Thermal Resistance

Mechanical Engineering

Treating a heat path as a circuit, with resistances that add in series.

Temperature difference drives heat flow, and the resistances along the path add in series.

$$Q = \Delta T \div \Sigma R \cdot \text{wall: } R = L \div kA \cdot \text{film: } R = 1 \div hA$$

Two layers of wall Series addition.	**R total = R1 + R2**
Adding insulation Diminishing returns.	**Raises R, cuts Q**
Adding fins On the fluid side.	**Raises A, so cuts R**

THE COMMON MISTAKE

× Ignoring the surface film resistances

✓ Add 1 ÷ hA at each face

In a well-insulated wall the films are negligible, but for a bare metal plate they are almost the whole resistance.

One-dimensional, steady state, constant conductivity. Corners, studs and bolts need a two-dimensional method.