Important Conduction Shape Factors for Different Configurations Formulas PDF

Formulas
Examples
with Units

List of 21
Important Conduction Shape Factors for Different Configurations Formulas

1) Finite Medium Formulas

1.1) Conduction through Edge of Two Adjoining Walls of Equal Thickness Formula

Evaluate Formula

Formula

$$S = 0.54 \cdot L_w$$

Example with Units

$$28\,\text{m} = 0.54 \cdot 51.85185\,\text{m}$$

1.2) Corner of Three Walls of Equal Thickness Formula

Evaluate Formula

Formula

$$S = 0.15 \cdot t_w$$

Example with Units

$$28\,\text{m} = 0.15 \cdot 186.66666\,\text{m}$$

1.3) Eccentric Isothermal Cylinder in Cylinder of Same Length Formula

Evaluate Formula

Formula

$$S = \frac{2 \cdot \pi \cdot L_c}{a} \cosh\left(\frac{D_1^2 + D_2^2 - 4 \cdot z^2}{2 \cdot D_1 \cdot D_2}\right)$$

Example with Units

$$28\,\text{m} = \frac{2 \cdot 3.1416 \cdot 4\,\text{m}}{a} \cosh\left(\frac{5.1\,\text{m}^2 + 13.739222\,\text{m}^2 - 4 \cdot 1.89\,\text{m}^2}{2 \cdot 5.1\,\text{m} \cdot 13.739222\,\text{m}}\right)$$

1.4) Hollow Spherical Layer Formula

Evaluate Formula

Formula

$$S = \frac{4 \cdot \pi \cdot r_i \cdot r_o}{r_o - r_i}$$

Example with Units

$$28\,\text{m} = \frac{4 \cdot 3.1416 \cdot 2\,\text{m} \cdot 19.53078889\,\text{m}}{19.53078889\,\text{m} - 2\,\text{m}}$$

1.5) Isothermal Cylinder at Center of Square Solid Bar of Same Length Formula

Evaluate Formula

Formula

$$S = \frac{2 \cdot \pi \cdot L_c}{\ln\left(\frac{1.08 \cdot w}{D}\right)}$$

Example with Units

$$28\,\text{m} = \frac{2 \cdot 3.1416 \cdot 4\,\text{m}}{\ln\left(\frac{1.08 \cdot 102.23759\,\text{m}}{45\,\text{m}}\right)}$$

1.6) Large Plane Wall Formula

Evaluate Formula

Formula

$$S = \frac{A}{t}$$

Example with Units

$$28\,\text{m} = \frac{105\,\text{m}^2}{3.75\,\text{m}}$$

1.7) Long Hollow Cylindrical Layer Formula

Evaluate Formula

Formula

$$S = \frac{2 \cdot \pi \cdot L_c}{\ln\left(\frac{r_2}{r_1}\right)}$$

Example with Units

$$28\,\text{m} = \frac{2 \cdot 3.1416 \cdot 4\,\text{m}}{\ln\left(\frac{13.994934\,\text{m}}{5.7036\,\text{m}}\right)}$$

1.8) Square Flow Passage with Width to b Ratio Greater than 1.4 Formula

Evaluate Formula

Formula

$$S = \frac{2 \cdot \pi \cdot L_{pipe}}{0.93 \cdot \ln\left(0.948 \cdot \frac{w_{o1}}{w_{i1}}\right)}$$

Example with Units

$$28\,\text{m} = \frac{2 \cdot 3.1416 \cdot 0.10\,\text{m}}{0.93 \cdot \ln\left(0.948 \cdot \frac{3.241843149\,\text{m}}{3\,\text{m}}\right)}$$

1.9) Square Flow Passage with Width to b Ratio Less than 1.4 Formula

Evaluate Formula

Formula

$$S = \frac{2 \cdot \pi \cdot L_{pipe}}{0.785 \cdot \ln\left(\frac{w_{o2}}{w_{i2}}\right)}$$

Example with Units

$$28\,\text{m} = \frac{2 \cdot 3.1416 \cdot 0.10\,\text{m}}{0.785 \cdot \ln\left(\frac{6.173990514\,\text{m}}{6\,\text{m}}\right)}$$

2) Infinite Medium Formulas

2.1) Isothermal Cylinder in Midplane of Infinite wall Formula

Evaluate Formula

Formula

$$S = \frac{8 \cdot d_s}{\pi \cdot D}$$

Example with Units

$$28\,\text{m} = \frac{8 \cdot 494.8008429\,\text{m}}{3.1416 \cdot 45\,\text{m}}$$

2.2) Isothermal Ellipsoid Buried in Infinite Medium Formula

Evaluate Formula

Formula

$$S = \frac{4 \cdot \pi \cdot a \cdot \sqrt{1 - \frac{b}{a^2}}}{\operatorname{atanh}\left(\sqrt{1 - \frac{b}{a^2}}\right)}$$

