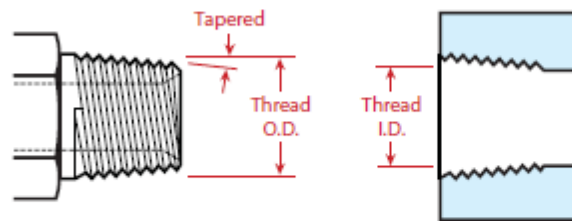
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Amercial Dryseal Pipe Threads

National Pipe Tapered Fuel (NPTF)

This connection is still widely used in fluid power systems, even though it is not recommended by the National Fluid Power Association (NFPA) for use in hydraulic applications. The thread is tapered and the seal takes place by deformation of the threads.



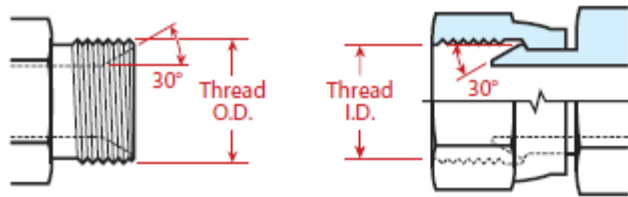
NPTF Thread Tip: Measure the thread diameter and subtract one quarter inch to find the nominal pipe size.

Inch Size	Dash Size	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
1/8	-02	1/8 - 27	13/32 (0.41")	3/8 (0.38")
1/4	-04	1/4 - 18	17/32 (0.54")	1/2 (0.49")
3/8	-06	3/8 - 18	11/16 (0.68")	5/8 (0.63")
1/2	-08	1/2 - 14	27/32 (0.84")	25/32 (0.77")
3/4	-12	3/4 - 14	1 1/16 (1.05")	1 (0.98")
1	-16	1 - 11 1/2	1 5/16 (1.32")	1 1/4 (1.24")
1 1/4	-20	1 1/4 - 11 1/2	1 21/32 (1.66")	1 19/32 (1.58")
1 1/2	-24	1 1/2 - 11 1/2	1 29/32 (1.90")	1 13/16 (1.82")
2	-32	2 - 11 1/2	2 3/8 (2.38")	2 5/16 (2.30")

National Pipe Straight Mechanical (NPSM)

This connection is sometimes used in fluid power systems. The female half has a straight thread and an inverted 30° seat. The male half has a straight thread and a 30° internal chamfer. The 30° seat of the female seals against the chamfer on the male. The threads hold the connection mechanically.

A properly chamfered NPTF male (page 2) will also seal with a NPSM female.



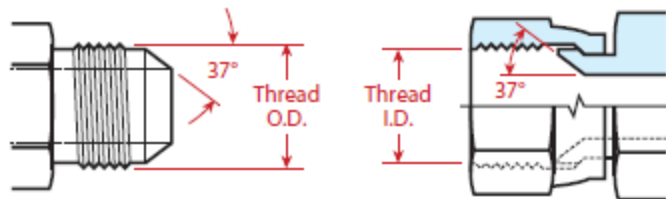
Inch Size	Dash Size	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
1/8	-02	1/8-27	13/32 (0.41")	3/8 (0.38")
1/4	-04	1/4-18	17/32 (0.54")	1/2 (0.49")
3/8	-06	3/8-18	11/16 (0.68")	5/8 (0.63")
1/2	-08	1/2-14	27/32 (0.84")	25/32 (0.77")
3/4	-12	3/4-14	1 1/16 (1.05")	1 (0.98")
1	-16	1-11 1/2	1 5/16 (1.32")	1 1/4 (1.24")
1 1/4	-20	1 1/4-11 1/2	1 21/32 (1.66")	1 19/32 (1.58")
1 1/2	-24	1 1/2-11 1/2	1 29/32 (1.90")	1 13/16 (1.82")
2	-32	2-11 1/2	2 3/8 (2.38")	2 5/16 (2.30")

JIC 37° Flare

SAE J514

Originally named for the now-defunct Joint Industrial Commission (JIC), this connection is very common in fluid power systems. Both the male and female halves of this connection have 37° seats. The seal takes place by establishing a line of contact between the male flare and the female cone seat. The threads hold the connection mechanically.

This connection is also commonly used with flared tubing (not pictured).



