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Hydraulic Oil Recommendation

The viscosity range of the hydraulic fluid is an extremely important factor in hydraulic pumps and motors. Since hydraulic units often work under extreme temperature changes, especially in moderate to severe duty cycles, the lubrications qualities of the oil in tight tolerance components is even more critical.

Viscosity choice is always a compromise; the fluid must be thin enough to flow easily but thick enough to seal and maintain a lubricating film between bearing and sealing surfaces. This film of oil helps to reduce friction and heat, which can ultimately lead to component damage.

Fluid temperature does affect viscosity. When choosing a fluid, it is important to consider the start-up and operating temperatures of the hydraulic system In general, as the fluid warms, it gets thinner and its viscosity decreases. At the highest temperatures, the fluid must be thick enough to provide lubrication and minimize internal leakage. Low viscosity leads to the following problems:

- Higher leakage across all sealing gaps in the pump leading to lower volumetric efficiencies and heat.
- Heat will cause loss of lubrication and will create severe wear as metal to metal contact causing premature failure of the gears, thrust plates and bearings.

The opposite is true when the fluid cools, its viscosity increases. At the lowest temperatures, the fluid must be thin enough to flow readily. High viscosity oil leads to the following problems:

- Sealing and lubrication gaps not being filled, loss of lubrication
- Filling losses occur which causes cavitation damage to the pump
- Higher mechanical efficiencies

Under normal operating temperatures it is recommended to keep the temperature of the hydraulic fluid in the range of 90° F to 140° F. Fluids may break down or oxidize at high temperatures, which leads to varnish or sludge deposits in the system and also reduces lubricity and results in reduced life of the unit. As a rule of thumb, operating temperatures over 176°F reduce the service life by half for every 50° F temperature increase, and should be avoided.

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PETROLEUM OILS (Mineral-based)

Viscosity Recommendations
Optimum operating viscosity is considered to be about 100 SUS (20 cSt).
Minimum approximately 50 - 60 SUS (7.5 - 10 cSt) Maximum at start up: approximately 7500 SUS (1600 cSt)

Recommended Viscosity Grades :

Grade	Viscosity at 100°F (40°C)	Viscosity at 210°F (100°C)
ISO 32	165 SUS (32 cSt)	44 SUS (5 cSt)
ISO 46	240 SUS (46 cSt)	49 SUS (7 cSt)
SAE 10	150 SUS (32 cSt)	41 SUS (4 cSt)
SAE 20	300 SUS (71 cSt)	51 SUS (7 cSt)

Other Desirable Properties
Viscosity Index: 90 minimum
Aniline Point: 175 minimum

Additives Usually Recommended:
Rust and Oxidation (R & O) Inhibitors
Foam Depressant

Note: Antiwear (AW) additives are not necessarily recommended. In some instances the presence of zinc compounds can actually be harmful to copper, bronze, or brass components used in the system. The use of AVV oil is optional with our gear units.

General Recommendations
High quality hydraulic oils are essential for satisfactory performance and long life of any hydraulic system. Such oils are usually prepared from highly refined, turbine oil stocks with which select additives are compounded. We suggest following the manufacturer's specifications or the recommendations of a reputable oil supplier for the specific oil requirements on your machine.

A high viscosity oil will generally give better performance and life than a thin oil. Oil of around 100 SUS (20 cSt) will give optimum performance. Your selection should be as near to optimum as possible at operating temperature but not so heavy at start-up as to cause cavitation. Cold start-up procedures which allow the use of heavier oils should prove worthwhile by increasing pump life. . the reservoir.

Operating Temperature
The optimum oil operating temperature is in the range of 120°-140°F (50°-60°C). Oil operating temperature should not exceed 200°F (93°C) with a maximum of 180°F (82°C) generally recommended. If the oil temperature will be above 180°F (82°C) for significant periods of time, then Viton (FKM) seals should be used. High temperatures may result in rapid oil deterioration and may point out the need for an oil cooler or a larger reservoir. The nearer to optimum temperature, the longer the service life will be of the oil, pump and other components

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Cold Weather Operation

Oils for use in cold weather should have a viscosity not exceeding 7500 SUS (1620 cSt) at the minimum start up temperature and a pour point of at least 20°F (11'C) below that temperature. Experience on the Alaskan North Slope has been satisfactory without using special oils or fluids. Start-up procedures must allow for a gradual warm-up and equipment should not be operated at full pressure until the oil reaches a reasonably fluid state.

Inlet Vacuum

Vacuum measured at the inlet port of the pump generally should not exceed **5 in.Hg** (13 cm). Higher vacuum can result in cavitation which may severely damage the pump. A usually acceptable rule of thumb is that the inlet line velocity should not exceed 8 fps (2.5 m/s). A long inlet line or the use of several fittings may necessitate increasing the line size. We suggest that each inlet port of a tandem pump have its own line from the reservoir.

