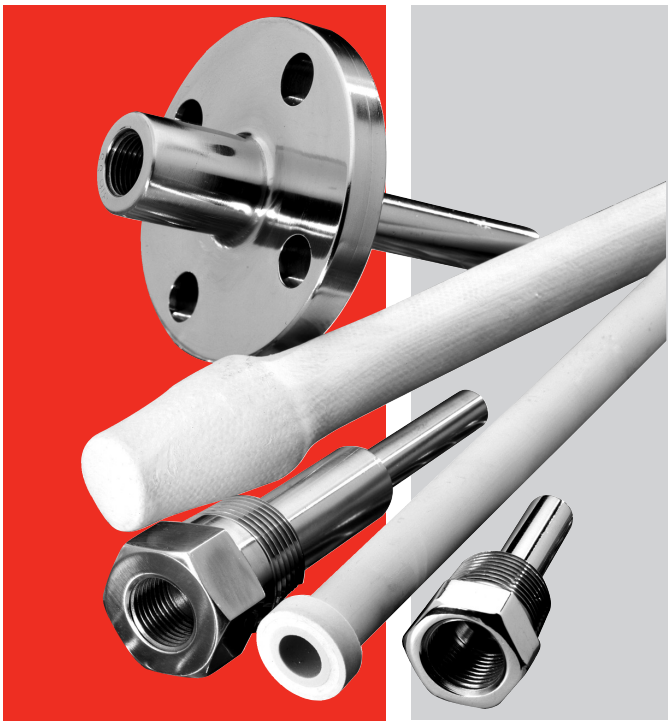
Thermowells



Manufactured from drilled bar stock, Watlow thermowells provide a pressure-tight connection at the point of installation. With thick walls, thermowells are sturdy enough to handle high pressure, high velocity and corrosive environments. They are frequently used in petrochemical and power plant applications.

Highly critical or demanding applications may require thermowells not only for protection of the temperature sensor, but also to withstand high pressure, erosion or both, caused by material flows through vessels.

Features and Benefits

Bar stock used to manufacture thermowells

- Provides protection against corrosion
- Round bar with wrench flats is substituted when hex is not available

Typical Applications

- Petrochemical
- Chemical
- Oil refineries
- Power plants
- Storage tanks and lines

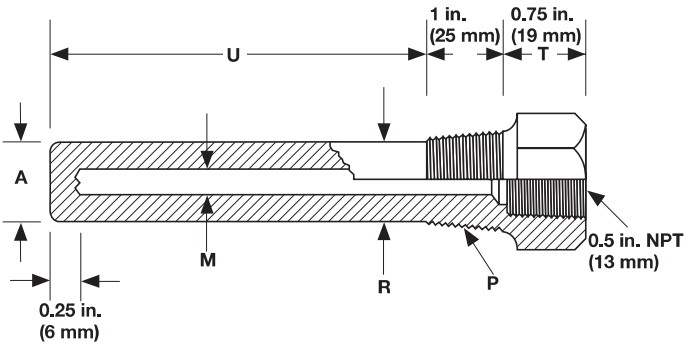
	Manufacturing Standards
Bar Stock	Mill Standards (±0.010 inch approximately)
Process Connection	Threaded: Inspected with standard ring gauge Flanged: Front J groove welds are ¼ inch wide by ¼ inch deep. Welds are machined, leaving ⅛ inch radius. Rear welds are ⅛ inch wide by ⅛ inch deep. Welds are machined, leaving ¼ inch radius. Full penetration welds are available upon request. Must be specified.
Stem O.D.	Straight: ±0.015 inch Tapered: ±0.015 inch (minor dimension)
U Dimension	±1/8 inch
Overall Dimension	±1/8 inch
End Thickness	1/4 inch ±1/16 inch
Finish	63 RMS
Bore	+0.005 inch -0.003 inch
Tapered Wells	The maximum taper on all thermowells is 16 inches +0.5 - 1.0.

Specifications listed are for standard thermowells or for thermowells manufactured where no other specifications prevail.