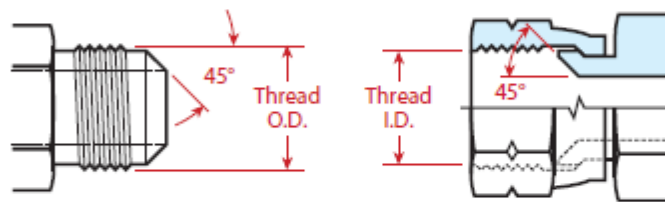
Tube Size	Dash Size	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
1/8	-02	5/16 - 24	5/16 (0.31")	9/32 (0.27")
3/16	-03	3/8 - 24	3/8 (0.38")	11/32 (0.34")
1/4	-04	7/16 - 20	7/16 (0.44")	13/32 (0.39")
5/16	-05	1/2 - 20	1/2 (0.50")	15/32 (0.45")
3/8	-06	9/16 - 18	9/16 (0.56")	17/32 (0.51")
1/2	-08	3/4 - 16	3/4 (0.75")	11/16 (0.69")
5/8	-10	7/8 - 14	7/8 (0.88")	13/16 (0.81")
3/4	-12	1 1/16 - 12	1 1/16 (1.06")	1 (0.98")
7/8	-14	1 3/16 - 12	1 3/16 (1.19")	1 1/8 (1.10")
1	-16	1 5/16 - 12	1 5/16 (1.31")	1 1/4 (1.23")
1 1/4	-20	1 5/8 - 12	1 5/8 (1.63")	1 9/16 (1.54")
1 1/2	-24	1 7/8 - 12	1 7/8 (1.88")	1 13/16 (1.79")
2	-32	2 1/2 - 12	2 1/2 (2.50")	2 7/16 (2.42")

SAE 45° Flare

SAE J512

This connection is very common in refrigeration, automotive and truck piping systems. The connectors are frequently made of brass. Both the male and female halves of this connection have 45° seats. The seal takes place between the male flare and the female cone seat. The threads hold the connection mechanically.

This connection is also commonly used with flared tubing (not pictured).



Tube Size	Dash Size	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
1/8	-02	5/16 - 24	5/16 (0.31")	9/32 (0.27")
3/16	-03	3/8 - 24	3/8 (0.38")	11/32 (0.34")
1/4	-04	7/16 - 20	7/16 (0.44")	13/32 (0.39")
5/16	-05	1/2 - 20	1/2 (0.50")	15/32 (0.45")
3/8	-06	5/8 - 18	5/8 (0.63")	9/16 (0.57")
1/2	-08	3/4 - 16	3/4 (0.75")	11/16 (0.69")
5/8	-10	7/8 - 14	7/8 (0.88")	13/16 (0.81")
3/4	-12	1 1/16 - 14	1 1/16 (1.06")	1 (0.99")
7/8	-14	1 1/4 - 12	1 1/4 (1.19")	1 5/32 (1.16")
1	-16	1 3/8 - 12	1 3/8 (1.31")	1 9/32 (1.29")

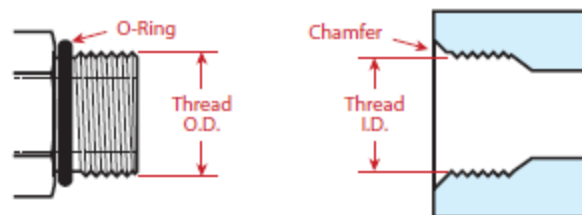
Caution: In sizes -02, -03, -04, 05, -08 and -10, the threads of the SAE 37° flare and SAE 45° flare are the same. However, the sealing surface angles are not the same.

SAE Straight Thread O-Ring (ORB)

SAE J1926-1 and ISO 11296-1

Conforms to MS16142, UN/UNF Threads

This port connection (sometimes called O-Ring Boss) is recommended for optimum leakage control in medium and high pressure hydraulic systems. The male connector has a straight thread and an O-ring. The female port has a straight thread, a machined surface (minimal spotface) and a chamfer to accept the O-ring. The seal takes place by compressing the O-ring into the chamfer. The threads hold the connection mechanically.