Example with Units

$$28\,\text{m} = \frac{4 \cdot 3.1416 \cdot 5.745084\,\text{m} \cdot \sqrt{1 - \frac{0.80\,\text{m}}{5.745084\,\text{m}^2}}}{\operatorname{atanh}\left(\sqrt{1 - \frac{0.80\,\text{m}}{5.745084\,\text{m}^2}}\right)}$$

2.3) Isothermal Sphere Buried in Infinite Medium Formula

Evaluate Formula

Formula

$$S = 4 \cdot \pi \cdot R_s$$

Example with Units

$$28\,\text{m} = 4 \cdot 3.1416 \cdot 2.228169\,\text{m}$$

2.4) Two parallel Isothermal Cylinders placed in Infinite medium Formula

Evaluate Formula

Formula

$$S = \frac{2 \cdot \pi \cdot L_c}{a} \cosh\left(\frac{4 \cdot d^2 - D_1^2 - D_2^2}{2 \cdot D_1 \cdot D_2}\right)$$

Example with Units

$$28\,\text{m} = \frac{2 \cdot 3.1416 \cdot 4\,\text{m}}{a} \cosh\left(\frac{4 \cdot 10.1890145\,\text{m}^2 - 5.1\,\text{m}^2 - 13.739222\,\text{m}^2}{2 \cdot 5.1\,\text{m} \cdot 13.739222\,\text{m}}\right)$$

3) Semi Infinite Medium Formulas

3.1) Disk Buried Parallel to Suface in Semi-Infinite Medium Formula

Evaluate Formula

Formula

$$S = 4 \cdot D_d$$

Example with Units

$$28\,\text{m} = 4 \cdot 7\,\text{m}$$

3.2) Isothermal Cylinder Buried in Semi-Infinite Medium Formula

Evaluate Formula

Formula

$$S_1 = \frac{2 \cdot \pi \cdot L_c}{\ln\left(\frac{4 \cdot d_s}{D}\right)}$$

Example with Units

$$6.6422\,\text{m} = \frac{2 \cdot 3.1416 \cdot 4\,\text{m}}{\ln\left(\frac{4 \cdot 494.8008429\,\text{m}}{45\,\text{m}}\right)}$$

3.3) Isothermal Rectangular Parallelepiped Buried in Semi-Infinite Medium Formula

Evaluate Formula

Formula

$$S = 1.685 \cdot L_{pr} \cdot \left(\log10\left(1 + \frac{D_{ss}}{W_{pr}}\right)\right)^{-0.59} \cdot \left(\frac{D_{ss}}{H}\right)^{-0.078}$$

Example with Units

$$28\,\text{m} = 1.685 \cdot 7.0479\,\text{m} \cdot \left(\log10\left(1 + \frac{8\,\text{m}}{11\,\text{m}}\right)\right)^{-0.59} \cdot \left(\frac{8\,\text{m}}{9\,\text{m}}\right)^{-0.078}$$

3.4) Isothermal Sphere Buried in Semi-Infinite Medium Formula

Evaluate Formula

Formula

$$S = \frac{2 \cdot \pi \cdot D_s}{1 - \left(\frac{0.25 \cdot D_s}{d_s}\right)}$$

Example with Units

$$28\,\text{m} = \frac{2 \cdot 3.1416 \cdot 4.446327\,\text{m}}{1 - \left(\frac{0.25 \cdot 4.446327\,\text{m}}{494.8008429\,\text{m}}\right)}$$

3.5) Isothermal Sphere Buried in Semi-Infinite Medium whose Surface is Insulated Formula

Evaluate Formula

Formula

$$S = \frac{2 \cdot \pi \cdot D_{si}}{1 + \frac{0.25 \cdot D_{si}}{d_s}}$$

Example with Units

$$28\,\text{m} = \frac{2 \cdot 3.1416 \cdot 4.466395\,\text{m}}{1 + \frac{0.25 \cdot 4.466395\,\text{m}}{494.8008429\,\text{m}}}$$

3.6) Row of Equally Spaced Parallel Isothermal Cylinders Buried in Semi-infinite Medium Formula

Evaluate Formula

Formula

$$S_2 = \frac{2 \cdot \pi \cdot L_c}{\ln\left(\frac{2 \cdot d}{\pi \cdot D} \cdot \sinh\left(\frac{2 \cdot \pi \cdot d_s}{d}\right)\right)}$$

Example with Units

$$0.0831\,\text{m} = \frac{2 \cdot 3.1416 \cdot 4\,\text{m}}{\ln\left(\frac{2 \cdot 10.1890145\,\text{m}}{3.1416 \cdot 45\,\text{m}} \cdot \sinh\left(\frac{2 \cdot 3.1416 \cdot 494.8008429\,\text{m}}{10.1890145\,\text{m}}\right)\right)}$$

3.7) Thin Rectangular Plate Buried in Semi-Infinite Medium Formula

Evaluate Formula

Formula

$$S = \frac{2 \cdot \pi \cdot W_{plate}}{\ln\left(\frac{4 \cdot W_{plate}}{L_{plate}}\right)}$$