Note: All accessories are subject to minimum purchase quantities.

Thermowells

Threaded Type—Straight



Standard Bore Size: 0.260 inch

Standard Materials: 304 SS, 316 SS

Typical Dimensions

Process Conn. NPT P in.	A in.	M in.	R in.	T in.
1	49/64	0.260	49/64	3/4
3/4	49/64	0.260	49/64	3/4

Ordering Information

Part Number

①	② T'Well Style	③ Stem Config.	④⑤⑥ "U" Dim. (fract in.)	⑦ T'Well Material	⑧ Process Conn. Size "P"	⑨ Flange Rating	⑩ Flange Face Type	⑪ Flange Material	⑫ Lag "T" (in.)	⑬ Lag "T" (fract. in.)	⑭ Bore Dia. "M"	⑮ Special Options
T	T	S							0	6		

② Thermowell Style	
T=	Threaded

③ Stem Configuration	
S =	Straight

④⑤⑥ "U" Dimension (fractional in.)	
024 =	2 1/2
044 =	4 1/2
074 =	7 1/2
104 =	10 1/2
134 =	13 1/2
164 =	16 1/2
224 =	22 1/2

Note: For "U" lengths not specified, contact factory.

⑦ Thermowell Material	
A =	304
C =	316 SS

⑧ Process Connection Size "P" (in.)	
D =	3/4 NPT
E =	1 NPT

⑨ Flange Rating	
0 =	No flange

⑩ Flange Face Type	
0 =	No flange

⑪ Flange Material	
0 =	No flange

⑫ Lag "T" (in.)	
0 =	No option available

⑬ Lag "T" (fractional in.)	
6 =	3/4 - Industry Standard

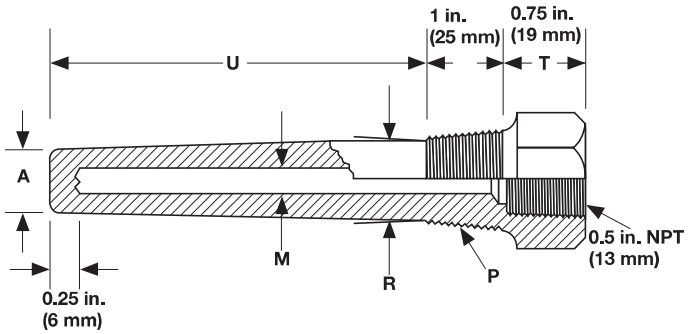
⑭ Bore Diameter "M" (in.)	
A =	0.260

⑮ Special Options	
0 =	None

Note: All accessories are subject to minimum purchase quantities.

Thermowells

Threaded Type—Tapered



Standard Bore Size: 0.260 inch

Standard Materials: 304 SS, 316 SS

Typical Dimensions

Process Conn. NPT P in.	A in.	M in.	R in.	T in.
1	5/8	0.260	1 1/16	3/4
3/4	5/8	0.260	7/8	3/4

Ordering Information

Part Number

①	②	③	④ ⑤ ⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮
	T'Well Style	Stem Config.	"U" Dim. (fract in.)	T'Well Material	Process Conn. Size "P"	Flange Rating	Flange Face Type	Flange Material	Lag "T" (in.)	Lag "T" (fract. in.)	Bore Dia. "M"	Special Options
T	T	T							0	6		

② Thermowell Style	
T=	Threaded

③ Stem Configuration	
T =	Standard taper

④⑤⑥ "U" Dimension (fractional in.)	
024 =	2 1/2
044 =	4 1/2
074 =	7 1/2
104 =	10 1/2
134 =	13 1/2
164 =	16 1/2
224 =	22 1/2
Note: For "U" lengths not specified, contact factory.	