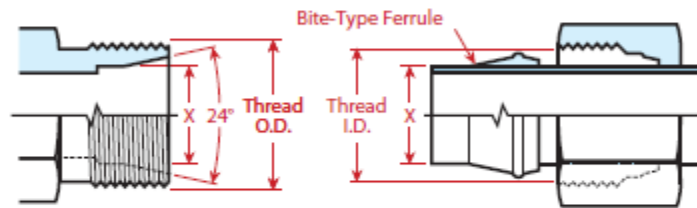


Nominal Port Size	Dash Size	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
1/8"	-02	5/16 - 24	5/16 (0.31")	9/32 (0.27")
3/16"	-03	3/8 - 24	3/8 (0.38")	11/32 (0.34")
1/4"	-04	7/16 - 20	7/16 (0.44")	13/32 (0.39")
5/16"	-05	1/2 - 20	1/2 (0.50")	15/32 (0.45")
3/8"	-06	9/16 - 18	9/16 (0.56")	17/32 (0.51")
1/2"	-08	3/4 - 16	3/4 (0.75")	11/16 (0.69")
5/8"	-10	7/8 - 14	7/8 (0.88")	13/16 (0.81")
3/4"	-12	1 1/16 - 12	1 1/16 (1.06")	1 (0.98")
7/8"	-14	1 3/16 - 12	1 3/16 (1.19")	1 1/8 (1.10")
1"	-16	1 5/16 - 12	1 5/16 (1.31")	1 1/4 (1.23")
1 1/4"	-20	1 5/8 - 12	1 5/8 (1.63")	1 9/16 (1.54")
1 1/2"	-24	1 7/8 - 12	1 7/8 (1.88")	1 13/16 (1.79")
2"	-32	2 1/2 - 12	2 1/2 (2.50")	2 7/16 (2.42")

Flareless Compression

SAE J514

The male connector has parallel threads and a 24° seat. The female half of this connection incorporates a bite-type ferrule/sleeve used in conjunction with a tube and a female nut. When the nut is tightened, the seal is made between the sleeve and the 24° seat. A seal is also made between the sleeve and the tubing. The threads hold the connection mechanically.

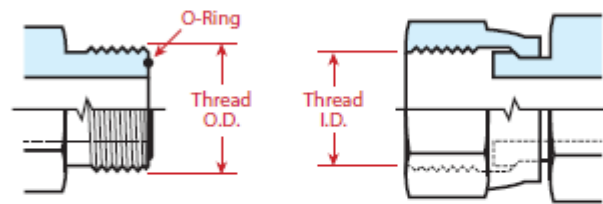


Tube O.D. (X)	Dash Size	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
1/8"	-02	5/16 - 24	5/16 (0.31")	9/32 (0.27")
3/16"	-03	3/8 - 24	3/8 (0.38")	11/32 (0.34")
1/4"	-04	7/16 - 20	7/16 (0.44")	13/32 (0.39")
5/16"	-05	1/2 - 20	1/2 (0.50")	15/32 (0.45")
3/8"	-06	9/16 - 18	9/16 (0.56")	17/32 (0.51")
1/2"	-08	3/4 - 16	3/4 (0.75")	11/16 (0.69")
5/8"	-10	7/8 - 14	7/8 (0.88")	13/16 (0.81")
3/4"	-12	1 1/16 - 12	1 1/16 (1.06")	1 (0.98")
7/8"	-14	1 3/16 - 12	1 3/16 (1.19")	1 1/8 (1.10")
1"	-16	1 5/16 - 12	1 5/16 (1.31")	1 1/4 (1.23")
1 1/4"	-20	1 5/8 - 12	1 5/8 (1.63")	1 9/16 (1.54")
1 1/2"	-24	1 7/8 - 12	1 7/8 (1.88")	1 13/16 (1.79")
2"	-32	2 1/2 - 12	2 1/2 (2.50")	2 7/16 (2.42")

O-Ring Face Seal (ORFS)

SAE J1453

This connection offers the very best leakage control available today. The male connector has a straight thread and O-ring in the face. The female has a straight thread and a machined flat face. The seal takes place by compressing the O-ring onto the flat face of the female, similar to a flange type fitting. The threads hold the connection mechanically.

