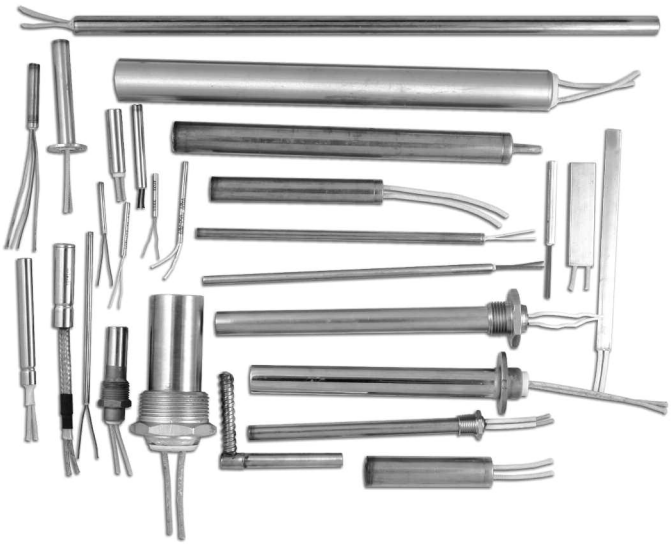
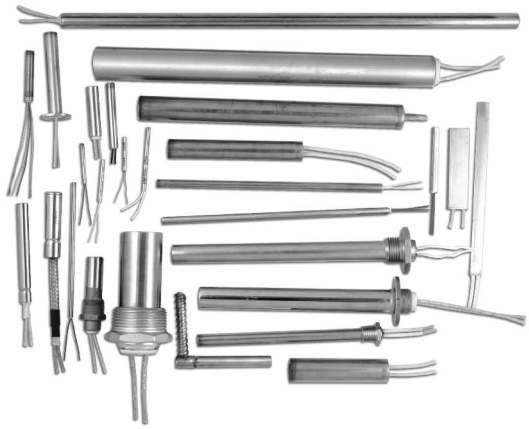




Hotwatt, established in 1952, began with the manufacturing of one product, the open coil heating element. Since then Hotwatt has expanded our product line to include cartridge, air process, immersion, strip and finned strip, tubular and finned tubular, band, foil, flexible glas-rope® and ceramic heaters. We are dedicated to the design and manufacturing of resistance heating elements for a variety of OEM and industrial applications. In addition, we can supply compatible accessory items which enable us to offer a complete heater system.







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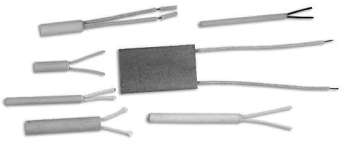
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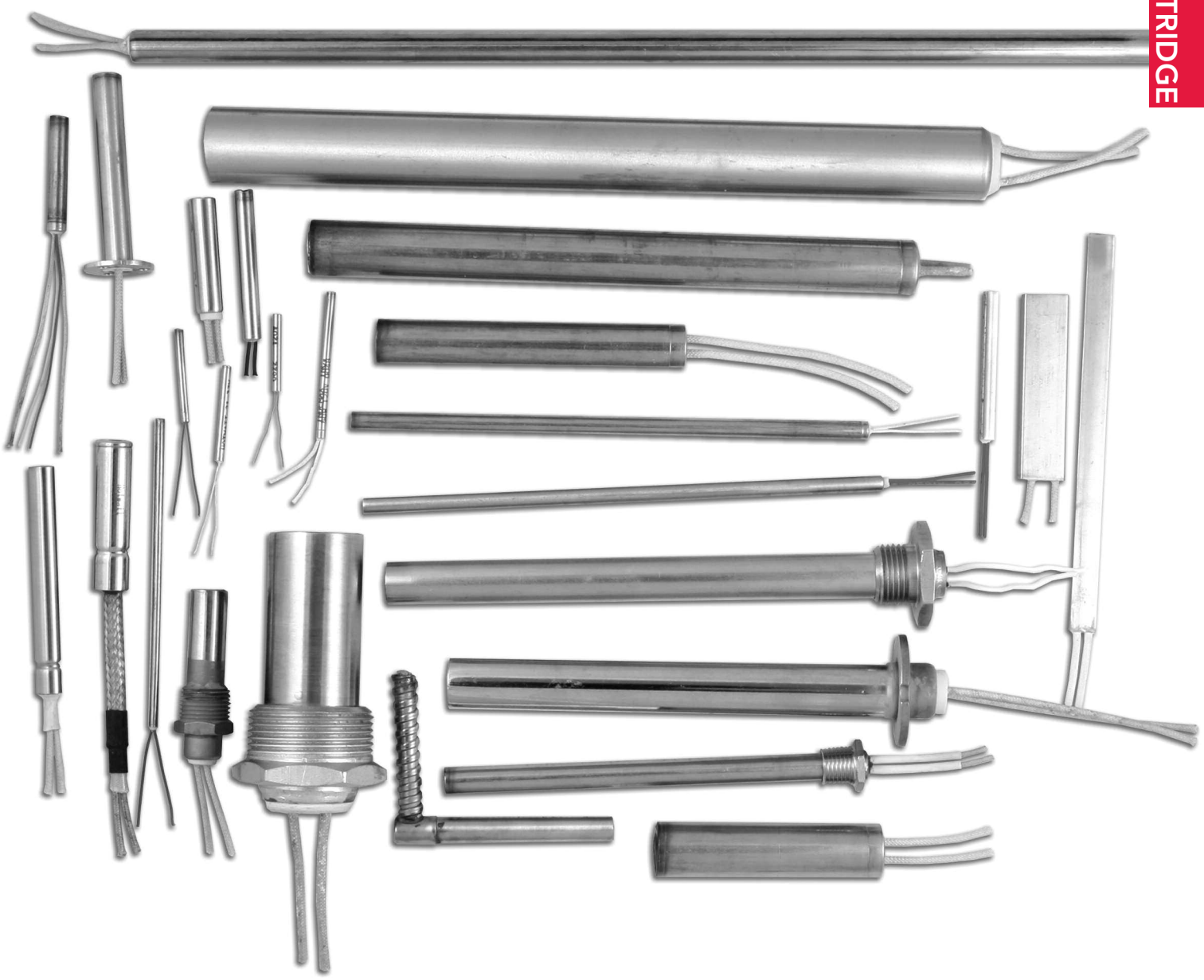
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Cartridge Heaters



