

# Fluid Power Design Data Sheet



## REVISED SHEET 79 - EVOLUTION DESIGN DATA FILE

### ISO PIPE THREAD AND PORT THREAD SIZES

**Pipe Threads.** These metric pipe thread sizes have been adopted by the International Standards Organization (ISO) and are primarily intended for pipes or tubes for screwing together or into ISO pipe ports on valves, cylinders, pumps, and other components. An appropriate thread sealant can be used, if necessary, to ensure pressure-tight joints.

However, except on very small ports, straight threads with O-ring seal may be preferred to pipe threads as component ports. Straight thread ports are shown on the back side of this sheet. ISO metric machine threads should be used instead of pipe threads for mechanical fastenings such as bolts and nuts.

British Standard Pipe (BSP) threads, using the Whitworth thread form, have been adopted as the ISO standard for pipe threads and will hereafter be called out as ISO and not as BSP. ISO taper pipe threads are similar to the American NPT thread, having the same nominal sizes based on the pipe OD in inches, but with a slightly different thread pitch so the two systems are not interchangeable. Pitch (the distance between threads) is expressed as the number of threads per 25.4 mm (1 inch). As with NPT threads, the nominal size does not represent true outside pipe diameter, but, in the larger sizes, it comes very close. Sizes start at 1/16" and go up through 6 inches. Note: there is no ISO thread modification such as the National Pipe Thread Fuel (NPTF) for improved sealing between threads. Usually a thread sealant is required.

There are two variations of ISO pipe threads. Parallel threads (also called straight threads) and taper threads. Taper threads have a 1:16 taper and the same reamers can be used as for NPT threads. Reamers are not strictly necessary, but, in the larger sizes, they enable a better thread to be produced. ISO pipe threads, when specified, are assumed to be parallel unless a taper thread is called out. Taper threads seal on the threads themselves. Parallel threads, if a leaktight fluid seal is required, seal with a gasket, washer, or O-ring against the female seat. Since there is only one thread pitch, the thread pitch is usually not specified, and they are called out only by nominal size as noted below.

ISO Specification 7/1, 1982 issue, contains information on threads in which the fluid seal is made on the threads and covers both taper and parallel threads. ISO Specification 228/1, 1982 issue, contains information on threads which do NOT seal on the threads. These specifications give information on thread form, machining dimensions, and tolerances. Information on inspection and gauging is in Part 2 of the same specifications. Copies of ISO specifications can be purchased from the American National Standards Institute (ANSI).

Taper external threads (Specification 7/1) can be mated to either taper or parallel internal threads. However, parallel external threads do not make a tight fluid seal on the threads and should not be used for jointing. They should not be mated with internal pipe threads except where a leaktight joint is not required.

ISO Standard Pipe Sizes (for both Parallel and Taper Threads)					
ISO Specification 228/1		ISO Specification 7/1		Pipe Diameters	
Parallel Thread Only	Suggested Tap Drill	Tapered or Parallel	Suggested Tap Drill	Pipe O.D. Inches	Pipe O.D. mm*
1/8-28	Q	1/8-28	21/64	0.3830	9,73
1/4-19	29/64	1/4-19	7/16	0.5180	13,16
3/8-19	37/64	3/8-19	9/16	0.6560	16,16
1/2-14	47/64	1/2-14	23/32	0.8250	20,96
5/8-14	54/64	----	----	0.9020	22,91
3/4-14	61/64	3/4-14	59/64	1.041	26,44
7/8-14	1-1/16	----	----	1.189	30,20
1-11	1-3/16	1-11	1-11/64	1.309	33,25
1-1/8-11	1-3/64	----	----	1.492	37,90
1-1/4-11	1-17/32	1-1/4-11	1-1/2	1.650	41,91
1-3/8-11	1-41/64	----	----	1.745	44,32
1-1/2-11	1-49/64	1-1/2-11	1-47/64	1.882	47,80
1-3/4-11	2	----	----	2.116	53,75
2-11	2-15/64	2-11	2-3/16	2.347	59,61
*In the ISO metric system, a decimal point is written with a comma instead of a period.					

Internal parallel threads (Specification 228/1) can be mated to external parallel threads. If a fluid-tight seal is required a sealing element (washer or gasket) must be used. ISO Specification 7/1 applies to pipe threads which make a fluid-tight seal on the threads. The correct way of calling them out is:

- Internal parallel threads: "Pipe thread ISO 7/1-Rp 1½" (for example).
  - Internal taper threads: "Pipe thread ISO 7/1-Rc 1½" (for example).
  - External threads (always tapered for ISO 7/1): Pipe thread ISO 7/1-R 1½" (for example).
- Under Specification 7/1 there is no external parallel thread. (See Specification 228/1 ).

ISO Specification 228/1 applies to pipe threads which do NOT make a fluid-tight seal on the threads. The correct way of calling them out is:

- Internal thread (one tolerance only): "Pipe thread ISO 228/1-G1½" (for example).
- External thread (closer tolerance): "Pipe thread ISO 228/1-G1½A" (for example).
- External thread (with wider tolerance): "Pipe thread ISO 228/1-G1YzB" (for example).