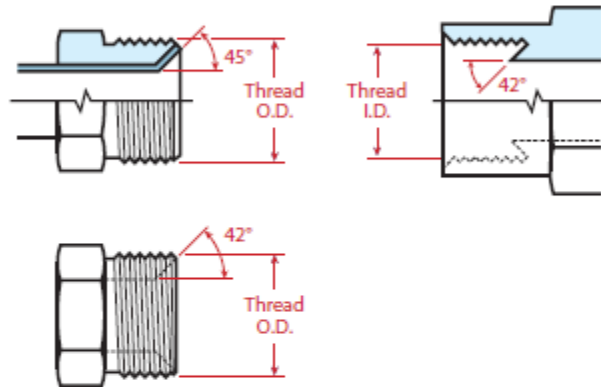


Inch Size	Dash Size	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
1/4	-04	9/16 - 18	9/16 (0.56")	17/32 (0.51")
3/8	-06	11/16 - 16	11/16 (0.69")	5/8 (0.63")
1/2	-08	13/16 - 16	13/16 (0.82")	3/4 (0.75")
5/8	-10	1 - 14	1 (1.00")	15/16 (0.93")
3/4	-12	1 3/16 - 12	1 3/16 (1.19")	1 1/8 (1.11")
1	-16	1 7/16 - 12	1 7/16 (1.44")	1 3/4 (1.36")
1 1/4	-20	1 11/16 - 12	1 11/16 (1.69")	1 5/8 (1.61")
1 1/2	-24	2 - 12	2 (2.00")	1 15/16 (1.92")

Inverted Flare

SAE J512

This connection is frequently used in automotive systems. The male connector can either be a 45° flare in the tube fitting form or a 42° seat in the machined adapter form. The female has a straight thread with a 42° inverted flare. The seal takes place on the flared surfaces. The threads hold the connection mechanically.



Inch Size	Dash Size	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
1/8	-02	5/16 - 28	5/16 (0.32")	9/32 (0.28")
3/16	-03	3/8 - 24	3/8 (0.38")	11/32 (0.34")
1/4	-04	7/16 - 24	7/16 (0.44")	13/32 (0.40")
5/16	-05	1/2 - 20	1/2 (0.50")	15/32 (0.45")
3/8	-06	5/8 - 18	5/8 (0.63")	9/16 (0.57")
7/16	-07	11/16 - 18	11/16 (0.69")	5/8 (0.63")
1/2	-08	3/4 - 18	3/4 (0.75")	23/32 (0.70")
5/8	-10	7/8 - 18	7/8 (0.88")	13/16 (0.82")
3/4	-12	1 1/16 - 16	1 1/16 (1.06")	1 (1.00")

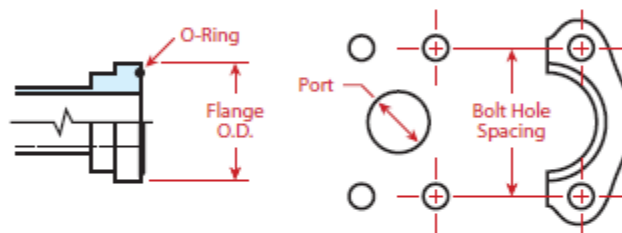
Four-Bolt Flange

SAE J518 and ISO 6162

Interchangeable with DIN 20066 and JIS B 8363, except for the bolt sizes.

This connection is commonly used worldwide to connect larger size hose and tubing (1/2" to 3") in fluid power systems. An O-ring, inserted into a ring groove in the flange head, seals on a smooth faced female port, and is held in place by two clamp halves and four bolts in rectangular pattern.

ISO 6162 / SAE J518 flanges come in two pressure classes: the standard series Code 61 and the high pressure (6,000 psi) Code 62.

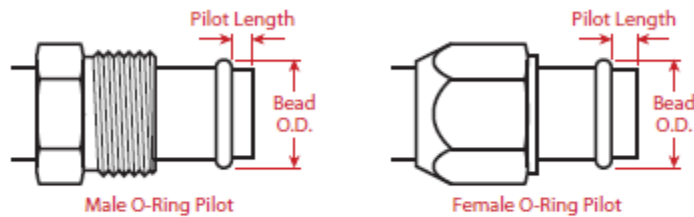


Port/ Inch Size	Dash Size	Code 61 Bolt Hole Spacing	Code 61 Flange Head Diameter	Code 62 Bolt Hole Spacing	Code 62 Flange Head Diameter
1/2	-08	1 1/2 (1.50")	1 3/16 (1.19")	1 19/32 (1.59")	1 1/4 (1.25")
3/4	-12	1 7/8 (1.88")	1 1/2 (1.50")	2 (2.00")	1 5/8 (1.63")
1	-16	2 1/16 (2.06")	1 3/4 (1.75")	2 1/4 (2.25")	1 7/8 (1.88")
1 1/4	-20	2 5/16 (2.31")	2 (2.00")	2 5/8 (2.63")	2 1/8 (2.13")
1 1/2	-24	2 3/4 (2.75")	2 3/8 (2.38")	3 1/8 (3.13")	2 1/2 (2.50")
2	-32	3 1/16 (3.06")	2 13/32 (2.81")	3 13/16 (3.81")	3 1/8 (3.13")
2 1/2	-40	3 1/2 (3.50")	3 5/16 (3.31")	n/a	n/a
3	-48	4 3/16 (4.19")	4 (4.00")	n/a	n/a

Note: CAT thick flanges have a flange thickness of 0.56" (all sizes) to interchange with Caterpillar® split flanges. All other CAT flange dimensions are identical to Code 62.

