

PIPING INFORMATION

FOR OILGEAR FLUID POWER SYSTEMS

PURPOSE OF INFORMATION:

The primary requirements for piping a fluid power system consists of conductors with the strength to SAFELY handle peak pressures, tubing and fittings in sizes adequate to transmit maximum volumes at reasonable velocities and conductors which are CLEAN and will remain free of contaminants. The designer of piping systems should be aware of the merits and limitations of various conductors and connectors. A study of suppliers' literature will facilitate proper selection and installation. The following printed information is intended only as a guide, is current as of the date of bulletin publication and is subject to change without notice.



I. HYDRAULIC FLUID LINE TUBING

FLARELESS, FLARED AND SELF-FLARING CONNECTIONS: Use the outside diameter size seamless steel tubing (refer to Table "A") with forged steel flareless locking shoulder or self-flaring fittings. Order seamless steel hydraulic fluid

line tubing to JIC specifications from supplier warehouse or The Oilgear Company. This tubing is dead soft, cold drawn, clean, oiled and sealed on the ends. Soft, low carbon, steel tubing should be painted or protected against rusting after installation.

II. PIPE OR PRESSURE TUBING

WELDED CONNECTIONS: Where size, pressure, service or mechanical considerations demand, use seamless steel pipe or mechanical tubing (refer to Table "B"). Use butt welded type steel flanges and forged steel fittings. Specific codes may dictate other pipe or tubing materials.

Seamless steel pipe, usually with ASTM specifications A-106, grade B, is available from some supplier warehouse stocks. Cold drawn finish is acceptable or, if only hot rolled is available, it should be pickled to remove scale. All piping **MUST** be clean and free of scale or corrosion when installed. **AVOID BENDS HAVING A RADIUS SMALLER THAN 12 PIPE DIAMETERS WITH THESE MATERIALS.**

Oilgear uses and stocks cold drawn, annealed, maximum Brinell 135, seamless low carbon steel mechanical tubing (refer to Table "B"). This tubing conforms to ASTM specifications A-519 or to comparable specifications established by Oilgear and suppliers. Use only tubing that is suitable for bending, scale free inside and out, protected with slushing oil against corrosion and has sealed ends.

III. CLEANLINESS

It is desirable to obtain an adequate cleanliness level that will assure uninterrupted operation, eliminate malfunction, accelerated wear or component failures. The required cleanliness level may vary from system to system depending on the contamination sensitivity of the system components, see Fluid Recommendation Bulletin.

(Continued on page 2)

REFERENCE MATERIAL

<u>DESCRIPTION</u>	<u>BULLETIN</u>
Fluid Recommendations	90000
Filtration Recommendations	90007
Fluid Supplier Recommendations	90008

SYSTEMS WITH REASONABLE SHORT PIPE LINES: The inside of the pipe or tubing should be bright, clean, free of grease, drawing compounds, oxide scale, carbon deposits and all contamination. Alkaline or petroleum solvents and wire brushing methods should be used to clean the pipe and the ends should be sealed for handling and storage.

Clean each individual piece **BEFORE** assembling into sections. **DO NOT** use rags, waste or other similar substances. Vibrate or tap each individual piece along its entire length to free foreign matter. Dissolve the protective coating on the inside of the pipe with solvent. Once coating is dissolved, drain and blow out with filtered **DRY** air to thoroughly dry inside of the pipe.

WARNING!

Always wear safety goggles when using solvents or compressed air. Failure to wear safety goggles could result in serious personal injury.

After fabricating the pipe into sections, each section should be cleaned with wire brushes or equivalent. Be sure each section is absolutely free of saw and file chips, dirt, abrasive, scale, slag, burrs, welding beads, cleaning fluids or other contaminants. Oil the inside of each pipe section and seal the ends. If the pipe section is to be immediately assembled, add filtered fluid and seal the system. Pressure test the system to locate and eliminate all leaks. Finally, circulate the system fluid through a full flow return line filter until all micronic foreign matter is removed. Install clean filter elements prior to machine or system start-up. To assure long service life, the system must be kept clean.

WARNING!

NEVER attempt to remove or install any hydraulic component while the system is running! Always stop the pump, shut power off and release pressure from the system before servicing or testing. Severe personal injury or death could result if system pressure is not released before servicing or testing.