⑦ Thermowell Material	
A =	304 SS
C =	316 SS

⑧ Process Connection Size "P" (in.)	
D =	3/4 NPT
E =	1 NPT

⑨ Flange Rating	
0 =	No flange

⑩ Flange Face Type	
0 =	No flange

⑪ Flange Material	
0 =	No flange

⑫ Lag "T" (in.)	
0 =	No option available

⑬ Lag "T" (fractional in.)	
6 =	3/4 - Industry Standard

⑭ Bore Diameter "M" (in.)	
A =	0.260

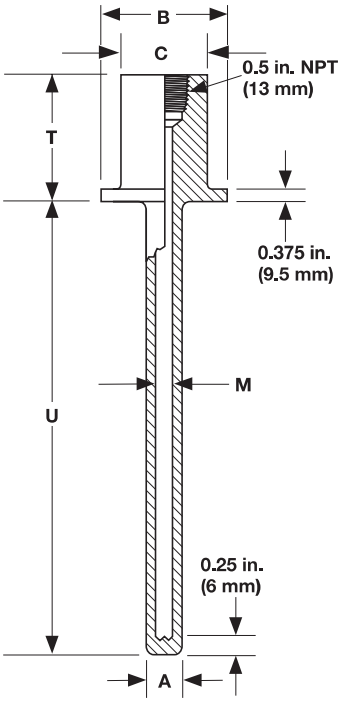
⑮ Special Options	
0 =	None

Note: All accessories are subject to minimum purchase quantities.

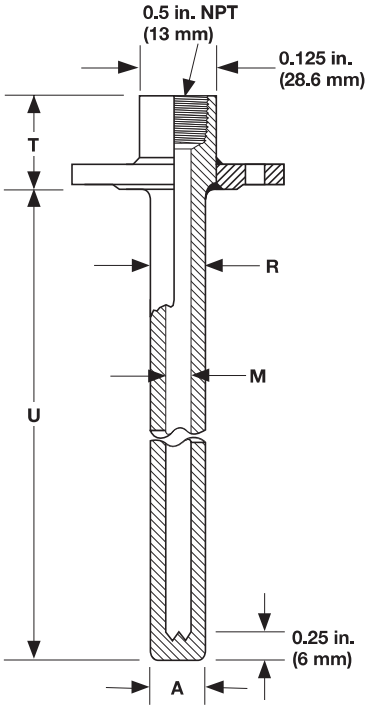
Thermowells

Other Available Thermowells

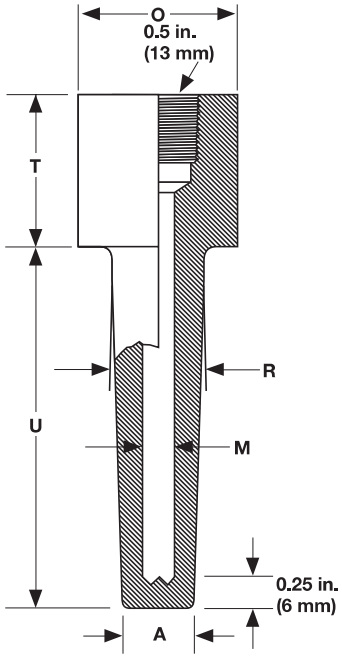
Van Stone Type (TVS)



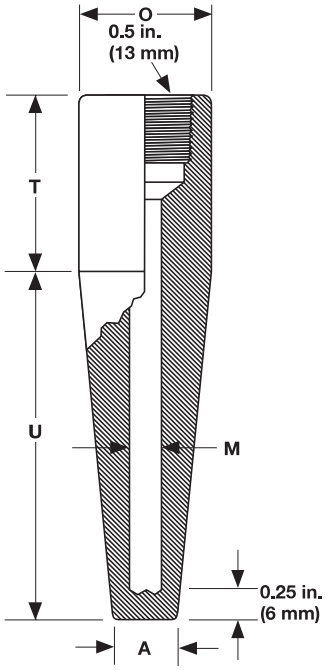
Welded Flange Well (TFS, TFT)



