Marine Lubricants Information Bulletin 13

Bright Stock

Solvent-extracted bright stock, with a viscosity in the range of 28.0 to 35.0 mm²/s (cSt) at 100ºC, is often used in higher-viscosity grade lubricants such as slow-speed engine cylinder oils. The old "bright stock is bad" belief can no longer be confirmed.

Mineral base oils

Mineral base oils are complex mixtures of paraffins, naphthenes, and aromatics. These hydrocarbons have different molecular arrangements of hydrogen and carbon atoms. The hydrocarbon composition of base oils is related to the crude oil source and the type of refinery process used to manufacture them. For example:

- Paraffins are saturated straight and branched strings of hydrocarbons
- Naphthenes are saturated cyclic hydrocarbon structures
- Aromatics contain unsaturated alkyl rings

Saturated paraffins and naphthenes are suitable hydrocarbons for base oils. Unsaturated aromatics are prone to oxidation that produces sludge and lacquer formation and, therefore, are undesirable in base oils.

The properties of base oils are related to their predominating chemical structure, which includes:

- Boiling range
- Viscosity
- Density
- Pour point
- Solvency
- Oxidation resistance
- Thermal stability

For the majority of applications, the most important characteristics of base oils are viscosity and viscosity index. The viscosity index (VI) is the rate of change in viscosity with changes in temperature.

Mineral base oil enhancement

The properties of base oils can be enhanced by refining methods. Solvent refining is the most common method for high-viscosity oils.

Solvent-extracted base oils have a higher VI than non-refined base oils. This happens when solvent extraction removes aromatic components, which have lower VI. For example, paraffinic base oils have a higher VI than naphthenic base oils. Typical naphthenic base oils have a VI below 50; whereas typical paraffinic base oils have a VI above 80. Chevron exclusively uses solvent neutral oils with a minimum VI of 90, which are generally referred to as high-viscosity index (HVI) base oils.

Base oils cover a wide viscosity range from approximately 4 to 35 mm²/s (cSt) at 100ºC. The viscosity level defines the grade of base oil into light, medium, and heavy neutral oils and bright stocks. The higher the molecular weight of the hydrocarbons, the more viscous the base oil.

Table 1 contains examples of typical HVI paraffinic base oils that are commonly used for lubricants blending.

Table 1: Typical HVI paraffinic base oils

Approximate viscosity range	mm^2/s (cSt) at 100°C
100 neutral oil (light)	4.0 – 4.5
150 neutral oil (light)	5.0 – 5.5
300 neutral oil (medium)	7.0 – 8.0
500 neutral oil (heavy)	10.5 – 11.0
600 neutral oil (heavy)	11.5 – 12.0
150 bright stock (light)	28.0 – 35.0

Marine slow-speed engine cylinder oils

Paraffinic base oils are used for blending slow-speed engine cylinder oils because of their excellent properties, which include high VI, good oxidation resistance, good thermal stability, low volatility and good demulsibility. These base oils are usually a mixture of medium-viscosity neutral oil and high-viscosity bright stock. This combination is commonly available on a worldwide basis, thus ensuring uniformity of the finished cylinder oil.

The base oils used for blending cylinder oils, such as Taro® Special HT 70 and Taro Special HT LS 40, are thoroughly tested. The results must pass Chevron's stringent quality requirements before receiving approval.

Apart from the base oils, a critical component of slow-speed engine cylinder oils is the additive package used. The main purposes of these additive packages are:

- Neutralizing acidic combustion by-products
- Providing detergency or cleaning effect
- Preventing deposit formation by keeping deposit precursors soluble in the oil (dispersant)
- Reducing friction and wear

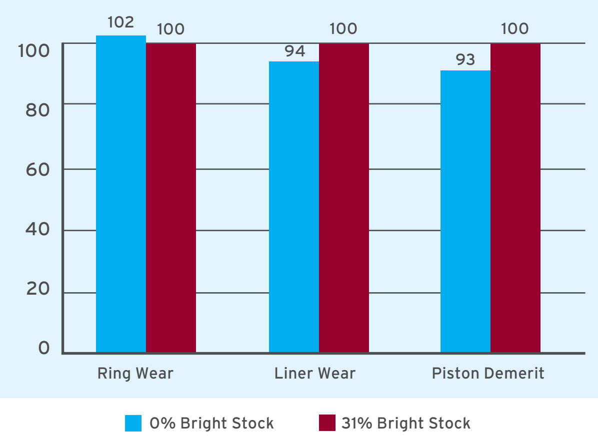
A carefully selected combination of base oils and additives results in a high-performance slow-speed engine cylinder oil.

Solvent neutral oil versus bright stock

A laboratory engine test with slow-speed engine cylinder oils provided conclusive information on the effect of using different base oils. The corrosive wear test was conducted on two different cylinder oils containing 0% and 31% bright stock and exactly the same additive package. Three parameters were analyzed: ring wear, liner wear and piston cleanliness.

The results, displayed in Figure 1, show that when a good quality bright stock is selected, there are no performance differences between a fully formulated cylinder oil blended with solvent neutral oils plus bright stock, and the same cylinder oil with only solvent neutral oils. The differences shown are all within the tolerances of the engine test.

Figure 1: Corrosive wear test – Bolnes corrosive wear matrix, relative performance, %



Conclusion

Specially selected and tested highly refined, solvent-extracted bright stocks give at least equal performance in fully formulated slow-speed engine cylinder oils. ■