Hotwatt manufactures a wide range of cartridge heating units for a variety of applications. This size, sheath, leads, terminals, wattage and voltage can be adapted to your heating requirements.

Hotwatt can provide you with heating units manufactured to your specifications to accommodate your application. Hotwatt stocks all material for the different diameter units listed in this catalog. Your order, specifying the wattage, voltage, diameter, length and lead type is readily and quickly fabricated from our inventory. In addition, many standard sizes are available from stock for immediate delivery.

Cartridge Heaters

Low to Medium Watt Density

U.L. Recognized – E56973
C.S.A. Certified 016386-0-000



Applications:

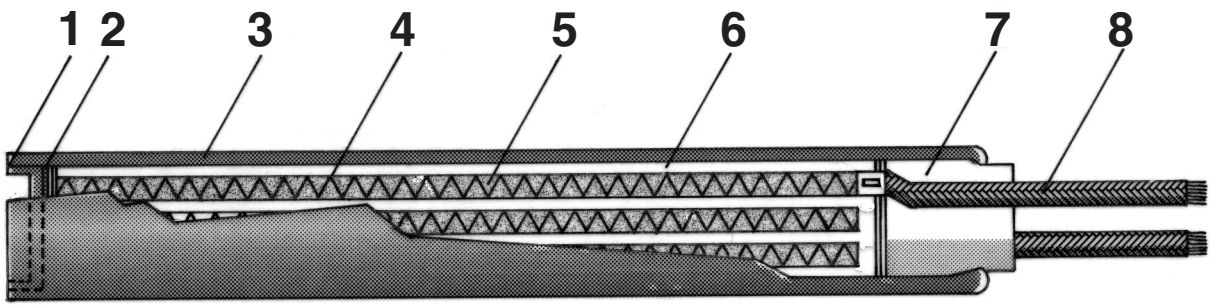
Compressor Crankcase Heating, Copiers, Dies, Food Processing, Glue Pots, Heat Sealing, Hot Melt Adhesive, Labeling, Medical Equipment, Packaging, Photographic Processing, Plastic Molding, Platens, Wax Pots.

Features:

- Hotwatt Precision Cartridge Heaters provided localized heat to restricted work areas requiring close thermal control. Dies, platens, and a variety of other types of processing equipment are efficiently heated. Closely controlled work temperatures up to 1250°F are obtained by a combination of heater location and proper wattage output.
- Basic designs are readily adaptable to a wide variety of special requirements, sizes, or ratings.
- Maximum surface temperatures up to 1250° F (677°C).
- Designations are etched on the sheath to preserve accurate shape.
- Heating elements arranged just beneath outside surface for maximum heat transfer, minimum core temperature and faster heating.
- Made in U.S.A.
- Where specified, units can be supplied liquid tight.
- Long, trouble free service.