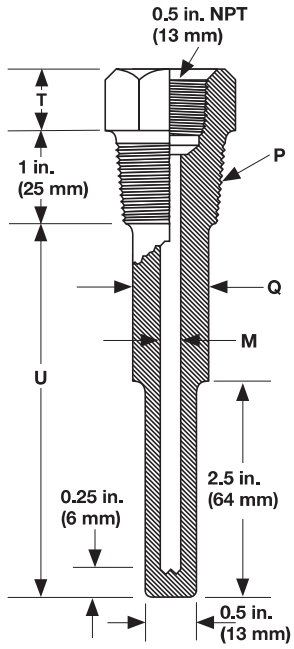
Socket Weld Type (TST)



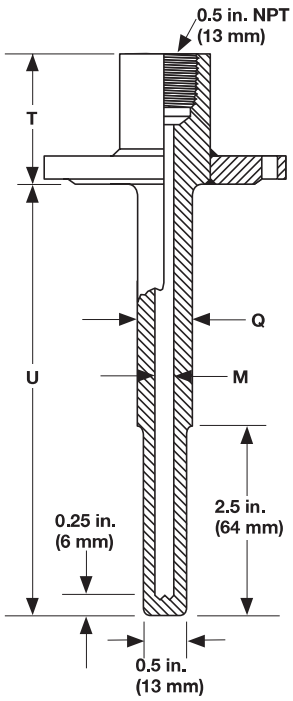
Weld-In Type (TWT)



Bimetallic Thermometer Wells–Threaded Type (TBD)



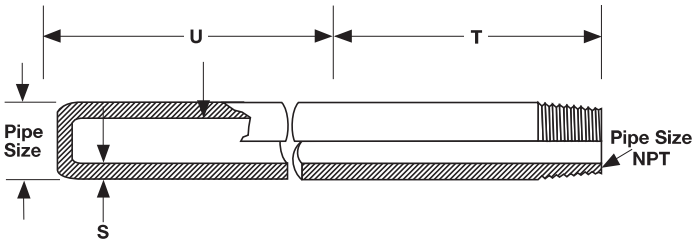
Bimetallic Thermometer Well–Flanged Type (TFD)



Note: Contact factory for price and availability.

Thermowells

Pipe Type



Standard Materials: 304, 316 and 446 SS and Alloy 601

Note: When no bushing is required, "U" becomes the overall length.

Standard "T" Dimension: 3 inches

Ordering Information

Part Number

①	② Pipe Size (in.)	③ Pipe Size "S"	④ ⑤ "U" Dim. (in.)	⑥ "U" Dim. (fract. in.)	⑦ Pipe Material	⑧ Process Conn. Size "P" (in.)	⑨ Flange Rating (lbs)	⑩ Flange Face Type	⑪ Bushing Alloy	⑫ Lag "T" (in.)	⑬ Lag "T" (fract. in.)	⑭ Bore Dia "M" (in.)	⑮ Special Options
P		N					0	0					

② Pipe Size (in.)	
C =	1/2
D =	3/4
E =	1

③ Pipe Type "S"	
N =	Schedule 40

④ ⑤ "U" Dimension (in.)
Whole inches: 00 to 99

⑥ "U" Dimension (fractional in.)	
0 =	0
1 =	1/8
2 =	1/4
3 =	3/8
4 =	1/2
5 =	5/8
6 =	3/4
7 =	7/8

⑦ Pipe Material	
A =	304 SS
C =	316 SS
K =	446 SS
W =	Alloy 601

⑧ Process Connection Size "P" (in.)	
D* =	3/4 NPT
E* =	1 NPT
F* =	1 1/4 NPT
0 =	No bushing

*Includes mounting bushing

⑨ Flange Rating (lbs)	
0 =	No flange

⑩ Flange Face Type	
0 =	No flange

⑪ Bushing Alloy	
0 =	No bushing
A =	304 SS
C =	316 SS
G =	Carbon steel
K =	446 SS
W =	Alloy 601

⑫ Lag "T" (in.)
Whole inches: 0 to 9

⑬ Lag "T" (fractional in.)	
0 =	0
1 =	1/8
2 =	1/4
3 =	3/8
4 =	1/2
5 =	5/8
6 =	3/4
7 =	7/8

⑭ Bore Diameter "M" (in.)	
J =	Per pipe size

⑮ Special Options	
0 =	None
X =	Special requirements, contact factory

Note: All accessories are subject to minimum purchase quantities.

