Fuel Oil Viscosity Converter: cSt, Redwood No. 1 and Saybolt

Convert fuel oil viscosity between centistokes, Redwood No. 1 seconds and Saybolt Universal seconds (SUS), in either direction.

Method: ASTM D2161 conversion of kinematic viscosity to Saybolt Universal viscosity (equation method); Redwood No. 1 viscometer conversion equations (Institute of Petroleum, two ranges)

Input parameters

Unit system: SI

Parameter	Value	Unit
Value entered is	Kinematic viscosity, cSt	
Value	180.00	
Test temperature (for the Saybolt temperature correction) Saybolt seconds depend slightly on the test temperature at the same cSt; 37.8 °C (100 °F) is the reference.	37.778	°C

Calculated results

Parameter	Value	Unit
Kinematic viscosity	180.00	cSt
Redwood No. 1 seconds	729.02	
Saybolt Universal seconds	833.90	

Notes for this case

• Redwood No. 1 seconds use v = 0.26 t − 171.5/t below 100 s and v = 0.247 t − 50/t above (v in cSt). Saybolt Universal seconds use the ASTM D2161 equation at 100 °F with its temperature correction 1 + 0.000061 (t − 100 °F). Above about 100 cSt Redwood seconds are about 4.05 × cSt and Saybolt seconds about 4.63 × cSt. Viscosity grades of fuel oil are stated at a temperature (50 °C for furnace oil in cSt, 100 °F for Redwood in older specifications): converting the unit does not convert the temperature.

Formula and method

$$\nu = 0.26\,t - \frac{171.5}{t}\ \ (t < 100\ \text{s}),\quad \nu = 0.247\,t - \frac{50}{t}\ \ (t \geq 100\ \text{s})$$

$$t_{SU} = \left[4.6324\nu + \frac{1 + 0.03264\nu}{\left(3930.2 + 262.7\nu + 23.97\nu^2 + 1.646\nu^3\right) 10^{-5}}\right]\left[1 + 0.000061\,(t_F - 100)\right]$$

Variables

from	Value entered is	-
x	Value	-
t	Test temperature (for the Saybolt temperature correction)	K
ν	Kinematic viscosity	m²/s
t_{R1}	Redwood No. 1 seconds	-
t_{SU}	Saybolt Universal seconds	-

Method and standards

Viscosity conversion.

Assumptions and limits

- Newtonian oil; the conversions are empirical fits to the viscometer calibrations.

References

ASTM D2161 conversion of kinematic viscosity to Saybolt Universal viscosity (equation method), Redwood No. 1 viscometer conversion equations (Institute of Petroleum, two ranges)

Report details

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Release checks	4 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/general/unit-conversions/fuel-oil-viscosity-converter

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Reopens the calculator with the inputs of this report.