Construction:

1. Heliarc welded end seal.
2. Mica.
3. Series 300 stainless steel sheath of precision dimensions and tolerances for intimate, stable, non-oxidizing contact with cavities machined for them.
4. Element wire situated in close proximity to outside surface for maximum heat transfer and minimum internal temperature while preserving good dielectric qualities.
5. Magnesium oxide packing.
6. Ceramic element support.
7. Ceramic cap.
8. Teflon insulated leads: ¼" diameter
   Fiberglass leads: 5/16" – ¾" diameter
   Post terminals: 1 5/16" – 2⅜"



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Cartridge Heaters

Low to Medium Watt Density

▼ Manfactured Items ▼

Round

Diameter: ⅛" (.124/.120) | 5/32" (.155/.152) | 3/16" (.186/.183)
Maximum Amperage: **2** Not UL/CSA | **2** Not UL/CSA | **3.5**

Sheath Length	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts
1"	SC12-1	10	15	SC15-1	10	15	SC18-1	10	20
1½"	SC12-1.5	10	25	SC15-1.5	10	25	SC18-1.5	10	32
2"	SC12-2	10	35	SC15-2	10	35	SC18-2	10	44
2½"	SC12-2.5	10	45	SC15-2.5	10	45	SC18-2.5	10	55
3"	SC12-3	10	55	SC15-3	10	55	SC18-3	10	70
3½"	SC12-3.5	10	65	SC15-3.5	10	65	SC18-3.5	10	80
4"	SC12-4	10	75	SC15-4	10	75	SC18-4	10	95
4½"	SC12-4.5	10	85	SC15-4.5	10	85	SC18-4.5	10	105
5"	SC12-5	10	95	SC15-5	10	95	SC18-5	10	120
5½"	SC12-5.5	10	105	SC15-5.5	10	105	SC18-5.5	10	132
6"	SC12-6	10	115	SC15-6	10	115	SC18-6	10	145
6½"	SC12-6.5	10	125	SC15-6.5	10	125	SC18-6.5	10	157
7"	SC12-7	10	135	SC15-7	10	135	SC18-7	10	170
7½"	SC12-7.5	10	145	SC15-7.5	10	145	SC18-7.5	10	182
8"	SC12-8	10	155	SC15-8	10	155	SC18-8	10	195
8½"	SC12-8.5	10	165	SC15-8.5	10	165	SC18-8.5	10	207
9"	SC12-9	10	175	SC15-9	10	175	SC18-9	10	220
9½"	SC12-9.5	10	185	SC15-9.5	10	185	SC18-9.5	10	232
10"	SC12-10	10	195	SC15-10	10	195	SC18-10	10	245
10½"	SC12-10.5	10	205	SC15-10.5	10	205	SC18-10.5	10	257
11"	SC12-11	10	215	SC15-11	10	215	SC18-11	10	270
11½"	SC12-11.5	10	225	SC15-11.5	10	225	SC18-11.5	10	282
12"	SC12-12	10	235	SC15-12	10	235	SC18-12	10	295

For longer lengths, compute wattage at: **10 watts per linear ½"** | **10 watts per linear ½"** | **12 watts per linear ½"**

• Lengths longer than those listed may be ordered.

Wattage

Minimum Wattage

The following table should be used to determine the allowable voltage for low wattage miniature elemnets:

Size:	⅛" Dia.-		5/32" Dia.		3/16" Dia.			
Length	30v	60v	120v	230v	30v	60v	120v	230v
1"	.6w	2.5w	10w	NA	.8w	3w	12w	NA
1½"	.6w	2.5w	10w	NA	.5w	2w	8w	30w
2"	.5w	2w	8w	27w	.4w	1.5w	6w	22w

NA-Not Available

▼ IN STOCK ITEMS ▼

Diameter: ⅛"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
1"	SC12-1	10	120	35	.01
1"	SC12-1	15	120	50	.01
1½"	SC12-1.5	20	120	40	.03
1½"	SC12-1.5	25	120	50	.03
2"	SC12-2	35	120	50	.06

Diameter: 5/32"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
1"	SC15-1	10	120	25	.05
1½"	SC15-1.5	20	120	35	.07
2"	SC15-2	35	120	40	.09

Diameter: 3/16"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
1½"	SC18-1.5	30	120	40	.07
2"	SC18-2	35	120	35	.09
3"	SC18-3	65	120	40	.11
4"	SC18-4	90	120	40	.13
4"	SC18-4	60	120	25	.13
4"	SC18-4	100	120	45	.13

Cartridge Heaters

Low to Medium Watt Density

CARTRIDGE

▼ Manfactured Items ▼

Diameter:	¼" (.249/.245)	5⁄16" (.311/.307)	⅜" (.374/.370)
Maximum Amperage:	**3.5**	**6**	**6**