Protection Tubes

Both ceramic and metal (pipe type) protecting tubes protect the temperature sensor from harsh environments. Unlike thermowells, they are not primarily designed for pressure tight applications. Protection tubes are often used in heat treatment furnaces, ovens, open container, flues and ducts.

Protecting tube construction styles are more limited than thermowells. The tubes offer the advantages of economy, corrosion resistance and, in some cases, higher temperature capabilities.

Protecting Tube Application Data

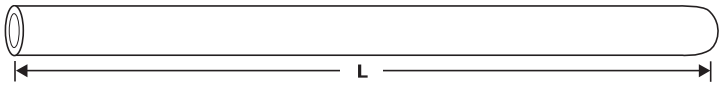
Material	Grade	Max. Use Air	Flexural Strength ($X10^3$ psi)	Thermal Conduct. W/m.K 1475°K	Thermal Shock Resistance	Remarks	Typical Applications
Hexoloy SA®	Sintered	3000°F (1650°C)	67	54.0	Excellent	Maintains strength to 3002°F (1650°C), exceptional corrosion resistance, does **not** creep, attacked by halides, fused caustics and ferrous metals	Incineration, molten aluminum and non-ferrous metals, flue gas, hydrofluoric and sulfuric acids, bauxite calcining
Silicon Carbide	Oxide Bonded	3000°F (1650°C)		15-20	Good	Permeable	Non-ferrous metals
Alumina	99.9%	3450°F (1900°C)	50	6.3	Fair-preheating to 900°F (482°C) recommended	Creeps (sags) at 3452°F (1900°C) ferrous metals, dry H^2	Barium, crown glass; non-ferrous metals; gas-tight protection for noble metal thermocouples in excess of 2400°F (1316°C)
	96%	3100°F (1700°C)	49	5.4	Same as above	Creeps at 3452°F (1900°C)	
Mullite	—	3100°F (1700°C)	12	2.1	Poor—must be pre-heated to 900°F (482°C)	Creeps at 3092°F (1700°C), attacked by halides—contains silica	Non-ferrous metals; gas-tight protection for base metal thermocouples to 2400°F (1316°C)
Metal Ceramic	LT-1	2500°F (1400°C)	45	29.0 (R.T.)	Must be preheated to 900°F (482°C) before immersion into molten metal at 1999°F (1093°C) or higher	Not recommended in carburizing, nitrogen atmospheres, high vacuum or in molten aluminum	Molten non-ferrous metals; calcining kilns, oxidizing atmospheres up to 2552°F (1400°C)
Coated Protection Tubes (SERIES 1100)		1400°F (760°C)			Excellent	Do not exceed 1400°F (760°C)	Molten aluminum, zinc and galvanizing; maximum operating temperature 1373°F (745°C)

Note: Please contact the factory for other mounting fittings availability.

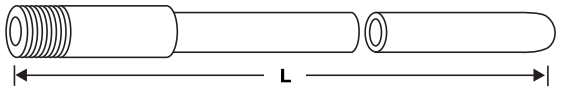
Note: All accessories are subject to minimum purchase quantities.

Protection Tubes

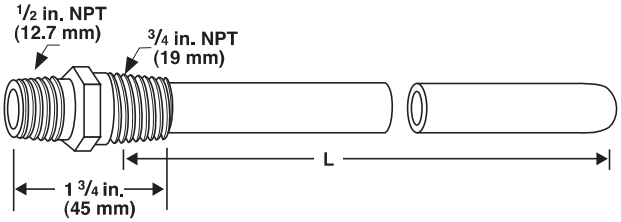
Ceramic Protecting Tubes



Mullite or Alumina Protecting Tube, Plain End



Mullite or Alumina Protecting Tube with TH-43 or TH-50 Ferrule



Mullite or Alumina Protecting Tube with TH-190 or TH-191 Fitting (¾ inch of Tube Enters Fitting)

