Technical Manual

3. PUMPABILITY TESTS - Samples of the above grades of greases must be sent by the lubricant vendor to the major manufacturers of automatic lubrication systems for pumpability tests at the designated ambient temperatures. The results of these tests should be sent to the Engineering Department of Bucyrus-Erie Company for review.
4. SEALS AND PACKING - If a vendor should recommend a multi-purpose grease which would require a special type of material for seals and packing, he should contact the Bucyrus-Erie Company Engineering Department and discuss these requirements with them.

NOTE: These performance requirements are benchmarks and not a specification. Therefore, meeting these limits as described above does not relieve the supplier of the responsibility associated with brand name products.

ACSL - AIR COMPRESSOR (SCREW TYPE) LUBRICANT

SCOPE

These lubricant performance requirements for screw type air compressors are only good for A-C Compressor Corp. screw compressors.

The following lubricants are recommended:

1. Automatic Transmission Fluid can be used for year-round operation. It must meet General Motors specification for Dexron II fluid or Ford Specification ESW-M2 C33-F (Type F Fluid).
2. Turbine Type Oil can be used if the ambient air temperature is above 32°F (0°C) at all times. It must have a minimum viscosity of 145-210 SSU at 100°F (38°C), maximum pour point of 0°F (-17°C) and must contain anti-rust, anti-oxidant and anti-foam inhibitors. It must also contain demulsifiers to promote rapid separation from water and have a minimum flash point of 400°F (204°C).
3. For compressors that work in ambient temperature ranges that drop below -10°F, Mobile Rarus SHC-924 synthetic lubricant can be used.

WARNING: Cold ambient temperature may cause the lubricant to thicken in the oil cooler and result in unit shutdown after a short run. The use of a synthesized hydrocarbon lubricant may be required. Care should be taken to insure its viscosity, foam, oxidation, and corrosion properties are equal to or exceed those of the recommended automatic transmission fluid. Only synthetic lubricants authorized by the compressor manufacturer may be used in the compressor.

SPECIFIC REQUIREMENTS

1. Air Cooled Type - Cylinder Lubricated From Crank Case

AMBIENT TEMPERATURE	SAE NUMBER	POUR POINT
BELOW 32°F	10W	-20°F
32°F TO 90°F	20W/20	0°F
ABOVE 90°F	30	+10°F

Flash Point 400° or higher
Fire Point 440° or higher
Viscosity Index Range 90-105

2. Water Cooled - Cylinders Lubricated Independent of Crank Case
   a. Cylinders - Using Lubricator

AIR PRESSURE	SAE NUMBER
UP TO 100 PSI	30
OVER 100 PSI	30

RGL - REGULAR TYPE GEAR LUBRICANT

SCOPE

Lubricant performance requirements for Regular Type Gear Lubricant.

APPLICATION

For enclosed helical, worm, bevel, spiral bevel and other gears or gear assemblies subjected to severe shock loads.