Sheath Length	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts
1"	SC25-1	10	25	SC32-1	10	35	SC37-1	10	35
1½"	SC25-1.5	10	50	SC32-1.5	10	70	SC37-1.5	10	70
2"	SC25-2	10	75	SC32-2	10	105	SC37-2	10	105
2½"	SC25-2.5	10	100	SC32-2.5	10	140	SC37-2.5	10	140
3"	SC25-3	10	125	SC32-3	10	175	SC37-3	10	175
3½"	SC25-3.5	10	150	SC32-3.5	10	210	SC37-3.5	10	210
4"	SC25-4	10	175	SC32-4	10	245	SC37-4	10	245
4½"	SC25-4.5	10	200	SC32-4.5	10	285	SC37-4.5	10	285
5"	SC25-5	10	225	SC32-5	10	325	SC37-5	10	325
5½"	SC25-5.5	10	250	SC32-5.5	10	360	SC37-5.5	10	360
6"	SC25-6	10	275	SC32-6	10	395	SC37-6	10	395
6½"	SC25-6.5	10	300	SC32-6.5	10	430	SC37-6.5	10	430
7"	SC25-7	10	325	SC32-7	10	465	SC37-7	10	465
7½"	SC25-7.5	10	350	SC32-7.5	10	500	SC37-7.5	10	500
8"	SC25-8	10	375	SC32-8	10	535	SC37-8	10	535
8½"	SC25-8.5	10	400	SC32-8.5	10	570	SC37-8.5	10	570
9"	SC25-9	10	425	SC32-9	10	605	SC37-9	10	605
9½"	SC25-9.5	10	450	SC32-9.5	10	640	SC37-9.5	10	640
10"	SC25-10	10	475	SC32-10	10	675	SC37-10	10	675
10½"	SC25-10.5	10	500	SC32-10.5	10	710	SC37-10.5	10	710
11"	SC25-11	10	525	SC32-11	10	745	SC37-11	10	745
11½"	SC25-11.5	10	550	SC32-11.5	10	780	SC37-11.5	10	780
12"	SC25-12	10	575	SC32-12	10	815	SC37-12	10	815

For longer lengths, compute wattage at:	**25 watts per linear ½"**	**35 watts per linear ½"**	**35 watts per linear ½"**

• Lengths longer than those listed may be ordered.

▼ IN STOCK ITEMS ▼

Diameter: ¼"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
1"	SC25-1	20	120	35	.01
1¼"	SC25-1.25	20	120	25	.01
1½"	SC25-1.5	7	120	7	.02
1½"	SC25-1.5	12	120	12	.02
1½"	SC25-1.5	30	120	30	.02
1½"	SC25-1.5	30	240	30	.02
1½"	SC25-1.5	50	120	50	.02
1½"	SC25-1.5	50	240	50	.02
2"	SC25-2	12	120	9	.03
2"	SC25-2	50	120	35	.03
2"	SC25-2	50	240	35	.03
2¼"	SC25-2.25	20	120	12	.03
2¼"	SC25-2.25	75	240	50	.03
2½"	SC25-2.5	20	120	9	.04
2½"	SC25-2.5	65	120	35	.04
2½"	SC25-2.5	65	240	35	.04

Diameter: ¼" (continued)

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
3"	SC25-3	25	120	11	.05
3"	SC25-3	100	240	45	.05
3½"	SC25-3.5	25	120	9	.06
3½"	SC25-3.5	90	120	35	.06
3½"	SC25-3.5	90	240	35	.06
4"	SC25-4	25	120	10	.07
4"	SC25-4	110	120	40	.07
4"	SC25-4	110	240	40	.07
4½"	SC25-4.5	25	120	7	.08
4½"	SC25-4.5	110	120	30	.08
4½"	SC25-4.5	110	240	30	.08
7"	SC25-7	40	120	8	.12
7"	SC25-7	150	120	29	.12
7"	SC25-7	150	240	29	.12

Cartridge Heaters

Low to Medium Watt Density

▼ IN STOCK ITEMS (Continued) ▼

Diameter: ⅜"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
1"	SC37-1	30	120	40	.04
1½"	SC37-1.5	10	120	5	.07
1½"	SC37-1.5	30	120	20	.07
1½"	SC37-1.5	30	240	20	.07
1½"	SC37-1.5	50	120	40	.07
1½"	SC37-1.5	50	240	40	.07
2"	SC37-2	15	120	9	.09
2"	SC37-2	70	120	35	.09
2"	SC37-2	70	240	35	.09
2"	SC37-2	100	120	50	.09
2½"	SC37-2.5	25	120	10	.12
2½"	SC37-2.5	100	120	40	.12
2½"	SC37-2.5	100	240	40	.12
3"	SC37-3	20	120	6	.15
3"	SC37-3	75	120	25	.15
3"	SC37-3	75	240	25	.15
3½"	SC37-3.5	40	120	12	.18
3½"	SC37-3.5	150	120	50	.18
3½"	SC37-3.5	150	240	50	.18
4"	SC37-4	20	120	5	.20
4"	SC37-4	55	120	12	.20
4"	SC37-4	75	240	20	.20
4"	SC37-4	220	120	50	.20
4"	SC37-4	220	240	50	.20
4½"	SC37-4.5	60	120	12	.23
4½"	SC37-4.5	250	120	50	.23
4½"	SC37-4.5	250	240	50	.23
5"	SC37-5	70	120	12	.27
5"	SC37-5	280	120	50	.27
5"	SC37-5	280	240	50	.27
5½"	SC37-5.5	25	120	4	.31
5½"	SC37-5.5	100	240	15	.31
6"	SC37-6	90	120	12	.36
6"	SC37-6	350	120	50	.36
6"	SC37-6	350	240	50	.36
8"	SC37-8	125	120	14	.16
8"	SC37-8	500	120	58	.16
8"	SC37-8	500	240	58	.18
9"	SC37-9	140	120	14	.18
9"	SC37-9	550	120	55	.18
9"	SC37-9	550	240	55	.18
10"	SC37-10	100	120	9	.20
10"	SC37-10	400	120	36	.20
10"	SC37-10	400	240	36	.20
12"	SC37-12	150	120	11	.22
12"	SC37-12	600	120	45	.22
12"	SC37-12	600	240	45	.22

