

INSULATION GUIDE



Insulation Calculations for Heat Loss using Teel BQ Americas PP-RCT Pipes

Teel BQ Americas Pipes like almost all pipes, are insulated to prevent condensation, freezing and heat loss. Teel BQ PP-RCT Pipes have relatively low thermal conductivity compared to metal pipes. Using Teel BQ pipes significantly improves energy savings as compared to traditional metal piping by reducing the amount of insulation.

Heat Gain and Loss Calculations

Metal pipes are considered conductors of heat causing system efficiencies, loss of energy and higher system costs. When compared to copper, steel and other metal pipes Teel BQ Americas PP-RCT pipes have low thermal conductivity (k factor). The following are comparisons of the thermal conductivity (K factor) expressed in BTU/(hr*ft*°F) at room temperature (68°F):

$$k_{\text{Teel BQ}} = 0.1387 \text{ BTU}/(\text{hr} \cdot \text{ft} \cdot ^\circ\text{F}) \text{ or } 1.6644 \text{ BTU} \cdot \text{in}/(\text{hr} \cdot \text{ft}^2 \cdot ^\circ\text{F})$$

$$k_{\text{copper}} = 227$$

$$k_{\text{steel}} = 31$$

$$k_{\text{ins}} = 0.0208333 \text{ (for typical 0.25" up to 1" closed cell foam insulation)}$$

$$k_{\text{ins}} = 0.02375 \text{ (for typical 1.50 up to 2" closed cell foam insulation)}$$

$\Delta T = 50^\circ\text{F}$ (typical temperature difference between hot water and room temperature)

The R-Value is the capacity of an insulating material to resist heat flow. The higher the R-Value, the greater the insulating power.

Heat loss can also be expressed through R-value, which has direct relationship with the K-values, as shown in the following equations:

$$R - \text{value} = \frac{\text{Equivalent Thickness (inches)}}{k - \text{factor} \left(\frac{\text{BTU inch}}{\text{hr ft}^2 \text{ } ^\circ\text{F}} \right)}$$

Where $r_{\text{pipe, i}}$ = Inner Radius and $r_{\text{pipe, o}}$ = Outer Radius

$$\text{Equivalent Thickness} = r_{\text{pipe, o}} \times \ln \left(\frac{r_{\text{pipe, o}}}{r_{\text{pipe, i}}} \right)$$

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Calculating Thermal Resistance Values (hr ft F / BTU)	Calculating Heat Loss (BTU / hr - ft)
R_{pipe} = Thermal resistance of pipe wall	q_{pipe} = Heat loss through a non-insulated pipe
$R_{pipe} = \frac{\ln\left(\frac{r_{pipe, o}}{r_{pipe, i}}\right)}{2\pi k_{Teel BQ}}$	$q_{pipe} = \frac{\Delta T}{R_{pipe}}$
R_{ins} = Thermal resistance of pipe insulation	q_{total} = Total heat loss through an insulated pipe
$R_{ins} = \frac{\ln\left(\frac{r_{ins, o}}{r_{pipe, o}}\right)}{2\pi k_{ins}}$	$q_{total} = \frac{\Delta T}{R_{total}}$
R_{total} = Total thermal resistance of pipe and pipe insulation	
$R_{total} = R_{pipe} + R_{ins}$	

The following heat loss tables are based on water temperature of 120°F and an ambient temperature of 70°F, with a 50°F ΔT.

SDR 6		Heat Loss of Teel BQ Americas PP-RCT Pipe both Bare and Insulated				
Pipe Size	Nom. O.D.	Q (BTU/hr*ft)	Q (BTU/hr*ft)	Q (BTU/hr*ft)	Q (BTU/hr*ft)	Q (BTU/hr*ft)
		Bare Pipe	0.5 Inch	1 Inch	1.5 Inch	2 Inch
20 mm	1/2"	20.22	5.15	3.91	3.70	3.33
25 mm	3/4"	23.90	6.00	4.47	4.18	3.74
32 mm	1"	28.29	7.11	5.20	4.80	4.26
40 mm	1-1/4"	32.70	8.34	6.00	5.48	4.82
50 mm	1-1/2"	37.42	9.79	6.95	6.28	5.47
63 mm	2"	42.26	11.56	8.13	7.26	6.28
75 mm	2-1/2"	45.99	13.10	9.16	8.13	7.00
90 mm	3"	49.90	14.93	10.41	9.18	7.86
110 mm	3-1/2"	54.21	17.22	12.00	10.52	8.97
125 mm	4"	56.91	18.84	13.15	11.49	9.77


