# Overall Heat Transfer Coefficient (U) of a Tube

Overall heat transfer coefficient of a tube from the outside and inside film coefficients, wall conduction and fouling, on the outside and inside area.

**Method:** Thermal resistances in series for a cylindrical wall

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Outside film coefficient | 60.000 | W/(m²·K) |
| Inside film coefficient | 5,000.0 | W/(m²·K) |
| Tube outside diameter | 51.000 | mm |
| Tube inside diameter | 42.000 | mm |
| Wall thermal conductivity | 45.000 | W/(m·K) |
| Outside fouling resistance (on the outside area) | 5.0000e-04 | m²·K/W |
| Inside fouling resistance (on the inside area) | 1.0000e-04 | m²·K/W |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| U on the outside area | 56.686 | W/(m²·K) |
| U on the inside area | 68.833 | W/(m²·K) |
| Total resistance (outside area basis) | 0.017641 | m²·K/W |
| Share of the wall in the resistance | 0.62367 | % |

## Formula and method

$$\frac{1}{U_o} = \frac{1}{h_o} + R_{fo} + \frac{d_o \ln(d_o/d_i)}{2k_w} + R_{fi}\frac{d_o}{d_i} + \frac{d_o}{d_i\, h_i} \qquad U_i = U_o \frac{d_o}{d_i} \qquad R_o = \frac{1}{U_o}$$

### Variables

| | | |
|---|---|---|
| $h_o$ | outside film coefficient | W/(m²·K) |
| $h_i$ | inside film coefficient | W/(m²·K) |
| $d_o$ | outside diameter | m |
| $d_i$ | inside diameter | m |
| $k_w$ | wall conductivity | W/(m·K) |
| $R_{fo}$ | outside fouling resistance | m²·K/W |
| $R_{fi}$ | inside fouling resistance | m²·K/W |
| $U_o$ | U on outside area | W/(m²·K) |
| $U_i$ | U on inside area | W/(m²·K) |
| $R_o$ | total resistance | m²·K/W |
| $s_w$ | wall share of resistance | – |

### Method and standards

Resistances in series for a cylindrical wall, referred to the outside area.

### Assumptions and limits

- Thin or thick wall (log-mean conduction); no fins (use the finned-tube calculator for the gas side).

### References

• Thermal resistances in series for a cylindrical wall

## Report details

| | |
|---|---|
| Report reference | FCC-H475-M8JH (the same inputs always give the same reference) |
| Generated | 17 November 2026, 19:49 UTC |
| Calculator | Overall Heat Transfer Coefficient (U) of a Tube |
| Method last reviewed | 11 November 2026 |
| Software release | FireCAD Calc, release of 17 November 2026 |
| 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/mechanical/heat-transfer/overall-heat-transfer-coefficient

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.