

Viscosity and specific gravity of the oil and pipe friction loss

Viscosity and kinematic viscosity

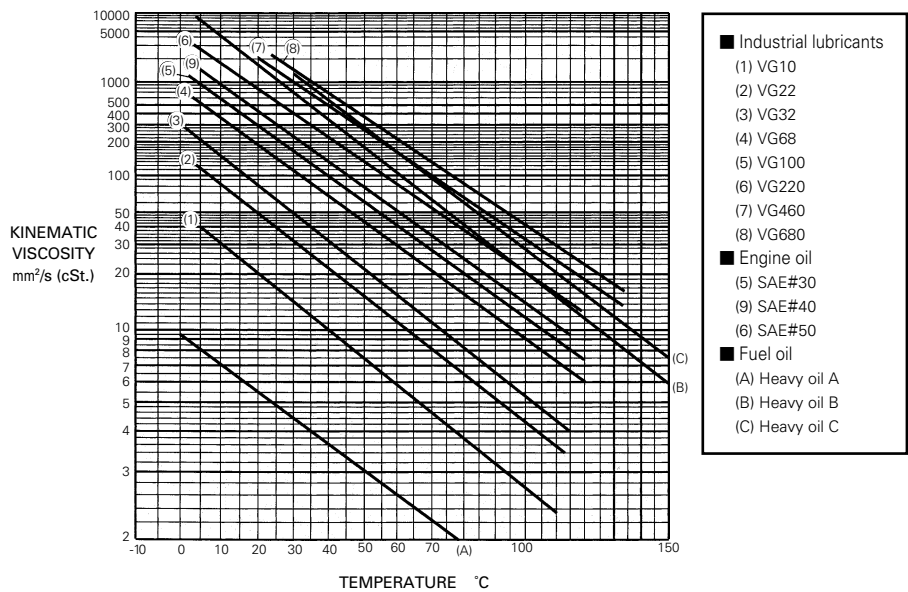
Each fluid has its own viscosity, and the flow velocity varies depending on the fluid if the fluid is flowing through a watershed set under certain conditions. This difference appears as resistance, and this tendency is called viscosity coefficient (viscosity).

The viscosity coefficient is expressed in poise in absolute units, where 1P=(poise)=1g/cm·s, 1/100 of which is 1cP(centipoise), and 1/100 of 1cP in SI units is 1Pa·s(pascal sec). In practice, kinematic viscosity coefficient (kinematic viscosity) is often used, and the value obtained by dividing the viscosity coefficient by the density is used as the kinematic viscosity coefficient. The unit of kinematic viscosity is 1St (Stokes) = 1 cm²/s, 1/100 of which is 1cst (centistokes), and in SI units, 1cSt x10⁻⁶ is called 1m²/s (square meter per sec).

$$1\text{Pa}\cdot\text{S} = 10\text{P} \quad 1\text{mm}^2/\text{s} = 1\text{cSt}$$

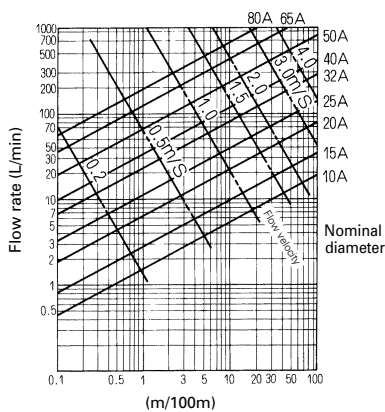
$$\text{cSt} = \frac{\text{CP}}{\text{Density}}$$

Temperature and viscosity daigrams of liquids



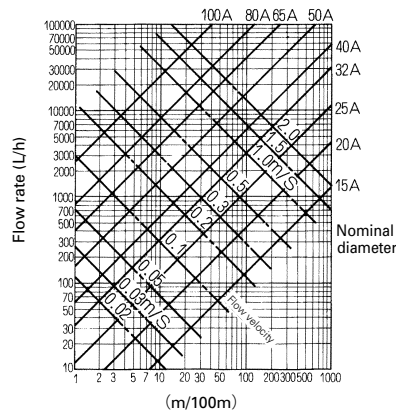
Piping friction loss diagram for kerosene, fuel oil A, and fuel oil B

Kerosene



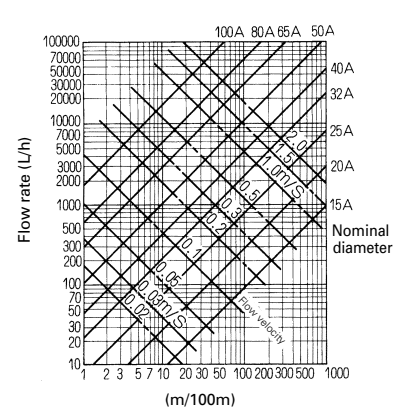
Kerosene friction loss diagram (m per 100m)

Fuel oil A



Fuel oil A friction loss diagram (m per 100m)

Fuel oil B



Fuel oil B friction loss diagram (m per 100m)

(Fuel oil A) Temperature correction factor a

Temperature	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C	100°C
a	1.0	0.38	0.16	0.089	0.053	0.031	0.024	0.016	0.011	0.009	0.007

● The graph is for a=1.0. Multiply the above coefficient by the temperature.

(Fuel oil B) Temperature correction factor a

Temperature	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C	100°C
a	9.2	2.3	1.0	0.44	0.22	0.12	0.075	0.047	0.032	0.024	0.018

● The graph is for a=1.0. Multiply the above coefficient by the temperature.

Viscosity and specific gravity of major fluids

Fluid name		Temperature	Viscosity mm ² /s	Specific gravity
No.60	Spindle oil	40°C	10	0.87
	Transformer insulating oil	40°C	8.4	0.88
	Machine 4 6	40°C	About 46	
	Turbine 5 6	40°C	About 56	0.92
No.40	Engine oil	100°C	13.5 - 41.0	
No.250	Diesel oil	100°C	13.5 - 41.0	0.90 - 0.94
JIS level-3 standard	Fuel oil C	50°C	250 - 1000	0.95 - 0.98
JIS level-2 standard	Fuel oil B	50°C	50 or less	0.92 - 0.95
JIS level-1 standard	Fuel oil A	50°C	20 or less	0.8591
Light Oil		30°C	About 3	0.80 - 0.83
White kerosene		30°C	About 1.3	0.76 - 0.80
Gasoline		30°C	About 0.5	About 0.70

Fluid name		Temperature	Viscosity mm ² /s	Specific gravity
Santosarm F R-2 Kaneclor KC-400		20°C	230 - 280	1.45
		100°C	3	1.33
		200°C	0.8	1.28
Dowtherm A		100°C	About 1	1.02 (100°C)
Edible oil		Normal temperature	25 - 110	0.91 - 0.93
Glycerin		20°C	About 1100	1.26
Molasses		Normal temperature	1,400 - 6,900	1.3 - 1.6
Honey		Normal temperature	1,400 - 14,000	1.3 - 1.5
Starch syrup		Normal temperature	13,000 - 129,000	1.4 - 1.7
Concentrated sulfuric acid 90%		20°C	About 13	1.8
Caustic soda 20%		20°C	About 6	1.22
Water		20°C	1.0	0.998
		60°C	0.5	0.983