Thermal Insulation Thickness and Heat Loss — Report

DOCUMENT

Plant / project	**Example Plant**
Equipment tag / system	**INS-01**
Calculation / document no.	**CALC-TI-001**
Revision	**0**
Prepared by	**Your name**
Checked by	**—**
Date	**07-Nov-2026**

Pipe (cylinder) · Hot service (above ambient) · Economic thickness basis · Outdoor (with wind) · Mineral (stone) wool, pipe section or slab · finish: Aluminium sheet, weathered · Heat loss calculated as in the publicly documented ASTM C680 / ISO 12241 approach, with published surface correlations; material data are generic allowances

Calculation basis

Status: **✓ Inputs OK · ℹ️ 8 default value(s) in use: emissivity of the bare surface, emissivity of the outer finish, conductivity design allowance factor, thickness step of the calculation grid, heat source efficiency, operating hours per year, interest, evaluation life of the insulation**

KEY INPUTS

Input	Unit	Value used
Process temperature (surface to be insulated)	°C	250.0
Ambient air temperature	°C	15.0
Wind speed (outdoor)	m/s	3.0
Outer diameter of the bare surface (pipe or sphere)	mm	219.1
Length of the pipe run	m	100.0
Existing insulation thickness (0 = bare)	mm	25.0

KEY INPUTS (CONTINUED) — INSULATION, TARGETS AND ECONOMICS

Input	Unit	Value used
Emissivity of the bare surface	–	0.80
Emissivity of the outer finish (jacket)	–	0.30
Conductivity design allowance factor	–	1.00
Thickness step of the calculation grid	mm	10.0
Installed insulation cost (material and labour)	per m³	1,200

Jacket / finish cost per outer surface area	per m²	60.00
Energy price (fuel or electricity)	per GJ	10.00
Heat source efficiency (hot) or cooling COP (cold)	–	0.85
Operating hours per year	h/yr	8,000
Interest (discount) rate	%	10.0
Evaluation life of the insulation	years	15

RESULTS

Result	Unit	Value
Economic thickness (standard step)	mm	100.0
Design thickness (standard step)	mm	100.0
Outer diameter of the insulated surface (design)	mm	419.1
Heat saved per year	MWh/yr	184
Cost saved per year	USD/yr	7,788
Installed cost of the design insulation	USD	19,930
Net benefit per year (saving minus capital charge)	USD/yr	5,167
Simple payback of the design insulation	years	2.56
Mean temperature of the insulation (design)	°C	135.8

HEAT LOSS, BARE VERSUS INSULATED

Item	Unit	Bare	Existing	Design
Insulation thickness	mm	0.0	25.0	100.0
Outer surface temperature	°C	250.0	41.3	21.6
Heat loss (hot) or heat gain (cold), total	kW	446.17	34.68	11.70
Heat loss per metre of pipe	W/m	4,461.7	346.8	117.0
Heat-loss reduction versus bare	%	—	92.2	97.4
Convective surface coefficient (natural + forced)	W/m²·K	14.45	13.76	11.78
Radiative surface coefficient	W/m²·K	13.13	1.86	1.68

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Calculation summary | PlantCalcKit v1.0

Heat lost (or gained) per year	MWh/yr	3,569	277	94
Energy cost per year	USD/yr	151,174	11,752	3,964

WHAT-IF — INSULATION THICKNESS OPTIONS

Option	Unit (thickness)	Thickness	Surface temperature, °C	Heat loss, kW	Reduction vs bare, %	Cost saved per year, USD	Payback, years
Option 1	mm	25.0	41.3	34.68	92.2	0	—
Option 2	mm	50.0	28.4	19.77	95.6	5,054	2.19
Option 3	mm	75.0	23.9	14.45	96.8	6,856	2.23
Option 4	mm	100.0	21.6	11.70	97.4	7,788	2.56
Option 5	mm	150.0	19.3	8.86	98.0	8,750	3.50

FINDINGS AND RECOMMENDATIONS

◆ **Opportunity**

Simple payback is 2.6 years, above 2 years: check whether a thinner step, a cheaper material or the existing insulation is good enough.

◆ **Opportunity**

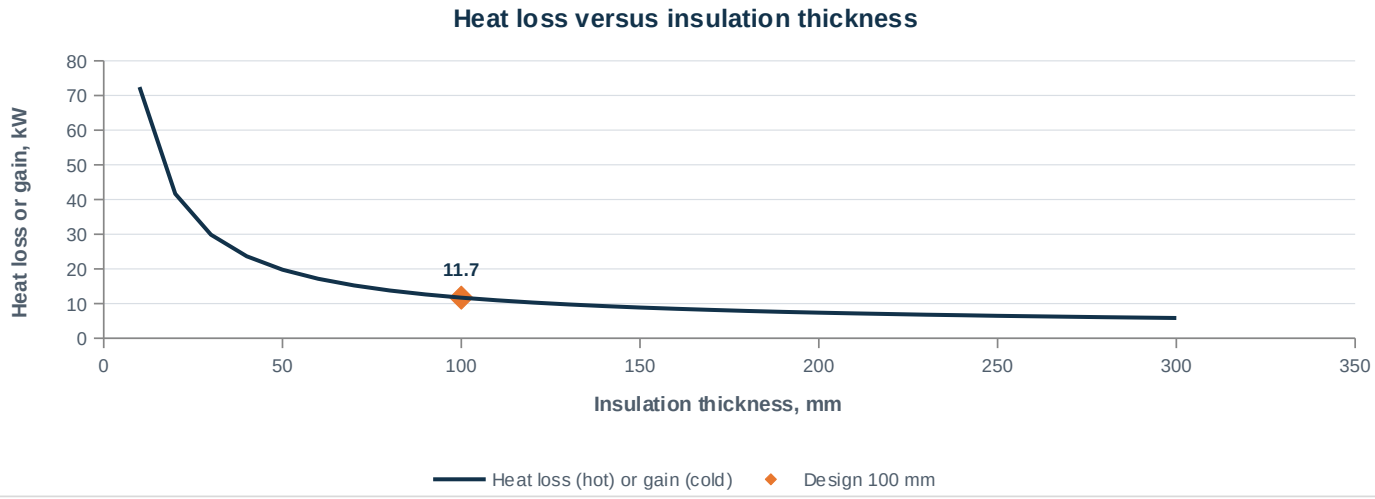
Changing from 25 mm to 100 mm saves 184 MWh of heat per year, worth 7,788 USD a year, with a payback of 2.56 years.