O-Ring Pilot Threads

This connection, sometimes known as Beadlock, is common to air conditioning systems, both in vehicle and commercial applications. Both the male and female halves of the connection have a pilot, either long or short. The seal takes place by compressing an O-ring adjacent to the bead of the tube. The threads hold the connection mechanically.



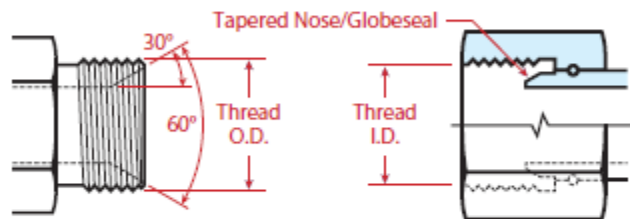
Male O-Ring Pilot Thread				Female O-Ring Pilot Thread	
Inch Size	Dash Size	Nominal Thread Size	Male Thread O.D.	Nominal Thread Size	Female Thread I.D.
3/8	-06	5/8 - 18	5/8 (0.62")	5/8 - 18	9/16 (0.57")
1/2	-08	3/4 - 18	3/4 (0.75")	3/4 - 16	11/16 (0.69")
5/8	-10	7/8 - 18	7/8 (0.87")	7/8 - 14	13/16 (0.81")
3/4	-12	1 1/16 - 16	1 1/16 (1.06")	1 1/16 - 14	1 (0.99")

Long Pilot				Short Pilot	
Inch Size	Nominal Tube Size	Bead O.D.	Pilot Length	Bead O.D.	Pilot Length
3/8	-06	0.52"	0.28"	0.52"	0.19"
1/2	-08	0.64"	0.39"	0.64"	0.19"
5/8	-10	0.77"	0.39"	0.77"	0.19"
3/4	-12	0.91"	0.39"	0.91"	0.19"

British Standard Pipe

British Standard Pipe Parallel (BSPP)

The BSPP (parallel) male connection is similar to, but not interchangeable with, the American NPSM male. The thread pitches are different in most sizes. The female swivel BSPP has a tapered nose, which seals on the cone seat of the male.



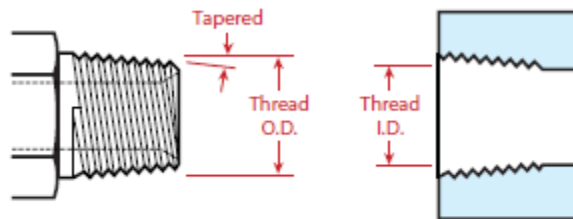
Inch Size	Dash Size	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
1/8	-02	1/8-28	3/8 (0.38")	11/32 (0.35")
1/4	-04	1/4-19	33/64 (0.52")	15/32 (0.47")
3/8	-06	3/8-19	21/32 (0.65")	19/32 (0.60")
1/2	-08	1/2-14	13/16 (0.82")	3/4 (0.75")
5/8	-10	5/8-14	7/8 (0.88")	13/16 (0.80")
3/4	-12	3/4-14	1 1/32 (1.04")	31/32 (0.97")
1	-16	1-11	1 5/16 (1.30")	1 7/32 (1.22")
1 1/4	-20	1 1/4-11	1 21/32 (1.65")	1 9/16 (1.56")
1 1/2	-24	1 1/2-11	1 7/8 (1.88")	1 25/32 (1.79")
2	-32	2-11	2 11/32 (2.35")	2 1/4 (2.26")

British Standard Pipe threads are sometimes identified as "G" (for parallel threads) or "R" (for tapered threads) followed by a fractional dimension.

Example: 1/2-14 BSPP may be expressed as G 1/2

British Standard Pipe Tapered (BSPT)

The BSPT (tapered) male connector is similar to American NPTF, but the thread pitches are different in most sizes. The thread form and diameters are close, but not identical. Sealing is accomplished by distorting the threads. A properly chamfered BSPT male will also seal with a BSPP female swivel.