Cartridge Heaters

Low to Medium Watt Density

CARTRIDGE

▼ Manfactured Items ▼

Diameter:	½" (.499/.494)			⅝" (.624/.619)			¾" (.749/.741)		
Maximum Amperage:	10			10			15		
Sheath Length	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts
1"	SC50-1	10	55	SC62-1	10	60			
1½"	SC50-1.5	10	100	SC62-1.5	10	120	SC75-1.5	40	140
2"	SC50-2	10	145	SC62-2	10	180	SC75-2	40	210
2½"	SC50-2.5	10	190	SC62-2.5	10	240	SC75-2.5	40	280
3"	SC50-3	10	235	SC62-3	10	300	SC75-3	40	350
3½"	SC50-3.5	10	280	SC62-3.5	10	360	SC75-3.5	40	420
4"	SC50-4	10	325	SC62-4	10	420	SC75-4	40	490
4½"	SC50-4.5	10	370	SC62-4.5	10	480	SC75-4.5	40	560
5"	SC50-5	10	415	SC62-5	10	540	SC75-5	40	630
5½"	SC50-5.5	10	460	SC62-5.5	10	600	SC75-5.5	40	700
6"	SC50-6	10	505	SC62-6	10	660	SC75-6	40	770
6½"	SC50-6.5	10	550	SC62-6.5	10	720	SC75-6.5	40	840
7"	SC50-7	10	595	SC62-7	10	780	SC75-7	40	910
7½"	SC50-7.5	10	640	SC62-7.5	10	840	SC75-7.5	40	980
8"	SC50-8	10	685	SC62-8	10	900	SC75-8	40	1050
8½"	SC50-8.5	10	730	SC62-8.5	10	960	SC75-8.5	40	1120
9"	SC50-9	10	775	SC62-9	10	1020	SC75-9	40	1190
9½"	SC50-9.5	10	820	SC62-9.5	10	1080	SC75-9.5	40	1260
10"	SC50-10	10	865	SC62-10	10	1140	SC75-10	40	1330
10½"	SC50-10.5	10	910	SC62-10.5	10	1200	SC75-10.5	40	1400
11"	SC50-11	10	955	SC62-11	10	1260	SC75-11	40	1470
11½"	SC50-11.5	10	1000	SC62-11.5	10	1320	SC75-11.5	40	1540
12"	SC50-12	10	1045	SC62-12	10	1380	SC75-12	40	1610

For longer lengths, compute wattage at: **45 watts per linear ½"** **60 watts per linear ½"** **70 watts per linear ½"**

• Lengths longer than those listed may be ordered.

▼ IN STOCK ITEMS ▼

Diameter: ½"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
1½"	SC50-1.5	18	120	12	.07
1½"	SC50-1.5	75	120	50	.07
1½"	SC50-1.5	75	240	50	.07
1½"	SC50-1.5	90	120	60	.07
2"	SC50-2	30	120	12	.11
2"	SC50-2	120	120	50	.11
2"	SC50-2	120	240	50	.11
2½"	SC50-2.5	40	120	12	.14
2½"	SC50-2.5	80	120	25	.14
2½"	SC50-2.5	150	120	50	.14
2½"	SC50-2.5	150	240	50	.14
3"	SC50-3	50	120	12	.17
3"	SC50-3	200	120	50	.17
3"	SC50-3	200	240	50	.17
4"	SC50-4	70	120	12	.23

Diameter: ½" (continued)

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
4"	SC50-4	275	120	50	.23
4"	SC50-4	275	240	50	.23
5"	SC50-5	85	120	12	.27
5"	SC50-5	350	120	50	.27
5"	SC50-5	350	240	50	.27
6"	SC50-6	110	120	12	.33
6"	SC50-6	425	120	50	.33
6"	SC50-6	425	240	50	.33
7"	SC50-7	135	120	14	.48
7"	SC50-7	550	120	55	.48
7"	SC50-7	550	240	55	.48
8"	SC50-8	160	120	14	.53
8"	SC50-8	650	120	55	.53
8"	SC50-8	650	240	55	.53
10"	SC50-10	210	120	14	.62

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Cartridge Heaters

Low to Medium Watt Density

▼ IN STOCK ITEMS (Continued) ▼

Diameter: ½" (continued)