Mullite Protecting Tubes

Part No.	I.D. X O.D. in.	Construction	Length in.
1152-	1/4 x 3/8	Plain end	12,18, 24, 30, 36, 42, 48
1153-	7/16 x 11/16	Plain end	
1155-	3/4 x 1	Plain end	
1152-N-	1/4 x 3/8	With TH-50 ferrule 7/8 - 27 threads	
1153-N-	7/16 x 11/16	With TH-43 ferrule 7/8 - 27 threads	
1153-190-	7/16 x 11/16	With TH-190 1/2 x 3/4 in. brass	
1153-191-		With TH-191 1/2 x 3/4 in. steel	

Order - Part No. Code - Length
Example: 1152-12, 1152-N-12, 1153-191-24

Alumina (99 Percent Minimum Purity) Protecting Tubes

Part No.	I.D. X O.D. in.	Construction	Length in.
1146	1/4 x 3/8	Plain end	12, 18, 24, 30, 36, 42
1147	7/16 x 11/16	Plain end	12, 18, 24, 30, 36, 42, 48
1146-N	1/4 x 3/8	TH-50 ferrule 7/8-27 threads	12, 18, 24, 30, 36, 42
1147-N	7/16 x 11/16	TH-43 ferrule 7/8-27 threads	12, 18, 24, 30, 36, 42
1147-190	7/16 x 11/16	With TH-190 1/2 x 3/4 in. brass	12, 18, 24, 30, 36, 42, 48
1147-191	7/16 x 11/16	With TH-191 1/2 x 3/4 in. steel	12, 18, 24, 30, 36, 42, 48

Dimension tolerance: Up to one inch, ±5 percent or 0.025 inch, whichever is greater; over one inch, ±4 percent or 0.050 inch, whichever is greater.

Order - Part No. Code - Length
Example: 1146-18, 1146-N-36, 1147-190-30

Note: All accessories are subject to minimum purchase quantities.

Protection Tubes

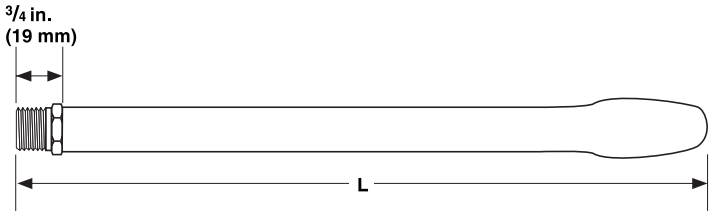
Coated Protection Tubes for Molten Aluminum, Zinc and Galvanizing Applications

SERIES 1100 Protection Tube

With a tough refractory laminated coating, SERIES 1100 protecting tubes resist erosion from molten aluminum, zinc or galvanizing baths. They stay strong, even at high temperatures and require no washing or maintenance to prolong their service life. A special protective cap at the tip provides fast response time, permitting thermal expansion without damage to the refractory laminate.

The 0.493 inch I.D. easily accommodates up to an 8-gauge beaded thermocouple and is stocked for immediate shipment. The maximum operating temperature for the SERIES 1100 is 1400°F (745°C).

Order - Part No. Code - Length
Example: 1100-24



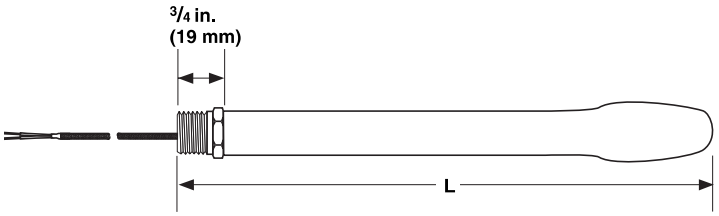
Part No.	I.D. in.	Nominal O.D. in.	Fitting in.	Tube Length in.
1100	0.493	1 1/2 Max.	3/4 NPT	12, 18, 24, 30, 36, 42, 48

SERIES 1101 Protection Thermocouple

Watlow's SERIES 1101 protected thermocouple assemblies incorporate a mineral-insulated stainless steel sheathed XACTPAK® thermocouple hermetically sealed within a refractory laminated SERIES 1100 protection tube. Standard calibration is Type K (part no. 402-2107), complete with 36 inches of high temperature insulated thermocouple wire.

