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## Hydraulic Installation Guidelines

### Appendix F

#### Pipe and Fitting Threads

Frequently there is confusion about the different threads used for pipe and fittings. The common thread standards are:

- NPT - American National Standard Taper Pipe Threads. Male and female threads are tapered. Thread angle is 60° and taper is 3/4" per foot. Thread sealant or compound must be used to seal the joint.
- SAE O-Ring Port - Straight inch series machine thread, an o-ring or other proprietary seal is used to provide the seal. Thread sealant or compound is not used.
- Metric O-Ring - Straight metric machine thread, an o-ring or other proprietary seal is used to provide the seal. Thread sealant or compound is not used.
- BSPP / BSPT - British Standard Pipe Thread Parallel / British Standard Pipe Thread Tapered. The thread angle is 55° and the taper on the tapered thread is 3/4" per foot.
  - BSPP has straight threads on male and female parts and use an o-ring or cutting face for sealing.
  - BSPT has a tapered thread on the male part and a straight or tapered thread on the female part. Thread sealant or compound must be used to seal the joint.

Some key dimensions for the above threads are listed in Tables F1 thru F3.

#### **Guidelines for Use**

- NPT and BSPT thread connections should not be used for pressure connections in hydraulic or lube piping.
- NPT and BSPT thread connections may be used for drain connections in hydraulic or lube systems. The proper thread sealant or compound must be used to prevent leaks.
- NPT and BSPT thread connections may be used for pneumatic system piping at pressures below 120 psi. The proper thread sealant must be used to prevent leaks.
- BSPP thread connections may be used for pressure connections in hydraulic and pneumatic piping systems.
- SAE O-Ring Port fittings are preferred for connections in hydraulic and pneumatic piping systems.

- Metric O-Ring fittings can be used for connections in hydraulic and pneumatic piping systems.

**Caution:**

NPT threaded parts can be screwed into BSPP / BSPT threaded parts due to the same or close threads per inch, but a poor connection will result due to the different thread angles. This may be permissible on gravity drain lines with no pressure, but there may be leaks.

**Please Note:**

The designations for BSPP and BSPT threads are:

- G is for internal and external straight threads. On external threads an A or B can follow the size callout after the G. This letter is just a tolerance class designator.
- R is for external tapered thread, R<sub>c</sub> is for internal tapered thread, R<sub>p</sub> is an alternate designation for internal straight threads used with external tapered thread.

**Table F1**  
**Pipe and Pipe Thread Data**

Nominal Size	O.D. inches	Sch. 40		Sch. 80		NPT Threads/in	BSPP / BSPT Threads/in
		I.D. (inches)	Area (in <sup>2</sup> )	I.D. (inches)	Area (in <sup>2</sup> )		
1/8	.405	.269	.0568	.215	.0364	27	28
1/4	.540	.364	.1041	.302	.0716	18	19
3/8	.675	.493	.1910	.423	.1405	18	19
1/2	.840	.622	.3040	.546	.2340	14	14
3/4	1.050	.824	.5330	.742	.4330	14	14
1	1.315	1.049	.8640	.957	.7190	11.5	11
1-1/4	1.660	1.380	1.495	1.278	1.283	11.5	11
1-1/2	1.900	1.610	2.036	1.500	1.767	11.5	11
2	2.375	2.067	3.355	1.939	2.953	11.5	11

Thread angle is 60° and taper is 3/4” per foot on NPT threads.

Thread angle is 55° and taper is 3/4” per foot on BSPT threads.

Thread angle is 55° on BSPP threads (no taper).

**Table F2**  
**SAE O-Ring Port Data**

Nominal Size (Dash Size)	Port Thread	Tube O.D. (inches)	Equiv. Pipe Size (NPT, BSPP, BSPT)
-2	5/16 - 24	1/8	1/8
-3	3/8 - 24	3/16	1/8
-4	7/16 - 20	1/4	1/8
-5	1/2 - 20	5/16	1/8
-6	9/16 - 18	3/8	1/4
-8	3/4 - 16	1/2	3/8
-10	7/8 - 14	5/8	1/2
-12	1-1/16 - 12	3/4	3/4
-14	1-3/16 - 12	7/8	3/4
-16	1-5/16 - 12	1	1
-20	1-5/8 - 12	1-1/4	1-1/4
-24	1-7/8 - 12	1-1/2	1-1/2
-32	2-1/2 - 12	2	2

**Table F3**  
**Metric Thread Port Data**

Port Thread	Tube O.D. (mm)	Equiv. Pipe Size (BSPP, BSPT, NPT)	Equiv. Dash Size (inch)
M 10 x 1	6	1/8	-4
M 12 x 1.5	8	1/8	-5
M 14 x 1.5	10	1/4	-6
M 16 x 1.5	12	3/8	-8
M 18 x 1.5	14	1/2	--
M 18 x 1.5	15	1/2	--
M 18 x 1.5	15	1/2	-10
M 22 x 1.5	18	3/4	--
M 27 x 2	20	3/4	-12
M 33 x 2	25	1	-16
M 42 x 2	30	1-1/4	--
M 42 x 2	32	1-1/4	-20
M 50 x 2	38	1-1/2	-24