Cheshire Pump Company Ltd

Centipoise* (cp)	Centistokes (cSt)	Saybolt Second Universal (SSU)	**Typical liquid**	Specific Gravity
1	1	31	Water	1.0
3.2	4	40	Milk	-
12.6	15.7	80	No. 4 fuel oil	0.82-0.95
16.5	20.6	100	Cream	-
34.6	43.2	200	Vegetable oil	0.912-0.924
88	110	500	SAE 10 oil	0.88-0.935
176	220	1000	Tomato juice	-
352	440	2000	SAE 30 oil	0.88-0.935
880	1100	5000	Glycerine	1.26
1561	1735	8000	SAE 50 oil	0.88-0.935
1760	2200	10,000	Honey	-
3000	4500	20,000	Glue	-
5000	6250	28,000	Mayonnaise	-
8640	10,800	50,000	Molasses B	1.40-1.49
15,200	19,000	86,000	Sour cream	-
17,640	19,600	90,000	SAE 70 oil	0.88-0.935
-	-	-	Ink-Printers	1.0-1.38
-	-	-	Sulfuric Acid	1.83

Viscosity and Density (Metric SI Units)
In the SI system of units the kilogram (kg) is the standard unit of mass, a cubic meter is the standard unit of volume and the second is the standard unit of time.

Density p
The density of a fluid is obtained by dividing the mass of the fluid by the volume of the fluid. Density is normally expressed as kg per cubic meter. *p* = kg/m3
Water at a temperature of 20°C has a density of 998 kg/m3
Sometimes the term 'Relative Density' is used to describe the density of a fluid.
Relative density is the fluid density divide by 1000 kg/m3
Water at a temperature of 20°C has a Relative density of 0.998

Dynamic Viscosity ì
Viscosity describes a fluids resistance to flow.
Dynamic viscosity (sometimes referred to as Absolute viscosity) is obtained by dividing the Shear stress by the rate of shear strain. The units of dynamic viscosity are: Force / area x time The Pascal unit (Pa) is used to describe pressure or stress = force per area This unit can be combined with time (sec) to define dynamic viscosity.
ì = Pa•s 1.00 Pa•s = 10 Poise = 1000 Centipoise
Centipoise (cP) is commonly used to describe dynamic viscosity because water at a temperature of 20°C has a viscosity of 1.002 Centipoise.
This value must be converted back to 1.002 x 10-3 Pa•s for use in calculations.

Kinematic Viscosity v
Sometimes viscosity is measured by timing the flow of a known volume of fluid from a viscosity measuring cup. The timings can be used along with a formula to estimate the kinematic viscosity value of the fluid in Centistokes (cSt). The motive force driving the fluid out of the cup is the head of fluid. This fluid head is also part of the equation that makes up the volume of the fluid. Rationalizing the equations the fluid head term is eliminated leaving the units of
Kinematic viscosity as area / time *v* = m2/s 1.0 m2/s = 10000 Stokes = 1000000 Centistokes

Water at a temperature of 20°C has a viscosity of 1.004 x 10-6 m2/s
This evaluates to 1.004000 Centistokes.
This value must be converted back to 1.004 x 10-6 m2/s for use in calculations.
The kinematic viscosity can also be determined by dividing the dynamic viscosity by the fluid density.

Kinematic Viscosity and Dynamic Viscosity Relationship
Kinematic Viscosity = Dynamic Viscosity / Density
v = ì / p
Centistokes = Centipoise / Density
To understand the metric units involved in this relationship it will be necessary to use an example:
Dynamic viscosity *ì* = Pa•s
Substitute for Pa = N/m2 and N = kg• m/s2
Therefore *ì* = Pa•s = kg/(m•s)
Density p = kg/m3
Kinematic Viscosity = *v* = *ì/p* = (kg/(m•s) x 10-3) / (kg/m3) = m2/s x 10-6

Net Positive Suction Head
Net positive suction head is the term that is usually used to describe the absolute pressure of a fluid at the inlet to a pump minus the vapour pressure of the liquid. The resultant value is known as the Net Positive Suction Head available.

The term is normally shortened to the acronym NPSHa, the ‘a’ denotes ‘available’.
A similar term is used by pump manufactures to describe the energy losses that occur within many pumps as the fluid volume is allowed to expand within the pump body. This energy loss is expressed as a head of fluid and is described as NPSHr (Net Positive Suction Head requirement) the ‘r’ suffix is used to denote the value is a requirement.

Different pumps will have different NPSH requirements dependant on the impellor design, impellor diameter, inlet type, flow rate, pump speed and other factors.
A pump performance curve will usually include a NPSH requirement graph expressed in metres or feet head so that the NPSHr for the operating condition can be established.

Pressure at the pump inlet
The fluid pressure at a pump inlet will be determined by the pressure on the fluid surface, the frictional losses in the suction pipework and any rises or falls within the suction pipework system