Reservoir

Reservoir capacity in gallons should at least equal total pump output in GPM_ When filling the reservoir, oil should pass through a 100-mesh screen. Pour only **clean oil** from **clean containers** into the reservoir. The reservoir should have a breather to allow air in or out. The filler cap and breather should be sealed to prevent moisture from entering. A hydraulic oil water content of as little as 0.1% can cause damage to hydraulic components

Filtration

Good filtration assures improved service life at today's high operating pressures. System filtration is recommended that will maintain a contamination level according to ISO 4406: 20/18/15 for 2000 psi (140 bar), 19/17/11 for 3000 psi (210 bar) and 17/15/12 for 4000 psi (275 bar) The specific filter recommendation should come from your equipment manufacturer or filter supplier

A 100 mesh screen should generally be used in the suction line leading to the pump. It should be of sufficient size to handle twice the pump capacity. The screen must be cleaned and checked regularly to avoid pump and system damage

Oil and filters should be changed on a regular schedule and the system flushed in accordance with the original equipment manufacturer's recommendations. Reservoir air breather filters should be cleaned periodically

Filtration is not a substitute for practicing cleanliness and proper preventive maintenance

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WATER BASE FIRE RESISTANT FLUIDS

Two types of water base fluids (WBF} may be used with our gear pumps and motors.
Both types of WBF come in various viscosity grades. Select the grade best suited to the equipment and its operation in terms of pressure, speed, temperature, duty cycle, etc. The fluid used should be recommended by the O.E.M. or a reputable fluid supplier

Operations outside the range of 400 to 2000 rpm and over 3000 psi (2000/2500 psi in the wider gear widths) should be reviewed with your Parker sales representative

Water-in Oil (60/40) invert Emulsions
Invert emulsions are approved for use with our bushing style pumps at pressures up to 3000 psi or 500 psi below catalog rated pressures, whichever is lower

With roller bearing pumps, life may be reduced to 20% to 50% of that experienced with petroleum oil. Reducing the pressure and/or gear width can extend pump life appreciably.

Water Glycol Solutions

Water glycol solutions of the types normally used in hydrostatic systems are recommended for use with our bushing style pumps. These consist of about 60% glycol and about 40% water with additives to improve lubricity and other characteristics. Pressures up to 3000 psi are approved, depending on the gear width. Water glycol solutions are not approved for use with our roller bearing pumps.

WBF Filtration

Filtration that seems to give the best results consists of *a* 100-mesh inlet screen and a return line filter. For water base fluids, the inlet screen should be sized up three to four times the pump capacity. The return line filter should be of a rating and size recommended by the fluid and filter manufacturers to achieve a recommended ISO contamination level

Note: Finer filtration may be required by other components in the system

High Water Base Fluids (HWBF)
The use of 95/5 emulsion is not recommended

Phosphate Ester
Phosphate ester does not appear to effect pump performance and service life, but Viton (FKM) seals should be used with this fluid. Viscosity characteristics of phosphate ester fluid limit the recommended ranges of operating and ambient temperatures

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Comments On The Use Of Other Oils And Fluids

Biodegradable Oil (Vegetable-Based)
Oils of this type with properties similar to recommended petroleum oils may be used with our bushing style pumps only. These are not approved for use in our roller bearing pumps. Performance, pressure ratings and durability are not adversely affected

Automatic Transmission Fluid (ATF)
In general these oils have low viscosity and may be used only at reduced operating pressures and oil temperatures

Diesel Fuel, Kerosene, Coal Oil
Although sometimes used as a dilutant for cold weather operations, their use is not recommended because they are insufficiently refined products

Transformer Oil
Sometimes used for extremely cold weather operation. It is not generally recommended as it becomes too thin at normal operating temperatures. Oil to U.S. Military Spec MIL-H-5606 is in this category.

OPERATING LIMITS GENERALLY RECOMMENDED WITH VARIOUS FLUIDS

Fluid:	Max.Operating Temp.	Max. Inlet Line Velocity	Max. Inlet Vacuum
Petroleum Oil	180°F(82°C)	8 fps(2.5m/s)	5” hg (13cm)
WIO Emulsion	150°F(65°C)	4 fps (1.2m/s)	0” Hg (0cm)
Water Glycol	150°F(65°C)	4 fps (1.2m/s)	0” Hg (0cm)

Note: These figures represent generally accepted maximums and will not prove satisfactory in all installations. For very severe duty cycles, it will likely be advantageous to design and operate the system at something less than these maximum limits

- DO NOT USE ANY TYPE OF FLUID NOT RECOMMENDED IN THIS BULLETIN WITHOUT FIRST CONSULTING OUR PRODUCT SUPPORT DEPT
- OBTAIN YOUR FINAL FLUID RECOMMENDATION FROM YOUR FLUID SUPPLIER