Fuel Oil Heating Value from °API Gravity

Gross (HHV) and net (LHV) heating values, hydrogen content and density of a fuel oil from its °API gravity and sulphur when no ultimate analysis is available.

Method: Ganapathy; Steam Plant Calculations Manual; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
API gravity	30.000	
Sulphur	0.50000	%

Calculated results

Parameter	Value	Unit
Specific gravity at 60 °F	0.87616	
Density at 60 °F	875.28	kg/m³
Hydrogen	12.058	%
Higher heating value	45.499	MJ/kg
Lower heating value	42.940	MJ/kg
Higher heating value per litre of oil (60 °F)	39.824	MJ/L

Formula and method

$$HHV = 17\,887 + 57.5\,°API - 102.2\,\%S \ \ (\mathrm{Btu/lb}), \quad \%H_2 = F - \frac{2122.5}{°API + 131.5}, \quad LHV = HHV - 91.23\,\%H_2, \quad SG = \frac{141.5}{131.5 + °API}$$

$$\rho = 999.0\,SG, \quad HHV_V = HHV\,\rho$$

Variables

$°API$	API gravity	-
S	Sulphur	-
SG	Specific gravity at 60 °F	-
ρ	Density at 60 °F	kg/m³
H_2	Hydrogen	-
HHV	Higher heating value	J/kg
LHV	Lower heating value	J/kg
HHV_V	Higher heating value per volume of liquid oil at 60 °F	J/m³
F	hydrogen constant by °API band	%

Method and standards

Ganapathy's correlations; F = 24.50 (0 to 9 °API), 25.00 (above 9 to 20), 25.20 (above 20 to 30), 25.45 (above 30 to 40): a value on a band edge takes the lower band. The steps make the hydrogen and LHV jump slightly at 9, 20 and 30 °API.

Assumptions and limits

- Petroleum fuel oils, 0–40 °API, sulphur 0–6 %.
- The LHV deducts only the water formed from hydrogen; the oil is taken as water-free.

References

• Ganapathy
• Steam Plant Calculations Manual
• 2nd ed. (Marcel Dekker, 1993)
• Q2.02
• Eqs. (4a)
• (4b)

- (5) and (6)
- Water density at 60 °F taken as 999.0 kg/m³

Report details

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Release checks	2 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/boilers-power-plant/combustion/fuel-oil-hhv-from-api

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.