

Accessories

Protection Tubes and Assemblies

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® <i>See page 154</i>	Sintered	1650°C (3000°F)	67	54.0	Excellent	Maintains strength to 1650°C (3002°F), 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 <i>See page 151</i>	Oxide Bonded	1650°C (3000°F)		15-20	Good	Permeable	Non-ferrous metals
Alumina <i>See page 150</i>	99.9%	1900°C (3450°F)	50	6.3	Fair—preheating to 482°C (900°F) recommended	Creeps (sags) at 1900°C (3452°F) ferrous metals, dry H ₂	Barium, crown glass; non-ferrous metals; gas-tight protection for noble metal thermocouples in excess of 1316°C (2400°F)
	96%	1700°C (3100°F)	49	5.4	Same as above	Creeps at 1900°C (3452°F)	
Mullite <i>See page 150</i>	—	1700°C (3100°F)	12	2.1	Poor—must be preheated to 482°C (900°F)	Creeps at 1700°C (3092°F), attacked by halides—contains silica	Non-ferrous metals; gas-tight protection for base metal thermocouples to 1316°C (2400°F)
Metal Ceramic <i>See page 151</i>	LT-1	1400°C (2500°F)	45	29.0 (R.T.)	Must be preheated to 482°C (900°F) before immersion into molten metal at 1093°C (1999°F) or higher	Not recommended in carburizing, nitrogen atmospheres, high vacuum or in molten aluminum	Molten non-ferrous metals; calcining kilns, oxidizing atmospheres up to 1400°C (2552°F)
Coated Protection Tubes (1100 SERIES) <i>See page 152</i>		760°C (1400°F)			Excellent	Do not exceed 760°C (1400°F)	Molten aluminum, zinc and galvanizing; maximum operating temperature 745°C (1373°F)

* Hot face temperature

Note: Other mounting fittings available; please consult factory.

Note: All accessories subject to minimum purchase quantities.

Accessories

Protection Tubes and Assemblies

Ceramic Protecting Tubes

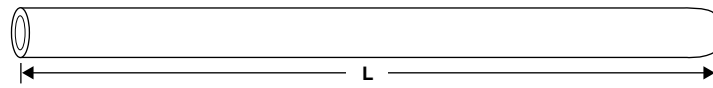
Order - Part No.

Code - Length

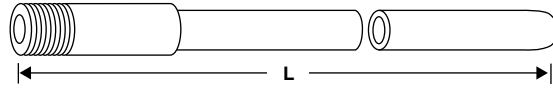
Example: 1152-12

1152-N-12

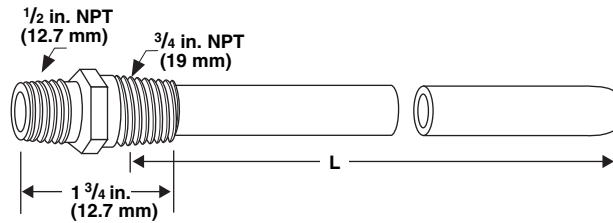
1153-191-24



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 (3/4 inch of Tube Enters Fitting)

Mullite Protecting Tubes*

Code 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, 54, 60
1153-	7/16 x 1/16		
1154-	3/4 x 1		
1155-	1 x 1 1/4		
1152-N-	1/4 x 3/8		
1153-N-	7/16 x 1/16	With TH-50 ferrule 7/8 - 27 threads	
1153-190-	7/16 x 1/16	With TH-190 1/2" x 3/4" brass	
1153-191-		With TH-191 1/2" x 3/4" steel	

Alumina (99% Minimum Purity) Protecting Tubes

Order - Part No.

Code - Length

Example: 1146-18

1146-N-36

1147-190-30

Code No.	I.D. X O.D. in.	Construction	Length in.
1146	1/4 x 3/8	Plain end	12, 18, 24, 30, 36, 42, 48
1147	7/16 x 1/16	Plain end	12, 18, 24, 30, 36, 42, 48, 54, 60
1148	3/4 x 1	Plain end	12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72
1149	1 x 1 1/4	Plain end	12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72
1146-N	1/4 x 3/8	TH-50 ferrule 7/8-27 threads	12, 18, 24, 30, 36, 42, 48
1147-N	7/16 x 1/16	TH-43 ferrule 7/8-27 threads	12, 18, 24, 30, 36, 42, 48, 54, 60
1147-190	7/16 x 1/16	With TH-190 1/2" x 3/4" brass	12, 18, 24, 30, 36, 42, 48, 54, 60
1147-191	7/16 x 1/16	With TH-191 1/2" x 3/4" steel	12, 18, 24, 30, 36, 42, 48, 54, 60

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.