Inch Size	Dash Size	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
1/8	-02	1/8 - 28	3/8 (0.38")	11/32 (0.35")
1/4	-04	1/4 - 19	33/64 (0.52")	15/32 (0.47")
3/8	-06	3/8 - 19	21/32 (0.65")	19/32 (0.60")
1/2	-08	1/2 - 14	13/16 (0.82")	3/4 (0.75")
5/8	-10	5/8 - 14	7/8 (0.88")	13/16 (0.80")
3/4	-12	3/4 - 14	1 1/32 (1.04")	31/32 (0.97")
1	-16	1 - 11	1 5/16 (1.30")	1 7/32 (1.22")
1 1/4	-20	1 1/4 - 11	1 21/32 (1.65")	1 9/16 (1.56")
1 1/2	-24	1 1/2 - 11	1 7/8 (1.88")	1 25/32 (1.79")
2	-32	2 - 11	2 11/32 (2.35")	2 1/4 (2.26")

British Standard Pipe threads are sometimes identified as "G" (for parallel threads) or "R" (for tapered threads) followed by a fractional dimension.

Example: 1/2 - 14 BSPT may be expressed as R 1/2

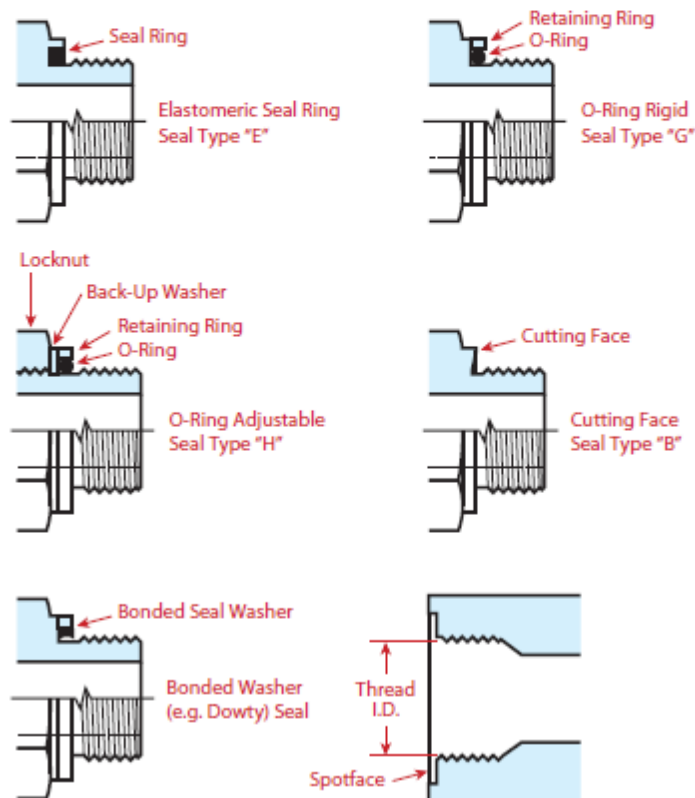
Flat Face Port with BSPP Threads

ISO 1179-1

DIN 3852, Part 2

Parallel threads seal using various sealing rings or washers, such as O-rings, bonded seals or metal to metal seals. The female port has a machined flat surface (spotface) which the male seals against.

Please see the ISO 228-1 "G" or BSPP thread dimensions on page 12.



Flat Face Port with Metric Threads

ISO 9974-1
DIN 3852, Part 1

This connection is similar to ISO 1179-1, except for the metric threads. The fittings have parallel threads and seal using various sealing rings, washers or metal to metal seals.

For illustration, please see the diagrams of ISO 1179-1 on the facing page.

ISO 261 "M" Metric Threads

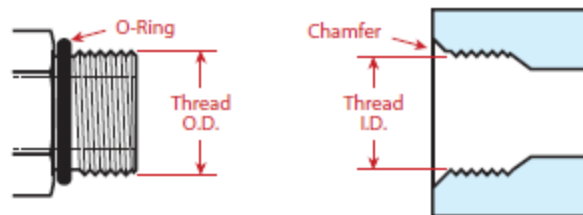
Metric Thread Size	Male Thread O.D.	Female Thread I.D.
M8x1.0	8 mm	7 mm
M10x1.0	10 mm	9 mm
M12x1.5	12 mm	10.5 mm
M14x1.5	14 mm	12.5 mm
M16x1.5	16 mm	14.5 mm
M18x1.5	18 mm	16.5 mm
M20x1.5	20 mm	18.5 mm
M22x1.5	22 mm	20.5 mm
M24x1.5	24 mm	22.5 mm
M26x1.5	26 mm	24.5 mm
M27x2.0	27 mm	25 mm
M33x2.0	33 mm	31 mm
M36x2.0	36 mm	34 mm
M42x2.0	42 mm	40 mm
M45x2.0	45 mm	43 mm
M48x2.0	48 mm	46 mm

Metric Port and Stud Ends

ISO 6149

ISO 261 Metric Threads and O-Ring Seal

This port connection is similar to the SAE J1926-1 Straight Thread O-Ring on page 6, except for the metric threads. The male connector has a straight metric thread and an O-ring. The female port has a straight metric thread, a machined surface (minimum spotface) and a chamfer to accept the O-ring. The seal is created by compressing the O-ring into the chamfer, and the threads hold the connection mechanically.



