

## VISCOSITY GRADES

Viscosity Grade Identification	Mid Point Viscosity cSt @ 40°C
ISO 2	2.2
ISO 10	10
ISO 15	15
ISO 22	22
ISO 32	32
ISO 46	46
ISO 68	68
ISO 100	100
ISO 150	150
ISO 220	220
ISO 320	320
ISO 460	460
ISO 680	680
ISO 1000	1000
ISO 1500	1500
ISO 3200	3200
ISO 6800	6800
ISO 46000	46000

## NLGI GREASE CLASSIFICATION

Number	60 Stroke Penetration @ 25°C
No. 000	445 to 475
No. 00	400 to 430
No. 0	355 to 385
No. 1	310 to 340
No. 2	265 to 295
No. 3	220 to 250
No. 4	175 to 205
No. 5	130 to 160
No. 6	85 to 115

## VOLUME

1 hectolitre = 100 litre = 26.4172 US gal  
= 0.629 bbl  
1 US gal = 3.78541 litres

## LENGTH, AREA

1 in = 25.4 mm  
1 yd = 0.914 m  
1 ft = 0.3048 m  
1 mile = 5280 ft = 1.609 km  
1 Nautical mile = 6080 ft = 1.853 km  
1 in<sup>3</sup> = 16.39 cm<sup>3</sup>  
1 ft<sup>3</sup> = 0.02832 m<sup>3</sup>

## TEMPERATURE

°C = 5/9 (°F-32)  
°F = 32+(°C/(5/9))

## FORCE AND TORQUE

1 lbf = 4.448 N  
1 kgf = 2.205 lbf = 9.807 N  
1 lbf ft = 1.356 Nm  
1 ton f ft = 3037 Nm

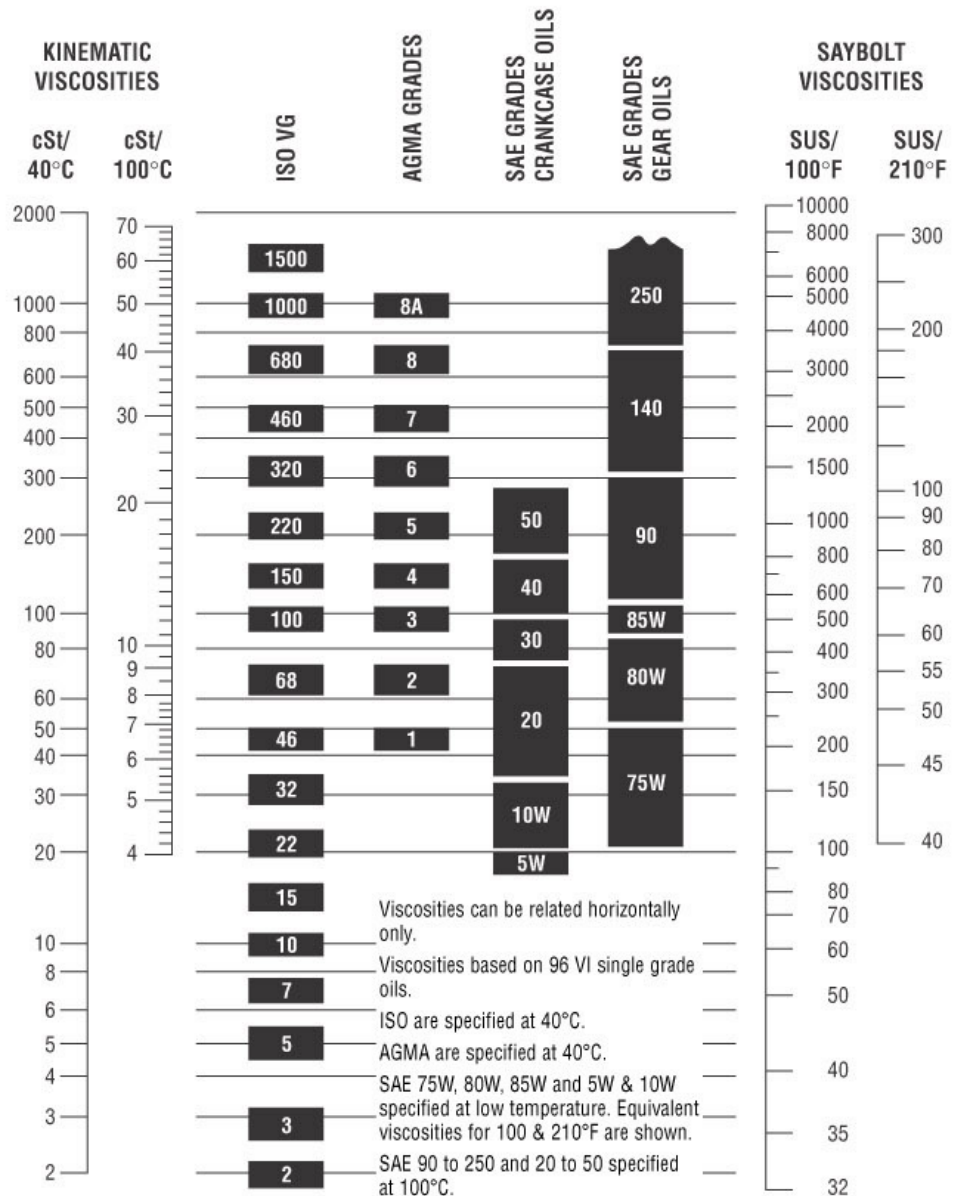
## MASS

1 lb = 0.4536 kg  
1 ton = 2240 lb = 1016 kg  
1 tonne = 1000 kg

## DENSITY

1 lb/in<sup>3</sup> = 27.68 g/cm<sup>3</sup>

## VISCOSITY CLASSIFICATION EQUIVALENTS



No. 2	185 to 220
No. 3	220 to 250
No. 4	175 to 205
No. 5	130 to 160
No. 6	85 to 115