SYSTEMS WITH LONG PIPE LINES: Special consideration should be given to the design, installation and preparation for service of systems involving long pipe runs, large heavy pipe sections and other unusual conditions. Start with clean tubing that is pickled, oiled and sealed. Keep all foreign matter out including solvents and moist air. Maintain the oil coating inside the tubing until the system is filled with fluid. Pressure test the system to locate and eliminate all leaks. Circulate the system fluid through a full flow return line filter until all micronic foreign matter is removed. Install clean filter elements prior to machine or system start-up.

NOTE:

When large systems are involved, we suggest contacting The Oilgear Company for information and/or assistance in system start-up.

IV. INSTALLATION

Select the shortest path for tubing consistent with flexibility to resist vibrations and relative movement under load strain. Long lines require larger diameter pipe to reduce head loss and shock resulting from sudden velocity changes. Avoid unnecessary "arches" in the tubing. Install air drain cocks or plugs at high points to facilitate system bleeding. Include tees or small auxiliary pipe taps for installation of test gages. All tubing should fit into position without straining. Tubing may be heated to a low temperature over a large area to remove strain, however, tubing must be recleaned to remove scale after any heating. Install suitable braces and supports to reduce tubing vibration or stain. **DO NOT** weld tubing to its support. Protect all tubing from mechanical loads or abuses. When fittings with copper gaskets are removed, anneal gasket to a dark cherry red before reassembly. Elastomeric seals must be removed before any welding is done.

FLARELESS, LOCKING SHOULDER OR SELF-FLARING JOINTS: Follow the manufacturer's instructions. Be sure the tubing is clean and free of burrs or corrosion.

STRAIGHT THREAD JOINTS: The Oilgear Company can furnish flanges suitable for "SAE J514a" straight thread hydraulic tube fittings with o-ring seals when specified by the customer.

ELECTRIC ARC WELDED TUBE JOINTS: Any joint to be welded must be absolutely clean and dry. **DO NOT** complete the weld with fittings on the unit. If butt welded fittings are used, only tack weld tubes to fittings, then remove the lines from the unit for complete welding. Always support the tubing and fittings with clamps or fixtures. **AVOID** concentrating heat at any spot to prevent burning the tubing. Over heating can cause excessive scale inside the tubing. Use AWS E71T-1 wire or E 7018 welding electrodes. Root penetration must be complete. Allow the welded joint to cool naturally, **DO NOT CHILL**. Welded joints and tubing with wall thickness of 3/4 inch or more should be stress relieved and cleaned. If socket welding is used, observe similar precautions. Be sure the weld fills socket and forms a smooth fillet to eliminate stress concentration. **DO NOT** weld steel tubing to brass or iron fittings. Remove all scale and slag on or in the tubes and joints prior to assembling.

FLARED JOINTS: If flared connections are required, use only steel fittings with steel tubing and follow the supplier's recommendations. Carefully remove burrs and clean out any saw or file chips or any other foreign matter. Slide the nut on the tubing. The flare should be made with a tool approved by the fitting manufacturer. Make flare the correct length to provide a good seal between the fitting and the nut. **AVOID** over working the flare end as it tends to harden the metal and subject it to cracking. To avoid distortion of the fitting wall, insert the tubing nut before tightening the fitting in place.

FLEXIBLE HOSE: When there is motion or excessive vibration between two end connections, The Oilgear Company suggests using a hydraulic flexible hose. Follow the supplier's recommendations on size, type, length, minimum bending radii and the method of installation. Bend the hose in one place only. **DO NOT** twist or place the hose under axial tension. Use tube fittings and adapter unions to relieve excessive strains. Provide sufficient slack to compensate for length changes under working

conditions and to avoid flexing or straining. **AVOID** sharp or excessive bends. Vertical connections prove the most practical.

WATER HEAT EXCHANGER PIPING: Water lines to and from heat exchanger or coolers will sweat easily. If made with steel tubing, they will rust or corrode. Use galvanized pipe or copper tubing to bring cool water to the exchanger and to carry hot water to drain.