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
10"	SC50-10	850	120	55	.62
10"	SC50-10	850	240	55	.62
12"	SC50-12	250	120	14	.69
12"	SC50-12	1000	120	55	.69
12"	SC50-12	1000	240	55	.69
14"	SC50-14	250	120	12	.48
14"	SC50-14	1000	240	48	.48
16"	SC50-16	250	120	10	.52
16"	SC50-16	1000	240	41	.52
18"	SC50-18	300	120	11	.57
18"	SC50-18	1200	240	44	.57
24"	SC50-24	450	120	12	1.34
24"	SC50-24	1800	240	49	1.34

Diameter: ⅝"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
2½"	SC62-2.5	20	120	5	.15
2½"	SC62-2.5	50	120	12	.15
2½"	SC62-2.5	75	240	20	.15
2½"	SC62-2.5	200	120	50	.15
2½"	SC62-2.5	200	240	50	.15
3"	SC62-3	65	120	12	.21
3"	SC62-3	250	120	50	.21
3"	SC62-3	250	240	50	.21
3½"	SC62-3.5	75	120	12	.25
3½"	SC62-3.5	300	120	50	.25
3½"	SC62-3.5	300	240	50	.25
3½"	SC62-3.5	350	120	60	.25
4"	SC62-4	90	120	12	.29
4"	SC62-4	350	120	50	.29
4"	SC62-4	350	240	50	.29
5"	SC62-5	115	120	12	.35
5"	SC62-5	450	120	50	.35
5"	SC62-5	450	240	50	.35
6"	SC62-6	100	120	7	.44
6"	SC62-6	135	120	123	.44
6"	SC62-6	350	120	30	.44
6"	SC62-6	400	240	30	.44
6"	SC62-6	540	120	50	.44
6"	SC62-6	540	240	50	.44
7"	SC62-7	160	120	12	.57
7"	SC62-7	635	120	50	.57
7"	SC62-7	635	240	50	.57
8"	SC62-8	190	120	12	.55
8"	SC62-8	750	120	57	.55
8"	SC62-8	750	240	57	.55
9"	SC62-9	235	120	14	.63

Diameter: ⅝" (continued)

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
9"	SC62-9	950	120	55	.63
9"	SC62-9	950	240	55	.63
10"	SC62-10	250	120	53	.68
10"	SC62-10	1000	120	53	.68
10"	SC62-10	1000	240	53	.68
12"	SC62-12	300	120	12	.75
12"	SC62-12	1200	240	53	.75
18"	SC62-18	375	120	11	1.03
18"	SC62-18	1500	240	44	1.03
20"	SC62-20	375	120	10	1.25
20"	SC62-20	1500	240	40	1.25
24"	SC62-24	500	120	11	1.47
24"	SC62-24	625	120	14	1.47
24"	SC62-24	2000	240	44	1.47
24"	SC62-24	2500	240	65	1.47

Diameter: ¾"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
2½"	SC75-2.5	60	120	12	.21
2½"	SC75-2.5	230	120	50	.21
2½"	SC75-2.5	230	240	50	.21
3½"	SC75-3.5	90	120	12	.29
3½"	SC75-3.5	350	120	50	.29
3½"	SC75-3.5	350	240	50	.29
3½"	SC75-3.5	350	120	60	.25
5"	SC75-5	125	120	12	.43
5"	SC75-5	500	120	50	.43
5"	SC75-5	500	240	50	.43
6"	SC75-6	160	120	12	.49
6"	SC75-6	650	120	50	.49
6"	SC75-6	650	240	50	.49
7"	SC75-7	190	120	12	.57
7"	SC75-7	760	120	50	.57
7"	SC75-7	760	240	50	.57
8"	SC75-8	220	120	12	.70
8"	SC75-8	750	120	40	.70
8"	SC75-8	885	120	50	.70
8"	SC75-8	885	240	50	.70
10"	SC75-10	275	120	11	.80
10"	SC75-10	1100	240	45	.80
12"	SC75-12	325	120	11	.92
12"	SC75-12	1300	240	45	.92
14"	SC75-14	315	120	10	1.03
14"	SC75-14	625	120	20	1.03
14"	SC75-14	1250	240	40	1.03
16"	SC75-16	450	120	12	1.14
16"	SC75-16	1800	240	49	1.14

Cartridge Heaters

Low to Medium Watt Density

▼ IN STOCK ITEMS (Continued) ▼

Diameter: ¾" (continued)

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
18"	SC75-18	500	120	12	1.25
18"	SC75-18	2000	240	49	1.25
20"	SC75-20	565	120	12	1.40
20"	SC75-20	2250	240	49	1.40
24"	SC75-24	595	120	11	1.50
24"	SC75-24	690	120	13	1.50
24"	SC75-24	2375	240	43	1.50
24"	SC75-24	2750	240	50	1.50
36"	SC75-36	625	120	8	2.05
36"	SC75-36	2500	240	36	2.05