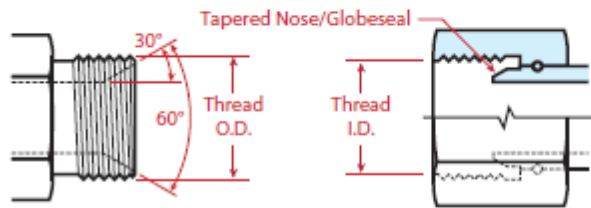
Metric Thread Size	Male Thread O.D.	Female Thread I.D.
M8x1.0	8 mm	7 mm
M10x1.0	10 mm	9 mm
M12x1.5	12 mm	10.5 mm
M14x1.5*	14 mm	12.5 mm
M16x1.5	16 mm	14.5 mm
M18x1.5	18 mm	16.5 mm
M22x1.5	22 mm	20.5 mm
M27x2.0	27 mm	25 mm
M33x2.0	33 mm	31 mm
M42x2.0	42 mm	40 mm
M48x2.0	48 mm	46 mm
M60x2.0	60 mm	58 mm

* M14x1.5 is recommended for diagnostic port applications

Metric 60° Cone

DIN 7631

This thread is frequently used in hydraulic systems. The male connector has a straight metric thread and a 60° (included angle) recessed cone. The female has a straight thread and a tapered nose/globeseal seat. The seal takes place between the cone of the male and nose of the tapered nose/globeseal flareless swivel. The threads hold the connection mechanically.

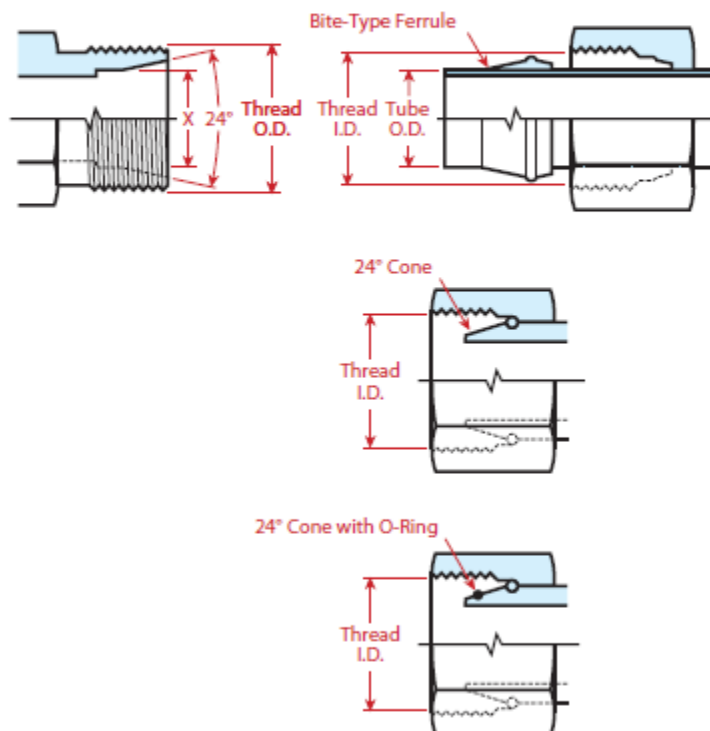


Use with Pipe/ Tube O.D.	Metric Thread Size	Male Thread O.D.	Female Thread I.D.
6 mm	M12x1.5	12 mm	10.5 mm
8 mm	M14x1.5	14 mm	12.5 mm
10 mm	M16x1.5	16 mm	14.5 mm
12 mm	M18x1.5	18 mm	16.5 mm
15 mm	M22x1.5	22 mm	20.5 mm
18 mm	M26x1.5	26 mm	24.5 mm
22 mm	M30x1.5	30 mm	28.5 mm
28 mm	M38x1.5	38 mm	36.5 mm
35 mm	M45x1.5	45 mm	43.5 mm
52 mm	M52x1.5	52 mm	50.5 mm

Metric Tube Compression / 24° Cone

DIN 2353

This metric system consists of one male and three female connectors, all of which have straight metric threads. Sealing takes place between the 24° seat in the male connector and the respective sealing areas in the female connectors.



