Fuel Oil Heater Duty and Steam Consumption

Heat and steam needed to heat furnace oil or LSHS to pumping or atomising temperature, from oil flow, specific heat, temperatures and heat-loss allowance.

Method: IAPWS R7-97(2012) IF97; first law of thermodynamics

Input parameters

Unit system: SI

Parameter	Value	Unit
Oil flow	1,500.0	kg/h
Mean specific heat of the oil From the oil supplier; heavy fuel oils are roughly 1.8–2.1 kJ/(kg·K) over this range.	1.9500	kJ/(kg·K)
Oil temperature in	40.000	°C
Oil temperature out (atomising or pumping)	110.00	°C
Heat-loss allowance Heater and pipework losses as a share of the oil duty; 10 % is a FireCAD starting value, not a published figure.	10.000	%
Heating steam pressure (saturated) Shown as gauge (bar g, kg/cm² g, psig) as plant headers read; choose an absolute unit to enter absolute pressure.	5.9867	bar g

Calculated results

Parameter	Value	Unit
Heater duty	62.562	kW
Steam consumption	109.04	kg/h
Steam saturation temperature	164.95	°C

Formula and method

$$\dot{Q} = \dot{m}_o c_p (T_2 - T_1)(1 + \lambda) \qquad \dot{m}_s = \frac{\dot{Q}}{h_{fg}(p_s)}$$

Variables

$\dot{m}_o$	oil flow	kg/s
c_p	mean specific heat of the oil	J/(kg·K)
T_1	oil temperature in	K
T_2	oil temperature out	K
λ	heat-loss allowance	–
p_s	heating steam pressure (absolute in SI; shown as gauge)	Pa
$\dot{Q}$	heater duty	W
$\dot{m}_s$	steam consumption	kg/s
T_{sat}	steam saturation temperature	K
h_{fg}	latent heat at p_s (IF97)	J/kg

Method and standards

Energy balance of the oil; steam condenses at saturation and leaves as saturated condensate (FireCAD IAPWS-IF97).

Assumptions and limits

- Condensate leaves saturated (no subcooling); constant specific heat.
- The heat-loss allowance multiplies the oil duty; its 10 % default is a starting value, not a published one.
- The steam pressure is shown as gauge; the 15 K approach warning is a FireCAD rule of thumb.

References

- IAPWS R7-97(2012) IF97
- first law of thermodynamics

Report details

Report reference	FCC-CKGK-SPGM (the same inputs always give the same reference)
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Release checks	3 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/fuel-ash-handling/fuel-oil-heating

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Reopens the calculator with the inputs of this report.