Conduction Shape Factors for Different Configurations Formulas

List of 21 Conduction Shape Factors for Different Configurations Formulas

Conduction Shape Factors for Different Configurations

1) Conduction through Edge of Two Adjoining Walls of Equal Thickness

Open Calculator

fx $$S = 0.54 \cdot L_w$$

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

2) Corner of Three Walls of Equal Thickness

Open Calculator

fx $$S = 0.15 \cdot t_w$$

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

3) Eccentric Isothermal Cylinder in Cylinder of Same Length

Open Calculator

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

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

4) Hollow Spherical Layer

Open Calculator

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

ex $$28.00001\text{m} = \frac{4 \cdot \pi \cdot 2\text{m} \cdot 19.53078889\text{m}}{19.53078889\text{m} - 2\text{m}}$$

5) Isothermal Cylinder at Center of Square Solid Bar of Same Length

Open Calculator

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

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

6) Large Plane Wall

Open Calculator

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

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

7) Long Hollow Cylindrical Layer

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

Infinite Medium

10) Isothermal Cylinder in Midplane of Infinite wall

Open Calculator

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

ex $$28\text{m} = \frac{8 \cdot 494.8008429\text{m}}{\pi \cdot 45\text{m}}$$

11) Isothermal Ellipsoid Buried in Infinite Medium

Open Calculator

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

ex $$28\text{m} = \frac{4 \cdot \pi \cdot 5.745084\text{m} \cdot \sqrt{1 - \frac{0.80\text{m}}{(5.745084\text{m})^2}}}{a\tanh\left(\sqrt{1 - \frac{0.80\text{m}}{(5.745084\text{m})^2}}\right)}$$

12) Isothermal Sphere Buried in Infinite Medium

Open Calculator

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

ex $$28\text{m} = 4 \cdot \pi \cdot 2.228169\text{m}$$

13) Two parallel Isothermal Cylinders placed in Infinite medium

Open Calculator

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

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

Semi-Infinite Medium

14) Disk Buried Parallel to Suface in Semi-Infinite Medium

Open Calculator

fx $$S = 4 \cdot D_d$$

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

15) Isothermal Cylinder Buried in Semi-Infinite Medium

Open Calculator

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

ex $$6.642218\text{m} = \frac{2 \cdot \pi \cdot 4\text{m}}{\ln\left(\frac{4 \cdot 494.8008429\text{m}}{45\text{m}}\right)}$$

16) Isothermal Rectangular Parallelepiped Buried in Semi-Infinite Medium

Open Calculator

fx $$S = 1.685 \cdot L_{pr} \cdot \left(\log 10\left(1 + \frac{D_{ss}}{W_{pr}}\right)\right)^{-0.59} \cdot \left(\frac{D_{ss}}{H}\right)^{-0.078}$$

ex $$28\text{m} = 1.685 \cdot 7.0479\text{m} \cdot \left(\log 10\left(1 + \frac{8\text{m}}{11\text{m}}\right)\right)^{-0.59} \cdot \left(\frac{8\text{m}}{9\text{m}}\right)^{-0.078}$$

17) Isothermal Sphere Buried in Semi-Infinite Medium

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

ex $$0.083085\text{m} = \frac{2 \cdot \pi \cdot 4\text{m}}{\ln\left(\frac{2 \cdot 10.1890145\text{m}}{\pi \cdot 45\text{m}} \cdot \sinh\left(\frac{2 \cdot \pi \cdot 494.8008429\text{m}}{10.1890145\text{m}} \right) \right)}$$

20) Thin Rectangular Plate Buried in Semi-Infinite Medium

Open Calculator

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

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

21) Vertical Isothermal Cylinder Buried in Semi-Infinite Medium

Open Calculator

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

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

Variables Used

- **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)*
- **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)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **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.
- Function: **atanh**, atanh(Number)
  The inverse hyperbolic tangent function returns the value whose hyperbolic tangent is a number.
- Function: **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.
- Function: **ln**, ln(Number)
  The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.
- Function: **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.
- Function: **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.
- Function: **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.
- Function: **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
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion

Check other formula lists

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

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