DIN 2353 L and DIN 2353 S

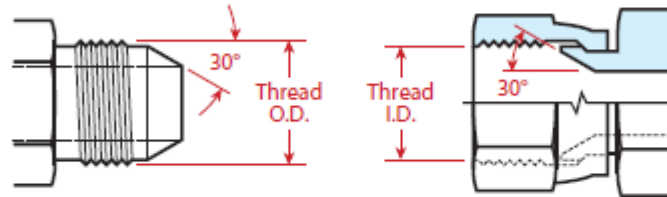
Metric tube compression fittings include two connections, the DIN 2353 L "light" series and the DIN 2353 S "heavy" series. The thread dimensions and tube sizes are different for each series.

DIN 2353 L Light Series Tube O.D.	DIN 2353 S Heavy Series Tube O.D.	Metric Thread Size	Male Thread O.D.	Female Thread I.D.
6 mm		M12x1.5	12 mm	10.5 mm
8 mm	6 mm	M14x1.5	14 mm	12.5 mm
10 mm	8 mm	M16x1.5	16 mm	14.5 mm
12 mm	10 mm	M18x1.5	18 mm	16.5 mm
	12 mm	M20x1.5	20 mm	18.5 mm
15 mm	14 mm	M22x1.5	22 mm	20.5 mm
	16 mm	M24x1.5	24 mm	22.5 mm
18 mm		M26x1.5	26 mm	24.5 mm
22 mm	20 mm	M30x2.0	30 mm	28 mm
28 mm	25 mm	M36x2.0	36 mm	34 mm
	30 mm	M42x2.0	42 mm	40 mm
35 mm		M45x2.0	45 mm	43 mm
42 mm	38 mm	M52x2.0	52 mm	50 mm

Japanese Industrial Standard

JIS 30° Flare

The JIS 30° flare connection is similar to the American JIC 37° flare (page 4), except for the 30° seat angle and the JIS B 0202 thread dimensions, which are the same as BSPP.

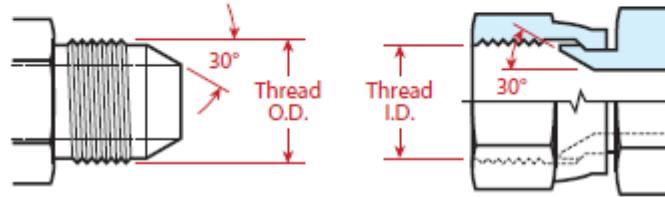


Inch Size	Dash Size	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
1/8	-02	1/8-28	3/8 (0.38")	11/32 (0.35")
1/4	-04	1/4-19	33/64 (0.52")	15/32 (0.47")
3/8	-06	3/8-19	21/32 (0.65")	19/32 (0.60")
1/2	-08	1/2-14	13/16 (0.82")	3/4 (0.75")
5/8	-10	5/8-14	7/8 (0.88")	13/16 (0.80")
3/4	-12	3/4-14	1 1/32 (1.04")	31/32 (0.97")
1	-16	1-11	1 5/16 (1.30")	1 7/32 (1.22")
1 1/4	-20	1 1/4-11	1 21/32 (1.65")	1 9/16 (1.56")
1 1/2	-24	1 1/2-11	1 7/8 (1.88")	1 25/32 (1.79")
2	-32	2-11	2 11/32 (2.35")	2 1/4 (2.26")

Komatsu 30° Flare

JIS Metric

Used extensively on Komatsu equipment, this connection has a 30° seat and parallel metric threads. Also referred to as JIS Metric, Komatsu fittings are sometimes confused with JIS 30° flare which has BSPP thread dimensions.



Dash Size	Metric Size Equivalent	Nominal Thread Size	Male Thread O.D.	Female Thread I.D.
-06	9	M18x1.5	18 mm	16.5 mm
-08	12	M22x1.5	22 mm	20.5 mm
-10	16	M24x1.5	24 mm	22.5 mm
-12	19	M30x1.5	30 mm	28.5 mm
-16	25	M33x1.5	33 mm	31.5 mm
-20	32	M36x1.5	36 mm	34.5 mm
-24	38	M42x1.5	42 mm	40.5 mm