SDR 7.4
Heat Loss of Teel BQ Americas PP-RCT Pipe both Bare and Insulated

Pipe Size	Nom. O.D.	Q (BTU/hr*ft)				
		Bare Pipe	0.5 Inch	1 Inch	1.5 Inch	2 Inch
20 mm	1/2"	21.12	5.20	3.94	3.73	3.36
25 mm	3/4"	25.07	6.07	4.51	4.21	3.76
32 mm	1"	30.12	7.22	5.26	4.85	4.30
40 mm	1-1/4"	35.05	8.48	6.08	5.54	4.86
50 mm	1-1/2"	40.30	9.98	7.05	6.36	5.53
63 mm	2"	46.26	11.84	8.26	7.37	6.36
75 mm	2-1/2"	50.63	13.45	9.33	8.26	7.10
90 mm	3"	55.52	15.39	10.63	9.35	7.99
110 mm	3-1/2"	60.67	17.82	12.29	10.74	9.13
125 mm	4"	64.18	19.57	13.51	11.76	9.97
160 mm	6"	70.89	23.43	16.23	14.06	11.87
200 mm	8"	77.42	27.64	19.26	16.63	13.99
250 mm	10"	85.12	32.82	23.00	19.81	16.63
315 mm	12"	94.66	39.61	27.87	23.93	20.03
355 mm	14"	100.42	43.82	30.87	26.46	22.11

SDR 9
Heat Loss of Teel BQ Americas PP-RCT Pipe both Bare and Insulated

Pipe Size	Nom. O.D.	Q (BTU/hr*ft)				
		Bare Pipe	0.5 Inch	1 Inch	1.5 Inch	2 Inch
20 mm	1/2"	21.87	5.25	3.97	3.75	3.38
25 mm	3/4"	26.25	6.13	4.54	4.25	3.79
32 mm	1"	31.65	7.31	5.31	4.89	4.33
40 mm	1-1/4"	37.14	8.60	6.13	5.59	4.90
50 mm	1-1/2"	43.18	10.14	7.13	6.42	5.58
63 mm	2"	49.73	12.05	8.37	7.45	6.43
75 mm	2-1/2"	55.10	13.75	9.48	8.37	7.18
90 mm	3"	60.71	15.77	10.81	9.49	8.09
110 mm	3-1/2"	67.20	18.34	12.54	10.93	9.26
125 mm	4"	71.30	20.19	13.80	11.98	10.12

SDR 11		Heat Loss of Teel BQ Americas PP-RCT Pipe both Bare and Insulated				
Pipe Size	Nom. O.D.	Q (BTU/hr*ft)	Q (BTU/hr*ft)	Q (BTU/hr*ft)	Q (BTU/hr*ft)	Q (BTU/hr*ft)
		Bare Pipe	0.5 Inch	1 Inch	1.5 Inch	2 Inch
32 mm	1"	33.04	7.38	5.34	4.92	4.35
40 mm	1-1/4"	38.88	8.69	6.18	5.63	4.93
50 mm	1-1/2"	45.55	10.27	7.19	6.47	5.62
63 mm	2"	53.01	12.23	8.46	7.52	6.48
75 mm	2-1/2"	59.27	13.99	9.59	8.46	7.24
90 mm	3"	65.75	16.09	10.96	9.60	8.17
110 mm	3-1/2"	73.32	18.77	12.74	11.08	9.37
125 mm	4"	78.20	20.70	14.04	12.16	10.25
160 mm	6"	88.33	25.07	17.00	14.64	12.28
200 mm	8"	98.79	29.95	20.35	17.44	14.56
250 mm	10"	111.48	36.12	24.57	20.96	17.43
315 mm	12"	128.19	44.47	30.19	25.62	21.20
355 mm	14"	138.66	49.82	33.73	28.54	23.54
400 mm	16"	149.92	55.90	37.72	31.81	26.17
450 mm	18"	161.27	62.58	42.11	35.41	29.05

SDR 17.6		Heat Loss of Teel BQ Americas PP-RCT Pipe both Bare and Insulated				
Pipe Size	Nom. O.D.	Q (BTU/hr*ft)	Q (BTU/hr*ft)	Q (BTU/hr*ft)	Q (BTU/hr*ft)	Q (BTU/hr*ft)
		Bare Pipe	0.5 Inch	1 Inch	1.5 Inch	2 Inch
125 mm	4"	92.12	21.57	14.43	12.45	10.46
160 mm	6"	106.39	26.34	17.58	15.06	12.57
200 mm	8"	121.52	31.75	21.17	18.03	14.98
250 mm	10"	141.00	38.74	25.76	21.82	18.02
315 mm	12"	168.34	48.48	31.99	26.91	22.07
355 mm	14"	186.76	54.90	35.99	30.14	24.61
400 mm	16"	207.24	62.33	40.55	33.80	27.49
450 mm	18"	229.92	70.78	45.67	37.90	30.70
500 mm	20"	250.30	79.12	50.74	41.95	33.88
560 mm	22"	272.76	88.98	56.74	46.75	37.65
630 mm	24"	293.15	99.80	63.47	52.17	41.92

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