▼ Manfactured Items ▼

Diameter:	15⁄16" (.936/.928)			1" (.999/.991)			1¼" (1.249/1.241)		
Maximum Amperage:	**25**			**25**			**30**		
Sheath Length	**Cat. No.**	**Min. Watts**	**Max. Watts**	**Cat. No.**	**Min. Watts**	**Max. Watts**	**Cat. No.**	**Min. Watts**	**Max. Watts**
2"	SC93-2	50	280	SC1.0-2	50	280	SC1.2-2	100	350
2½"	SC93-2.5	50	375	SC1.0-2.5	50	375	SC1.2-2.5	100	470
3"	SC93-3	50	470	SC1.0-3	50	470	SC1.2-3	100	590
3½"	SC93-3.5	50	565	SC1.0-3.5	50	565	SC1.2-3.5	100	710
4"	SC93-4	50	660	SC1.0-4	50	660	SC1.2-4	100	830
4½"	SC93-4.5	50	755	SC1.0-4.5	50	755	SC1.2-4.5	100	950
5"	SC93-5	50	850	SC1.0-5	50	850	SC1.2-5	100	1070
5½"	SC93-5.5	50	945	SC1.0-5.5	50	945	SC1.2-5.5	100	1190
6"	SC93-6	50	1040	SC1.0-6	50	1040	SC1.2-6	100	1310
6½"	SC93-6.5	50	1135	SC1.0-6.5	50	1135	SC1.2-6.5	100	1430
7"	SC93-7	50	1230	SC1.0-7	50	1230	SC1.2-7	100	1550
7½"	SC93-7.5	50	1325	SC1.0-7.5	50	1325	SC1.2-7.5	100	1670
8"	SC93-8	50	1420	SC1.0-8	50	1420	SC1.2-8	100	1790
8½"	SC93-8.5	50	1515	SC1.0-8.5	50	1515	SC1.2-8.5	100	1910
9"	SC93-9	50	1610	SC1.0-9	50	1610	SC1.2-9	100	2030
9½"	SC93-9.5	50	1705	SC1.0-9.5	50	1705	SC1.2-9.5	100	2150
10"	SC93-10	50	1800	SC1.0-10	50	1800	SC1.2-10	100	2270
10½"	SC93-10.5	50	1895	SC1.0-10.5	50	1895	SC1.2-10.5	100	2390
11"	SC93-11	50	1990	SC1.0-11	50	1990	SC1.2-11	100	2510
11½"	SC93-11.5	50	2085	SC1.0-11.5	50	2085	SC1.2-11.5	100	2630
12"	SC93-12	50	2180	SC1.0-12	50	2180	SC1.2-12	100	2750
For longer lengths, compute wattage at:	**95 watts per linear ½"**			**95 watts per linear ½"**			**120 watts per linear ½"**		

Phone: 978-777-0070 ■ Fax: 978-774-2409

Cartridge Heaters

Low to Medium Watt Density

▼ Manfactured Items ▼

Diameter:	**1.90**" (1.890/1.910)	2⅜" (2.365/2.385)
Maximum Amperage:	**40**	**40**

Sheath Length	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts
6"	SC1.9-6	500	1400			
7"	SC1.9-7	500	1700			
8"	SC1.9-8	500	1960	SC2.3-8	500	2300
9"	SC1.9-9	500	2240	SC2.3-9	500	2650
10"	SC1.9-10	500	2500	SC2.3-10	500	3000
12"	SC1.9-12	500	3100	SC2.3-12	500	3630
14"	SC1.9-14	500	3650	SC2.3-14	500	4300
16"	SC1.9-16	500	4200	SC2.3-16	500	5000
18"	SC1.9-18	500	4750	SC2.3-18	500	5600
20"	SC1.9-20	500	5300	SC2.3-20	500	6270
22"	SC1.9-22	500	5900	SC2.3-22	500	6930
24"	SC1.9-24	500	6450	SC2.3-24	500	7600
26"	SC1.9-26	500	7000	SC2.3-26	500	8250
28"	SC1.9-28	500	7550	SC2.3-28	500	8900
30"	SC1.9-30	500	8100	SC2.3-30	500	9570
32"	SC1.9-32	500	8700	SC2.3-32	500	10250
34"	SC1.9-34	500	9250	SC2.3-34	500	10900
36"	SC1.9-36	500	9800	SC2.3-36	500	11550
38"	SC1.9-38	500	10350	SC2.3-38	500	12200
40"	SC1.9-40	500	10900	SC2.3-40	500	12870
42"	SC1.9-42	500	11500	SC2.3-42	500	13530
44"	SC1.9-44	500	12000	SC2.3-44	500	14200
46"	SC1.9-46	500	12600	SC2.3-46	500	14850
48"	SC1.9-48	500	13200	SC2.3-48	500	15500

For longer lengths, compute wattage at:	**280 watts per linear 1"**	**330 watts per linear 1"**

• Lengths longer than those listed may be ordered.