TABLE "A"

SEAMLESS STEEL TUBING

FOR FLARED, FLARELESS LOCKING SHOULDER, OR SELF-FLARING FITTINGS

SAE	NPT	CONTROL PRESSURE (To 500 PSI [34,5 Bar])		LOW PRESSURE (To 1500 PSI [103,4 Bar])		HIGH PRESSURE (To 3500 PSI [241,4 Bar])		ULTRA HIGH PRESSURE (To 5000 PSI [344,8 Bar])	
		O. D.	WALL	O. D.	WALL	O. D.	WALL	O. D.	WALL
4	1/8	1/4"	.035"	1/4"	.035"	-----	-----	-----	-----
5	1/8	5/16"	.035"+	5/16"	.035"+	-----	-----	-----	-----
6	1/4	3/8"	.035"+	3/8"	.049"	3/8"	.060"	3/8"	.083 Δ
8	3/8	1/2"	.035"+	1/2"	.049"	1/2"	.083"	1/2"	.095 Δ
10	1/2	5/8"	.035"+	5/8"	.049"	5/8"	.095"	5/8"	.120 Δ
12	3/4	3/4"	.035"+	3/4"	.065"	3/4"	.109"	3/4"	.120 * Δ
16	1	1"	.065"	1"	.109"	1"	.120"	-----	-----
20	1-1/4	1-1/4"	.065"	1-1/4"	.120"	1-1/4"	.156" Δ +	-----	-----
24	1-1/2	1-1/2"	.065"+	1-1/2"	.120"	1-1/2"	.188" Δ +	-----	-----

+ Not used by The Oilgear Company

Δ Not flareable per SAE J533

* 4500 PSI (310,3 Bar) Maximum

NOTE:

Some of the above items are not stocked by The Oilgear Company

TABLE "B"

SEAMLESS STEEL PIPE

FOR WELDED CONNECTIONS

NORMAL PIPE	To 700 PSI (48,3 Bar)		To 2000 PSI (137,9 Bar)		To 3500 PSI (241,4 Bar)		To 5000 PSI (344,8 Bar)	
	O. D.	WALL	O. D.	WALL	O. D.	WALL	O. D.	WALL
1/8	_____	_____	_____	_____	.405"	.068" (1)	.405"	.095" (2)
1/4	_____	_____	_____	_____	.540"	.088" (1)	.540"	.119" (2)
3/8	_____	_____	_____	_____	.675"	.091" (1)	.675"	.126" (2)
1/2	_____	_____	.840"	.109" (1)	.840"	.147" (2)	.840"	.187" (3)
3/4	_____	_____	1.050"	.113" (1)	1.050"	.154" (2)	1.050"	.218" (3)
1			1.315"	.133" (1)	1.315"	.179" (2)	1.315"	.250" (3)
1-1/4			1.660"	.140" (1)	1.660"	.191" (2)	1.660"	.250" (3)
1-1/2	1.900"	.145" (1)	1.900"	.200" (2)	1.900"	.281" (3)	1.900"	.400" (4)
2	2.375"	.154" (1)	2.375"	.218" (2)	2.375"	.343" (3)	2.375"	.436" (4)
2-1/2	2.875"	.203" (1)	2.875"	.276" (2)	2.875"	.375" (3)	2.875"	.552" (4)
3	3.500"	.216" (1)	3.500"	.300" (2)	3.500"	.438" (3)	3.500"	.600" (4)
4	4.500"	.237" (1)	4.500"	.337" (2)	4.500"	.531" (3)	4.500"	.674" (4)
5	5.563"	.258" (1)	5.563"	.625" (3)	5.563"	.750" (4)	_____	_____
6	6.625"	.280" (1)	6.625"	.718" (3)	6.625"	.864" (4)	_____	_____
8	8.625"	.322" (1)	8.625"	.906" (3)	_____	_____	_____	_____

- (1) Schedule 40
- (2) Schedule 80
- (3) Schedule 160
- (4) XXH

NOTE:

The Oilgear Company does not stock all sizes of large heavy wall pipe.

IMPORTANT:

Piping and fittings properly selected and installed can give long and satisfactory service. Defective or contaminated tubing and fittings, improper installation, vibration, repeated severe shocks or mechanical damage may result in serious leakage, breaks, damage or malfunction of hydraulic system components. All these can cost you money in down-time, maintenance and repair costs.



THE OILGEAR COMPANY

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