Note: All accessories subject to minimum purchase quantities.

Accessories

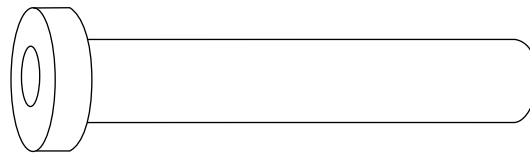
Protection Tubes and Assemblies

Silicon Carbide and Cast Iron Protecting Tubes

Order - Part No.

Code - Length

Example: 1080-18



Silicon Carbide Protecting or Target Tube

Silicon Carbide Protecting Tubes—Oxide Bonded

Code No.	I.D. X O.D. in.	Construction	Length in.	Weight per in.
1080	1 x 1 3/4	Plain end	12, 18, 24, 30, 36	0.15 lbs
1081	1 x 1 3/4	Collar, 3 inch dia.*		0.17 lbs

*Back edge of flange rounded.

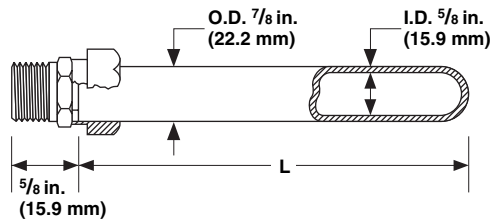
Special Application Protecting Tubes

Order - Part No.

Code - Length

Example: 1161-36

Metal-Ceramic Protecting Tube



Watlow's SERV-RITE® metal-ceramic protecting tube is composed of metallic chromium and aluminum oxide. The metal imparts shock resistance and high thermal conductivity for fast, precise readings; the stable ceramic resists deformation, corrosive attack, abrasion and oxidizing atmospheres over 1205°C (2200°F).

Thermocouples can be installed directly, eliminating the expense of multi-tube assemblies. Metal-ceramics resist surface deformation below the maximum recommended operating temperature of 1355°C (2500°F). They are useful in calcining kilns, for preheat temperature control of open hearth furnaces, for continuous immersion in molten brass, bronze, copper, zinc and lead and in sulphurous gases.

In use, excess thermal or mechanical shock should be avoided. Though superior to ceramics, metal-ceramic tubes are not as shock resistant as metal alloys, and may require preheating for certain applications.

Note: Not recommended in molten aluminum.

Code No.	I.D. X O.D. in.	Construction	Length in.
1161	5/8 x 7/8	Std. 3/4 inch conduit connector	12, 18, 24, 30, 36

Note: All accessories subject to minimum purchase quantities.

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Protection Tubes and Assemblies

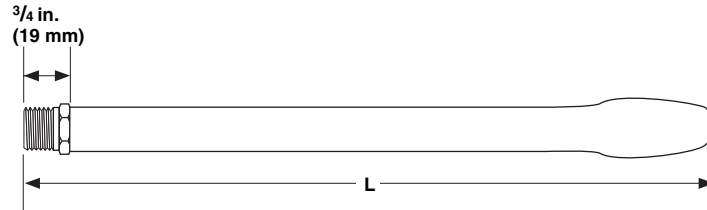
Coated Protecting Tubes for Molten Aluminum, Zinc and Galvanizing Applications

Order - Part No.

Code - Length

Example: 1100-24

SERIES 1100 Protecting 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 higher temperatures, and require no washing or maintenance to prolong their service life. A special protective cap at the tip provides fast response time,

while permitting thermal expansion without damage to the refractory laminate.

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

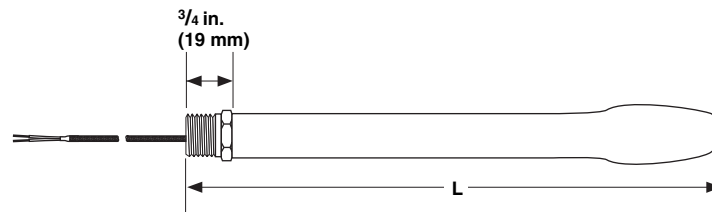
Code No.	I.D. in.	Nominal O.D. in.	Fitting in.	Tube Length in.
1100	0.493	1 ½ Max.	¾ NPT	12, 18, 24, 30, 36, 42, 48

Order - Part No.

Code - Length

Example: 1101-12

SERIES 1101 Protected 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 protecting tube. Standard calibration is Type K (part no. 402-2107),

complete with 36 inches of high temperature insulated thermocouple wire.

Like the 1100, the 1101 assembly requires no washing or maintenance to prolong its service life, yet gives fast, accurate readings in molten aluminum, zinc and galvanizing baths.