## ISO PORT THREADS FOR PUMPS, VALVES, CYLINDERS, AND OTHER COMPONENTS

**Port Threads.** The ISO (International Standards Organization) has adopted these straight thread sizes for fluid ports on pumps, valves, cylinders, and other components. They seal with a metric O-ring. They will also be used on tube and hose fittings and on port adaptors. They cover a size range from about 1/8" to 2-1/2". Specifications, such as port machining dimensions, finishes, and tolerances, are shown in ISO Specification 6149-1980(E). A copy can be purchased from the ANSI.

In the ISO metric system, a decimal point is made with a comma instead of a period. Threads are called out by OD and pitch in millimeters. Pitch is the distance between adjacent thread crests. For example, a port size of M12 x 1,5 means a thread OD of 12 mm and a pitch of 1-1/2 mm. Since there is only one pitch, port threads may be called out by diameter alone, as M12, etc. ISO pipe threads, either parallel or tapered, can also be used as component port threads. See chart on front side of this sheet.

SI Metric Port Size, Millimeters	Inch Equiv. Diam.	Nearest* Smaller U.S.Port	Nearest* Largest U.S.Port	Suggested O-Ring Seal**
M5 x 0,8	0.1968			5,00 x 1,50
M8 x 1,0	0.3150			7,00 x 1,50
M10 x 1,0	0.3937			9,00 x 1,50
M12 x 1,5	0.4724	7/16-20	1/2-20	11,00 x 2,00
M14 x 1,5	0.5512	1/2-20	9/16-20	13,00 x 2,00
M16 x 1,5	0.6299			15,00 x 2,00
M18 x 1,5	0.7087		3/4-16	17,00 x 2,00
M22 x 1,5	0.8661		7/8-14	20,00 x 2,00
M27 x 2,0	1.063	1-1/16-12		24,00 x 2,00
M33 x 2,0	1.299	1-3/16-12	1-5/16-12	30,00 x 3,00
M42 x 2,0	1.654	1-5/8-12		40,00 x 3,00
M50 x 2,0	1.969	1-7/8-12		46,00 x 3,00
M60 x 2,0	2.362		2-1/2-12	56,00 x 3,00

Coarse Series Size, mm	Tap Drill Diam., mm	Fine Series Size, mm	Tap Drill Diam., mm
M1,6 x 0,35	1,25	<i>M1,6 x 0,20</i>	1,40
M1,8 x 0,35	1,45	<i>M1,8 x 0,20</i>	1,60
M2,0 x 0,40	1,60	<i>M2,0 x 0,25</i>	1,75
M2,2 x 0,45	1,45	<i>M2,2 x 0,25</i>	1,95
M2,5 x 0,45	2,05	<i>M2,5 x 0,35</i>	2,15
M3,0 x 0,50	2,50	<i>M3,0 x 0,35</i>	2,65
M3,5 x 0,60	2,90	<i>M3,5 x 0,35</i>	3,15
M4,0 x 0,70	3,30	<i>M4,0 x 0,50</i>	3,50
M4,5 x 0,75	3,70	<i>M4,5 x 0,50</i>	4,00
M5,0 x 0,80	4,20	<i>M5,0 x 0,50</i>	4,50
M6,0 x 1,00	5,00	<i>M6,0 x 0,75</i>	5,25
M7,0 x 1,00	6,00	<i>M7,0 x 0,75</i>	6,25
M8,0 x 1,25	6,75	<i>M8,0 x 1,00</i>	7,00
M10 x 1,50	8,50	<i>M10 x 1,25</i>	8,75
M12 x 1,75	10,2	<i>M12 x 1,25</i>	10,7
M14 x 2,00	12,0	<i>M14 x 1,50</i>	12,5
M16 x 2,00	14,0	<i>M16 x 1,50</i>	14,5
M18 x 2,50	15,5	<i>M18 x 1,50</i>	16,5
M20 x 2,50	17,5	<i>M20 x 1,50</i>	18,5
M24 x 3,00	21,0	<i>M24 x 2,00</i>	22,0
M30 x 3,50	26,5	<i>M30 x 2,00</i>	28,0
M33 x 3,50	29,5	<i>M33 x 2,00</i>	31,0
M36 x 4,00	32,0	<i>M36 x 3,00</i>	33,0
M39 x 4,00	35,0	<i>M39 x 3,00</i>	36,0

## ISO METRIC MACHINE SCREW THREADS FOR NUTS AND BOLTS

ISO threads are called out by diameter and pitch. A thread of 5 mm diameter and 0.80 mm pitch would be called out as MS x 0,80. Pitch is the distance, in mm, between adjacent threads. Convert to threads per inch by dividing into 25.4. There is a coarse and a fine thread series. Normally, the coarse thread series is used and may be called out by diameter alone, as MS. The fine thread series must have both diameter and pitch called out, as MS x 0.5. If pitch is not called out, the coarse thread is assumed.

The chart shows the more standard sizes for machine screws and bolts from M6 (approx. 1/16") to M39 (approx. 1-7/16"). Sometimes other sizes are available. Larger standard sizes run up to 300 mm or more. Smaller sizes go down to 0.3 mm (.012").

Recommended tap drills will produce from 70 to 80% full thread depth. On many threads, a good drill size for tapping can be figured by subtracting pitch from major (outside) diameter.

In this chart, fine threads from M1,6 to M7 are listed but are seldom used and may be difficult to obtain. They are shown in italic type.

Note: These thread sizes are not used as port threads in components. Please refer to the chart on your left.