As with the SERIES 1100 protection tube, the SERIES 1101 assembly requires no washing or maintenance to prolong its service life. It delivers fast, accurate readings in molten aluminum, zinc and galvanizing baths.

Order - Part No. Code - Length
Example: 1101-12



Part No.	Calibration	Nominal O.D. in.	Fitting in.	Lead Length in.	Tube Length in.
1101	K	1 1/2 Max.	3/4 NPT	36	12, 18, 24, 30, 36

Note: All accessories are subject to minimum purchase quantities.

Protection Tubes

Hexoloy SA® Tubes

Physical Properties of Hexoloy® Materials—Technical Data

Typical Values	Hexoloy® Grade
Physical Properties	SA
Composition* (Phases)	SiC
Density kg/m³ (g/cm³)	3100 (3.10)
Hardness-Knopp (Kg/mm²)	2800
Flexural Strength 4 pt. @ RT** MPa (x 103 lb/in²)	460 (67)
Flexural Strength 3 pt. @ RT** MPa (x 103 lb/in²)	550 (80)
Compressive Strength RT MPa (x 103 lb/in²)	3900 (560)
Modulus of Elasticity RT GPa (x 106 lb/in²)	410 (59)
Weibull Modulus (2 Parameter)	10
Poisson Ratio	0.14
Fracture Toughness @ RT Double Torsion and SENB MPa/ √ m (x 103 lb/in²/ √ in)	4.60 (4.20)
Coefficient of Thermal Expansion 68°-1,292°F (RT-700°C) x 10⁻⁶mm/mmK (x 10⁻⁶in/in°F)	4.02 (2.20)
Maximum Service Temp. (Air) °C (°F)	1650 (3000)
Mean Specific Heat @ RT (J/gm K)	0.67
Thermal Conductivity @ RT W/m K (BTU/ft h °F)	125.6 (72.6)
Thermal Conductivity 200°C W/m K (BTU/ft h °F)	102.6 (59.3)
Thermal Conductivity 400°C W/m K (BTU/ft h °F)	77.5 (44.8)
Electrical Resistivity① RT, ohm-cm 1000°C, ohm-cm	0.2 to 300① 0.01 to 0.2①
Emissivity	0.9
Max Warpage	0.005/inch

* Composition code: Si = Free Silicon Metal; C = Free Graphite; SiC = Silicon Carbide; TiB = Titanium Diboride

** Test Bar Size: 1/8 x 1/4 x 2 inch (3.2 x 6.4 x 50.8 mm), Outer Span = 1.5 inch; Inner Span = 0.75 inch

① Dependent upon dopants in Hexoloy SA® SiC which will decrease electrical resistivity to a desired range

How to Order

To order, specify the following part numbers and lengths required for your application.

Order - Part No. Code - Length
Example: 1040-12

Cemented mounting fittings are available for most tubes. Contact the factory or your local Watlow sales representative or distributor for information.

Part No.	O.D./I.D. in.	Lengths in.
1040	3/8 x 1/4	6, 12, 18, 24
1041	5/8 x 3/8	
1042	3/4 x 1/2	

Tubes with Optional Mounting Fittings

Tube Part No.	Head Mount	Process Mount	Fitting Description	Lengths in.
1040-L	1/2 NPT	1/2 NPT	Cemented hex nipple	6, 12, 18, 24
1041-M	3/4 NPT	3/4 NPT	Cemented hex nipple	
1042-P	3/4 NPT	3/4 NPT	Cemented hex nipple	

Example: 1041-M-24 is a 5/8 x 3/8 inch Hexoloy® tube 24 inches long with a single 3/4 inch NPT cemented hex fitting.

Note: The maximum recommended temperature rating for cemented fittings is 1000°F (538°C) continuous.

Note: All accessories are subject to minimum purchase quantities.