ℹ️ **Note**

Outdoor: wind of 3.0 m/s raises the surface coefficient to 13.5 W/m²K; design the weather protection and check the heat loss at the design wind speed.

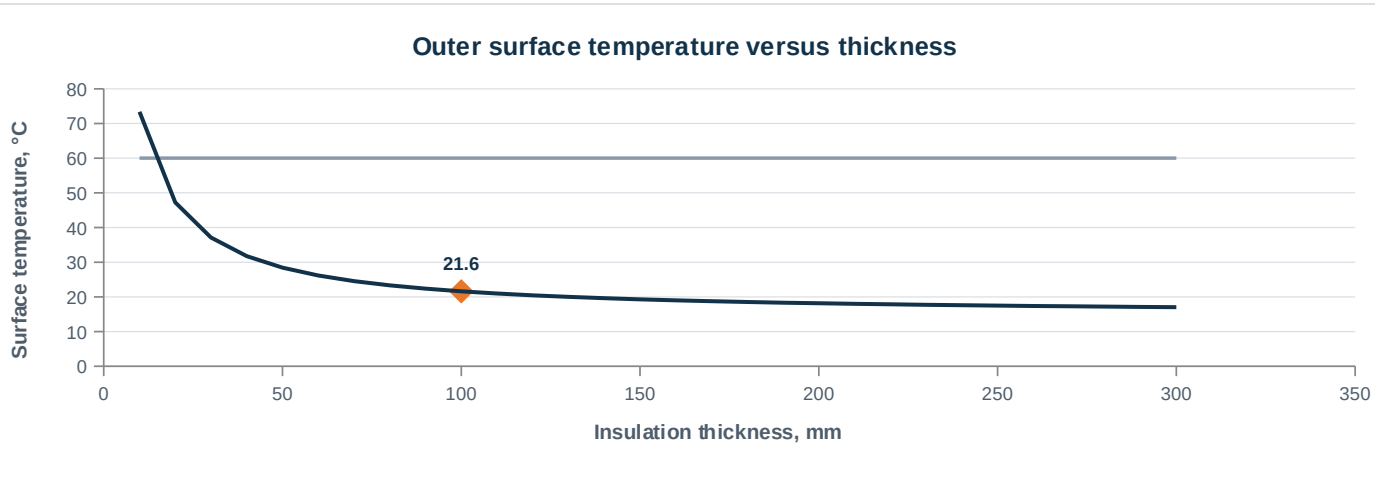
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CHARTS



Observations — heat loss

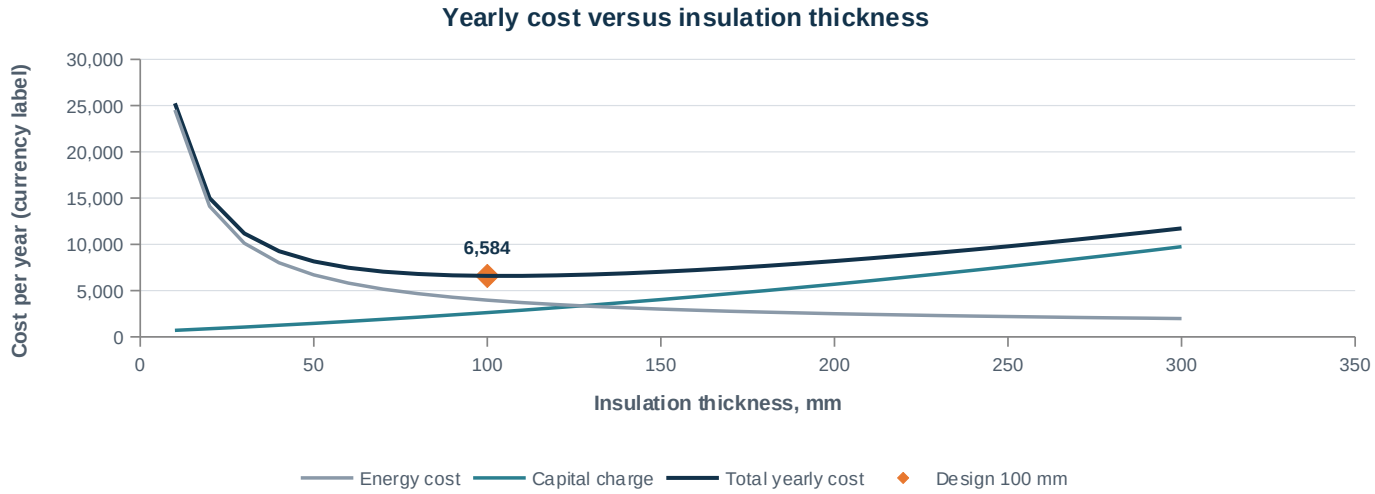
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Observations — surface temperature

[Write your observations here]

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Observations — yearly cost

[Write your observations here]

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