GENERAL REQUIREMENTS

<table>
<tr><th>PROPERTY</th><th>PROCEDURE ASTM</th><th>ACCEPTANCE</th></tr>
<tr><td>Oxidation Stability</td><td>D2893</td><td>Increase in Kinematic viscosity at 210°F should not exceed 8%.</td></tr>
<tr><td>Rust Protection</td><td>D665</td><td>No rust after 24 hours with synthetic sea water.</td></tr>
<tr><td>Corrosion Protection</td><td>D130</td><td>#1b strip after 3 hours at 250°F.</td></tr>
<tr><td>Foam Suppression</td><td>D892</td><td>Test limits
Max. Vol. of foam (ML) after:
<table><tr><th>Seq.</th><th>Temp.</th><th>5 Min. Blow</th><th>10 Min. Rest</th></tr><tr><td>I</td><td>75°F</td><td>75</td><td>10</td></tr><tr><td>II</td><td>200°F</td><td>75</td><td>10</td></tr><tr><td>III</td><td>75°F</td><td>75</td><td>10</td></tr></table></td></tr>
<tr><td>Demulsibility (Per Para. 3.2)</td><td>D2711-69</td><td><table><tr><th></th><th colspan="2">AGMA GRADES</th></tr><tr><th></th><th>2EP-6EP</th><th>7EP & UP</th></tr><tr><td>Max. % Water in Oil</td><td>1.0%</td><td>1.0%</td></tr><tr><td>Max. Cuff</td><td>2.0 ml</td><td>4.0 ml</td></tr><tr><td>Min. Free Water</td><td>60 ml</td><td>50 ml</td></tr></table></td></tr>
<tr><td>Timken OK Load</td><td>D2782</td><td>Pass typical of 55#</td></tr>
<tr><td>EP Test -4 Ball</td><td>D2783</td><td>1) Load wear index, Min. KG = 40
2) Load weld, Min. KG = 250</td></tr>
<tr><td>Wear Test -4 Ball</td><td>E2266</td><td>Wear scar dia., mm. Max. = .6
1 Hr., 130°F, 1800 RPM, 20 KG</td></tr>
<tr><td>FZG Test</td><td></td><td>Stages passed = 11 Min.</td></tr>
<tr><td>Resistance to separation</td><td></td><td>Should not separate in storage and should maintain extreme pressure characteristics when subjected to centrifugal forces in use.</td></tr>
</table>

COMPOUNDING

Should contain mild EP, agents of the leaded, sulphur-phosphorus or equivalent type. Synthesized hydrocarbon fluids are not excluded as Regular-Type Gear Lubricants.

VISCOSITY AND VISCOSITY INDEX

For the maximum gear life the heaviest viscosity gear oil should be used, limited by the gearcase ambient temperature and duty cycle. The gear oil used must have a viscosity index equal to or greater than the required minimum of this specification.

The AGMA grade is SUS (Saybolt Universal Seconds) as specified in this standard for gear oil viscosity. This tends to overcome the confusion (motor oil & gear oil, viscosity at what temperature, etc.) of selecting a grade of oil based on SAE numbers.

PARAFFINNIC BASE PETROLEUM HYDRAULIC FLUID

Approved oils will typically have Denison HF-O spec. certification. In general, the oils will meet the following minimum requirements:

1. Maximum Viscosity = 14,000 SSU (3,000 CST) at the minimum expected ambient temperature (for start-up).

WARNING: Starting with viscosities greater than 3,000 CST could void warranty.

2. Minimum Viscosity = 65 SSU at the maximum operating temperature of the hydraulic system.
3. Ideal Viscosity = 100 SSU at normal operating temperature of the hydraulic system.
4. Minimum Viscosity Index = 90
5. Neutralization Number = 10 or less for new oil.
6. Oxidation Hours to 2.0 Neutralization Number per D-943 = 1,500 hours minimum.
7. Demulsibility (easy separation from water) per D-1401 = 30 ±15 minutes to 3 ml. max. of emulsion.

WARNING: In general, water will not separate from motor oils or automatic transmission fluids, therefore these fluids are NEVER recommended as hydraulic system fluids.

8. Hydrolytic Stability per D-2619 = Copper wt. loss not to be more than .50 mg/cm^2

The oil should contain rust and oxidation (R+O) inhibitors and foam depressants.

WARNING: The use of water or glycol base or any other fire resistant fluid is prohibited since serious damage to the hydraulic system will occur which will void the warranty on the machine hydraulic system.

Obtain oil from a reputable supplier. Contact the Bucyrus-Erie Service Department for specific oil recommendations or approval.

The following figure 4A-2 illustrates the acceptable temperature range for various viscosity grades (VG) of oil assuming a viscosity index of 125.

NOTE: These performance requirements are bench marks and not a specification. Therefore, meeting these limits as described above does not relieve the supplier of the responsibility associated with brand name products.