Code No.	Calibration	Nominal O.D. in.	Fitting in.	Lead Length in.	Tube Length in.
1101	K	1 ½ Max.	¾ NPT	36	12, 18, 24, 30, 36, 42, 48

Note: All accessories subject to minimum purchase quantities.

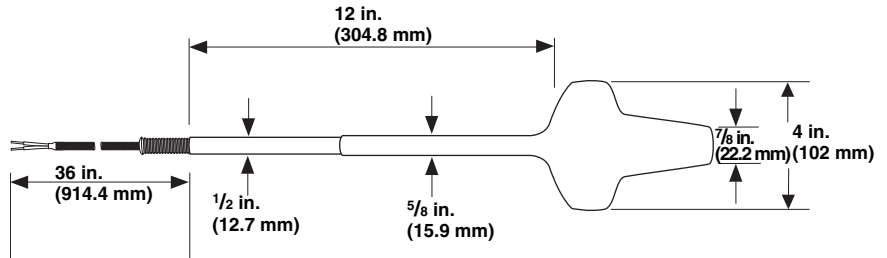
Accessories

Protection Tubes and Assemblies

Coated Protecting Tubes for Molten Aluminum, Zinc and Galvanizing Applications

Continued

SERIES 1102 Floating Protected Thermocouple



A thermocouple that floats! It contains a 0.125 inch O.D. XACTPAK ASTM E 230 Type K stainless steel sheathed thermocouple for quick, accurate temperature indication approximately three inches below the surface of the melt or bath—where control is needed most. This trouble-free unit gives you continuous temperature indication at dip-out depth—regardless of metal level. Chances of breakage are minimized, thanks to a patented buoyant fiber collar that absorbs shock if struck by ladles or

skimmers. The SERIES 1102 floats easily aside to permit unobstructed skimming.

High temperature, 36 inch insulated thermocouple wire is standard (optional stainless steel overbraid, part no. 1112). A metal sleeve with strain relief spring at the top protects against molten metal splash and wire abrasion. The thick, rugged refractory laminated thermocouple protecting cone provides rapid heat transfer and full physical protection.

Part No.	Wire Type	Calibration in.	Nominal O.D. in.	Lead Length in.	Stem Length
1102-12	Fiberglass	K	4	36	12
1112-12	Fiberglass with stainless steel overbraid				

Note: All accessories subject to minimum purchase quantities.

Accessories

Protection Tubes and Assemblies

Hexoloy SA® Tubes



* 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

Physical Properties of Hexoloy® Materials—Technical Data

Typical Values	Hexoloy® Grade
Physical Properties	SA
Composition* (Phases)	SiC
Density kg/m ³ (g/cm ³)	3100 (3.10)
Hardness-Knopp (Kg/mm ²)	2800
Flexural Strength 4 pt. @ RT** MPa (x 103 lb/in ²)	460 (67)
Flexural Strength 3 pt. @ RT** MPa (x 103 lb/in ²)	550 (80)
Compressive Strength RT MPa (x 103 lb/in ²)	3900 (560)
Modulus of Elasticity RT GPa (x 106 lb/in ²)	410 (59)
Weibull Modulus (2 Parameter)	10
Poisson Ratio	0.14
Fracture Toughness @ RT Double Torsion and SENB MPa/√m (x 103 lb/in ² /√in)	4.60 (4.20)
Coefficient of Thermal Expansion RT-700°C (68°-1,292°F) x 10 ⁻⁶ mm/mmK (x 10 ⁻⁶ in/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 Resistivity ^① RT, ohm-cm	0.2 to 300 ^①
1000°C, ohm-cm	0.01 to 0.2 ^①
Emissivity	0.9
Max Warpage	0.005/inch

How to Order

Watlow stocks a wide variety of Hexoloy® tubes for immediate shipment. 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 further information.

Code No.	O.D./I.D. in.	Lengths in.
1040	3/8 x 1/4	6, 12, 18, 24, 30, 36
1041	5/8 x 3/8	
1042	3/4 x 1/2	

Tubes with Optional Mounting Fittings

Tube Code No.	Head Mount	Process Mount	Fitting Description	Lengths in.
1040-L	1/2 NPT	1/2 NPT	Cemented hex nipple	6, 12,
1041-M	3/4 NPT	3/4 NPT	Cemented hex nipple	18, 24,
1042-P	3/4 NPT	3/4 NPT	Cemented hex nipple	30, 36

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: Maximum recommended temperature rating of cemented fitting is 538°C (1000°F) continuous.

Note: All accessories subject to minimum purchase quantities.