Saving from Repairing Missing Pipe Insulation (ISO 12241)

Heat loss of a bare and an insulated length of pipe by the ISO 12241 method, and the energy, fuel cost and payback of insulating it.

Method: ISO 12241 insulated and bare pipe heat loss (engine InsulatedPipe); fuel = heat/η

Input parameters

Unit system: SI

Parameter	Value	Unit
Pipe outer diameter	114.30	mm
Bare length	40.000	m
Fluid temperature	180.00	°C
Ambient temperature	30.000	°C
Insulation thickness to apply	50.000	mm
Insulation conductivity	0.045000	W/(m·K)
Bare pipe emissivity	90.000	%
Cladding emissivity	10.000	%
Hours per year	8,000.0	h
Boiler efficiency (same CV basis as the fuel cost)	85.000	%
Fuel cost per GJ of fuel energy (same CV basis as η)	600.00	
Insulation cost per metre	2,500.0	

Calculated results

Parameter	Value	Unit
Bare loss per metre	1,023.2	W/m
Insulated loss per metre	58.822	W/m
Fuel energy saved per year	1,307.0	GJ
Cost saved per year	784,195	
Payback (months)	1.5302	

Notes for this case

- Still air (ISO 12241); outdoors in wind the bare loss is higher, so the saving is conservative. Valves and flanges: use equivalent lengths.

Formula and method

$$q' = \frac{T_i - T_a}{\frac{\ln(D/D_o)}{2\pi\lambda} + \frac{1}{h_{se}\pi D}}, \quad h_{se} = h_{cv} + h_r \quad \text{(ISO 12241; bare pipe: } D = D_o\text{, no insulation term)}$$

$$\Delta E = \frac{(q'_b - q'_i) L\, t}{\eta}, \quad \Delta C = \Delta E\, c_f, \quad t_{pb} = \frac{12\, C_i L}{\Delta C}$$

Variables

D_o	Pipe outer diameter	m
L	Bare length	m
T_i	Fluid temperature	K
T_a	Ambient temperature	K

S	Insulation thickness to apply	m
λ	Insulation conductivity	W/(m·K)
ε_b	Bare pipe emissivity	-
ε_i	Cladding emissivity	-
t	Hours per year	s
η	Boiler efficiency (same CV basis as the fuel cost)	-
c_f	Fuel cost per GJ of fuel energy (same CV basis as η)	-
C_i	Insulation cost per metre	-
q'_b	Bare loss per metre	W/m
q'_i	Insulated loss per metre	W/m
ΔE	Fuel energy saved per year	J
ΔC	Cost saved per year	-
t_{pb}	Payback (months)	-

Method and standards

ISO 12241 difference.

Assumptions and limits

- Still air, steady state.
- The bare pipe surface is taken at the fluid temperature (inner film and wall neglected): right for steam, but for slow-moving liquids it overstates the bare loss and so the saving.
- Boiler efficiency and fuel cost per GJ on one calorific-value basis.

References

• ISO 12241 insulated and bare pipe heat loss (engine InsulatedPipe); fuel = heat/η

Report details

Report reference	FCC-8Z9D-YG24 (the same inputs always give the same reference)
Generated	17 November 2026, 19:46 UTC
Calculator	Saving from Repairing Missing Pipe Insulation (ISO 12241)
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/environmental/carbon-energy/insulation-repair-saving

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.