### SAE ENGINE OIL VISCOSITY GRADES

SAE Viscosity Grade	cSt @ 100°C min.
5W	3.8
10W	4.1
20	5.6
30	9.3
40	12.5
50	16.3

### SAE TRANSMISSION GEAR OIL GRADES

SAE Viscosity Grade	Viscosity @ 100°C cSt
70W	4.1
75W	4.1
80W	7.0
85W	11.0
90	13.5
140	24.0
250	41.0

### GEAR OIL LUBRICANT NUMBERS (AGMA)

AGMA Lubricant	No	
R&O Gear Oils	EP Gear Lubricants	ISO Viscosity Grade
1	—	46
2	2EP	68
3	3EP	100
4	4EP	150
5	5EP	220
6	6EP	320
7 Comp	7EP	460
8 Comp	9EP	680
8A Comp	—	1000

1 ton = 2240 lb = 1016 kg  
1 tonne = 1000 kg

### DENSITY

1 lb/in<sup>3</sup> = 27.68 g/cm<sup>3</sup>  
1 lb/ft<sup>3</sup> = 16.02 kg/m<sup>3</sup>

### PRESSURE, STRESS

1 lbf/in<sup>2</sup> = 0.07031 kgf/cm<sup>2</sup> = 6895 N/m<sup>2</sup>  
1 kgf/cm<sup>2</sup> = 0.09807 MN/m<sup>2</sup> = 0.9807 Bar  
1 lbf/ft<sup>2</sup> = 47.88 N/m<sup>2</sup>  
1 ft H<sub>2</sub>O = 62.43 lbf/ft<sup>2</sup> = 2989 N/m<sup>2</sup>  
1 in Hg = 70.73 lbf/ft<sup>2</sup> = 3386 N/m<sup>2</sup>  
1 bar = 14.50 lbf/in<sup>2</sup> = 10<sup>5</sup> N/m<sup>2</sup>  
1 atm = 14.70 lbf/in<sup>2</sup> = 1.013 bar  
= 760 mm Hg = 101.3 kPa

### POWER

1 hp = 550 ft lbf/s = 0.7457 kW  
1 ft lbf/s = 1.356 W

### ENERGY, WORK, HEAT

1 ft lbf = 1.356 J  
1 kWh = 3.6 MJ  
1 Btu = 778.2 ft lbf = 252 cal = 1055 J

### VELOCITY AND FLOWRATE

1 mph = 1.467 ft/s = 1.609 km/h = 0.447 m/s  
1 knot = 1.853 km/h = 0.5114 m/s  
1 ft<sup>3</sup>/s = 0.02832 m<sup>3</sup>/s  
1 gal/min = 7.577 x 10<sup>-5</sup> m<sup>3</sup>/s

5	AGMA are specified at 40°C.	40
4	SAE 75W, 80W, 85W and 5W & 10W specified at low temperature. Equivalent viscosities for 100 & 210°F are shown.	35
3		
2	SAE 90 to 250 and 20 to 50 specified at 100°C.	32

### ISO VISCOSITY CLASSIFICATION SYSTEM

Many petroleum products are graded according to the ISO Viscosity Classification System, approved by the International Standards Organization (ISO). Each ISO viscosity grade number corresponds to the mid-point of a viscosity range expressed in centistokes (cSt) at 40°C. For example, a lubricant with an ISO grade of 32 has a viscosity within the range of 28.8-35.2, the midpoint of which is 32.

Rule-of-Thumb: The comparable ISO grade of a given product whose viscosity in SUS at 100°F is known can be determined by using the following conversion formula:

$$\text{SUS @ 100°F} \div 5 \cong \text{cSt @ 40°C}$$

### REPRESENTATIVE WEIGHTS OF PETROLEUM PRODUCTS

	Pounds per US Gallon	Pounds per 55-gal Drum	Barrels (42-gal) per Short Ton
LP Gas	4.52	248	10.5
Aviation Gasoline	5.90	325	8.16
Motor Gasoline	6.17	339	7.70
Kerosene	6.76	372	7.02
Distillate Fuel Oils	7.05	388	6.76
Lubricating Oils	7.50	413	6.34
Residual Fuel Oils	7.88	434	6.04
Paraffin Wax	—	367	7.12
Grease	—	458	5.71
Asphalt	—	477	5.49

### TEMPERATURE CONVERSIONS

	Centigrade	Fahrenheit	Absolute (Kelvin)
Absolute zero	-273.16	-459.58	0
Boiling point of water	100	212	373.2
Freezing point of water	0	32	273.2
Room temperature	25	77	298.2