Example with Units

$$28\,\text{m} = \frac{2 \cdot 3.1416 \cdot 35.42548\,\text{m}}{\ln\left(\frac{4 \cdot 35.42548\,\text{m}}{0.05\,\text{m}}\right)}$$

3.8) Vertical Isothermal Cylinder Buried in Semi-Infinite Medium Formula

Evaluate Formula

Formula

$$S = \frac{2 \cdot \pi \cdot l_c}{\ln\left(\frac{4 \cdot l_c}{D_1}\right)}$$

Example with Units

$$28\,\text{m} = \frac{2 \cdot 3.1416 \cdot 8.40313\,\text{m}}{\ln\left(\frac{4 \cdot 8.40313\,\text{m}}{5.1\,\text{m}}\right)}$$

Variables used in list of Conduction Shape Factors for Different Configurations Formulas above

- **a** Semi Major Axis of Ellipse *(Meter)*
- **A** Cross-Sectional Area *(Square Meter)*
- **b** Semi Minor Axis of Ellipse *(Meter)*
- **d** Distance Between Centers *(Meter)*
- **D** Diameter of Cylinder *(Meter)*
- D_1 Diameter of Cylinder 1 *(Meter)*
- D_2 Diameter of Cylinder 2 *(Meter)*
- D_d Diameter of Disk *(Meter)*
- d_s Distance from Surface to Centre of Object *(Meter)*
- D_s Diameter of Sphere *(Meter)*
- D_{si} Diameter of Sphere Insulated *(Meter)*
- D_{ss} Distance from Surface to Surface of Object *(Meter)*
- **H** Height of Parallelepiped *(Meter)*
- l_c Length of Cylinder 1 *(Meter)*
- L_c Length of Cylinder *(Meter)*
- L_{pipe} Length of Pipe *(Meter)*
- L_{plate} Length of Plate *(Meter)*
- L_{pr} Length of Parallelepiped *(Meter)*
- L_w Length of Wall *(Meter)*
- r_1 Inner Radius of Cylinder *(Meter)*
- r_2 Outer Radius of Cylinder *(Meter)*
- r_i Inner Radius *(Meter)*
- r_o Outer Radius *(Meter)*
- R_s Radius of Sphere *(Meter)*
- **S** Conduction Shape Factor *(Meter)*
- S_1 Conduction Shape Factor 1 *(Meter)*
- S_2 Conduction Shape Factor 2 *(Meter)*
- **t** Thickness *(Meter)*
- t_w Thickness of Wall *(Meter)*

Constants, Functions, Measurements used in list of Conduction Shape Factors for Different Configurations Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **acosh**, acosh(Number) *Hyperbolic cosine function, is a function that takes a real number as an input and returns the angle whose hyperbolic cosine is that number.*
- Functions: **atanh**, atanh(Number) *The inverse hyperbolic tangent function returns the value whose hyperbolic tangent is a number.*
- Functions: **cosh**, cosh(Number) *The hyperbolic cosine function is a mathematical function that is defined as the ratio of the sum of the exponential functions of x and negative x to 2.*
- Functions: **ln**, ln(Number) *The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.*
- Functions: **log10**, log10(Number) *The common logarithm, also known as the base-10 logarithm or the decimal logarithm, is a mathematical function that is the inverse of the exponential function.*
- Functions: **sinh**, sinh(Number) *The hyperbolic sine function, also known as the sinh function, is a mathematical function that is defined as the hyperbolic analogue of the sine function.*
- Functions: **sqrt**, sqrt(Number) *A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.*
- Functions: **tanh**, tanh(Number) *The hyperbolic tangent function (tanh) is a function that is defined as the ratio of the hyperbolic sine function (sinh) to the hyperbolic cosine function (cosh).*
- Measurement: **Length** in Meter (m) *Length Unit Conversion*

- **w** Width of Square Bar *(Meter)*
- w_{i1} Inner Width 1 *(Meter)*
- w_{i2} Inner Width 2 *(Meter)*
- w_{o1} Outer Width 1 *(Meter)*
- w_{o2} Outer Width 2 *(Meter)*
- W_{plate} Width of Plate *(Meter)*
- W_{pr} Width of Parallelepiped *(Meter)*
- **z** Eccentric Distance Between Objects *(Meter)*

- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion

Download other Important Conduction PDFs

- Important Conduction in Cylinder Formulas
- Important Conduction in Plane Wall Formulas
- Important Conduction in Sphere Formulas
- Important Conduction Shape Factors for Different Configurations Formulas
- Important Other shapes Formulas
- Important Steady State Heat Conduction with Heat Generation Formulas
- Important Transient Heat Conduction Formulas

Try our Unique Visual Calculators

- Percentage change
- LCM of two numbers
- Proper fraction

Please SHARE this PDF with someone who needs it!

This PDF can be downloaded in these languages

English Spanish French German Russian Italian Portuguese Polish Dutch

9/23/2024 | 11:42:18 AM UTC