HYDRAULIC FLUIDS

When selecting a hydraulic fluid for a particular application, a number of properties may need to be considered:

- viscosity
- lubricity and wear reduction
- oxidation stability
- corrosion protection
- air and water separation characteristics
- bulk modulus (resistance to compression)
- pour point
- fire resistance

Viscosity

In the majority of systems, where hydrocarbon-based hydraulic fluids are used, kinematic viscosity is generally the most important property to consider when selecting the hydraulic fluid.

In order to determine the viscosity grade required for an application, it is necessary to consider: the starting viscosity at ambient temperature, the optimum operating viscosity range for the system's components and the system's expected operating temperature.

Manufacturers publish permissible and optimal viscosity values for hydraulic components, which vary according to the type and construction of the component.

For example, consider an application where the ambient temperature is 30°C, system operating temperature is 75°C and the optimum viscosity range for the system's components is between 16 and 36 centiStokes (cSt). From the viscosity/temperature diagram on page three it can be seen that if an ISO46 oil was chosen, the viscosity would be 80 cSt at 30°C and 12 cSt at 75°C. Clearly, the viscosity at operating temperature falls outside of optimum for the system's components. In this application, ISO68 oil would be more suitable, giving a starting viscosity of 110 cSt at 30°C and an operating viscosity of 18 cSt at 75°C, which falls within the optimum range for the system's components.

Bulk Modulus

The bulk modulus for hydrocarbon-based fluids is approximately 250,000 psi, (17,240 bar) which results in a volumetric change of approximately 0.4% per 1000 psi (70 bar). This can be expressed as the additional volume of oil required to develop a desired pressure and can be calculated using the following formula:

$V_A = p \times V \div 250,000$

Where

V_A = additional volume in cubic inches
p = pressure in psi
V = volume of oil under pressure in cubic inches

In metric units

$V_A = p \times V \div 17241$

Where

V_A = additional volume in litres
p = pressure in bar
V = volume of oil under pressure in litres

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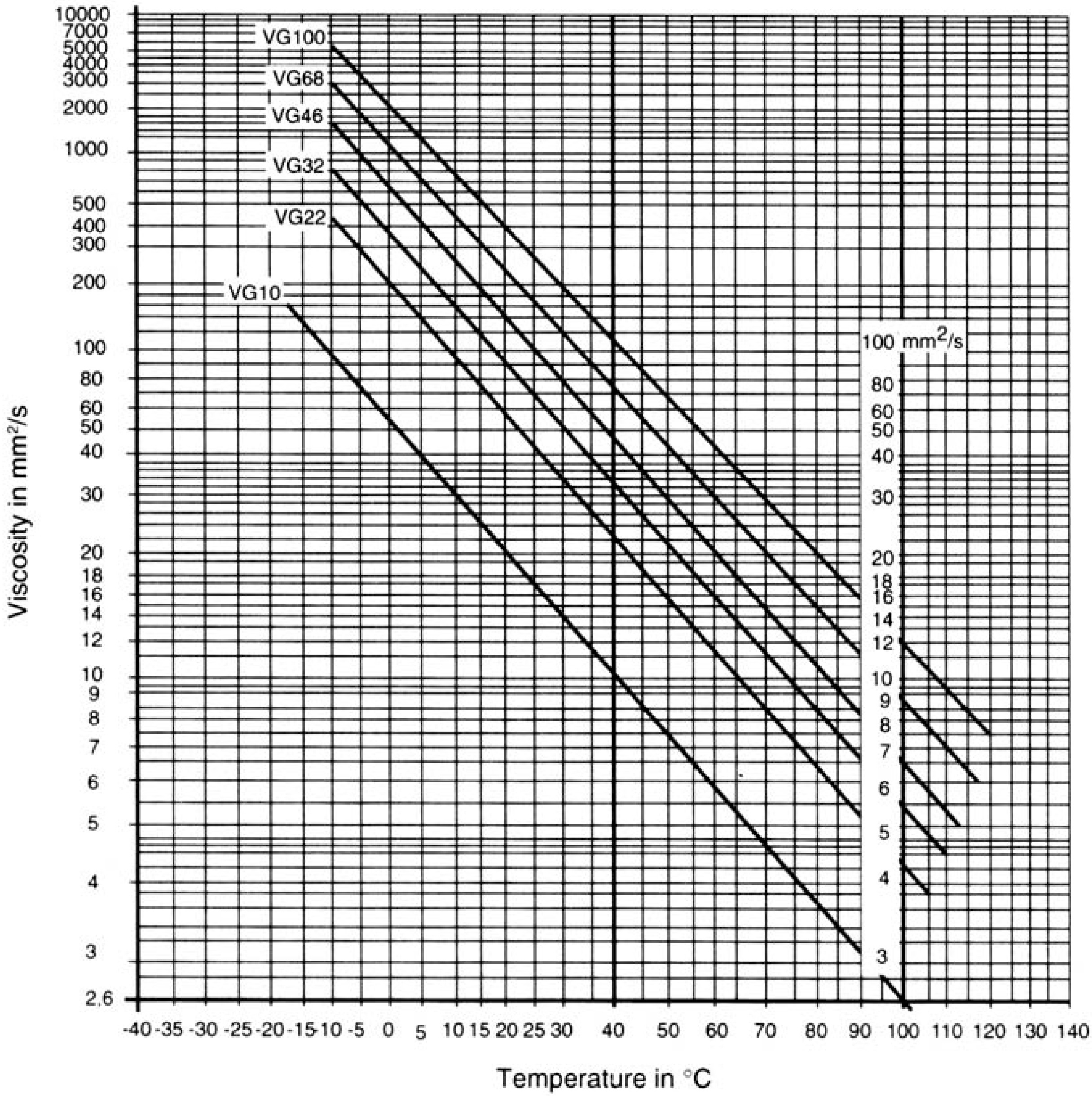
Temperature / viscosity diagram for ISO hydraulic oils



Conversion	cSt = mm²/s
SUS (32 – 99)	cSt = 0.2253 × SUS – (194.4 ÷ SUS)
SUS (100 – 240)	cSt = 0.2193 × SUS – (134.6 ÷ SUS)
SUS (> 240)	cSt = SUS ÷ 4.635

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