Wattage

The maximum wattages listed are computed at 60 watts per square inch of heated surface. With proper fit in a heat sink, long life can be expected at this watt density. Consult factory for higher watt density applications. Lower watt density will result in longer life. Any wattage within standard limits may be ordered without affecting price.

Voltage

Standard voltages are either 120V or 240V (subject to limits above). Lower voltages are available.

Termination

All units up to 15⁄16" diameter, within published amperage limits, are manufactured with 6" (type SF1) leads, longer length leads are available. Standard insulation on ¼" units is Teflon (200°C); Fiberglass (250°C) is standard on units 5⁄16" in diameter and larger. All units 15⁄16" and larger are manufactured with post terminals (type SF-3). Optional Type SF1 leads are available.
Stock units supplied with 12" leads.

Tolerances

Wattage tolerances are held to +5%, -10% at rated voltage. Diameter is always .001" less, but not more than .009" less, than the nominal (fractional) heater diameter except for 1.90" and 2⅜" diameters. This sizing is maintained so that all units are a slide fit into a standard reamed hole of the size ordered. Thermal action will expand the unit to a snug fit for best heat conduction. If close hole tolerances are not maintained, operating life may be drastically reduced. See specific heater size for exact tolerances. Length tolerances are ±2% with a 1⁄16" minimum. Consult factory for closer tolerances.

How to Order

After determining the wattage required and the line voltage available, determine the physical space available for heaters and the number of heaters required.
Review Stock lists for In-Stock Items.
Review Special Features, see page 22-27
Specify: catalog number, wattage, voltage, lead type, and special features, if required.
Example: SC62-8.5/600W240V/SF1-16/SF14-10

Cartridge Heaters

Superwatt® High Watt Density

U.L. Recongnized - E56973
C.S.A. Certified - LR - 016386-0-000



Applications:

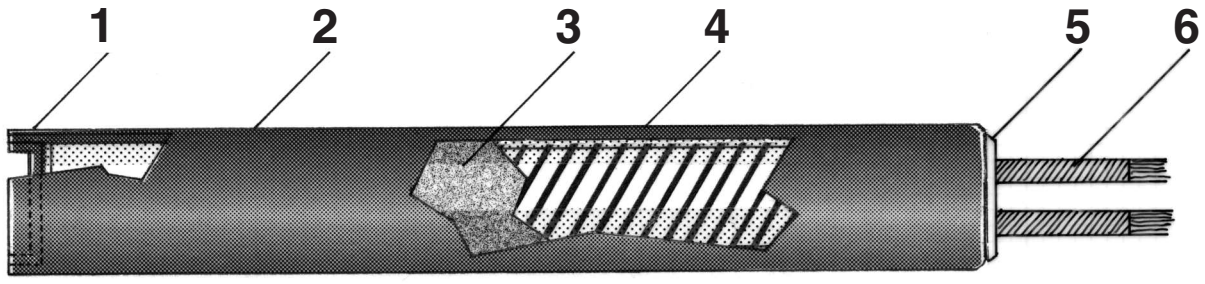
Dies, Heat Sealing, Hot Melt Adhesive, Plastic Molding, Platens, Shoe Machinery.

Features:

- **Elements are designed for maximum:** Watt density, temperature, heat transfer and heater life.
- The useful life of a Cartridge heating element is determined by how quickly the heat generated in the resistance wire can be disappated to the outside sheath. With low and moderate watt density elements, such as Hotwatt's standard line, the conventional method of inserting helical coils in formed ceramics is an entirely satisfactory method of construction because the wire temperature relative to sheath temperature, even though considerably higher, is still well within safe long-life operating temperatures.
- The Superwatt® cartridge heater accelerates the transfer of heat from the resistance wire to the sheath. This is accomplished by relocating the wire so that it is closer to the sheath; and swaging the outside diameter of the heater, thereby compressing the magnesium oxide filler so that it becomes an improved conductor of heat from the wire while maintaining its dielectric properties. (See diagram this page). By improving the heat transfer rate, it is possible to manufacture elements of higher densities because the differential between the wire temperature and the sheath temperature has been minimized.
- Long, trouble free service.
- Made in U.S.A.

Construction:

1. Heliarc welded end seal.
2. Series 300 stainless steel sheath of precision dimensions and tolerances for intimate, stable, non-oxidizing contact with cavities machined for them.
3. Pure magnesium oxide compressed to an optimum density for best heat transfer and electrical insulation at elevated temperatures.
4. Element wire situated in close proximity to outside surface for maximum heat transfer and minimum internal temperature while preserving good dielectric qualities.
5. Ceramic cap.
6. Fiberglass insulated leads.



Phone: 978-777-0070 ■ Fax: 978-774-2409

Cartridge Heaters

Superwatt® High Watt Density

▼ Manfactured Items ▼

Diameter: ⅛" (.124/.120)
Maximum Amperage: **3.5** Not UL/CSA

Sheath Length	Cat. No.	Min. Watts	Max. Volts
1"	HS12-1	CONSULT FACTORY	
1½"	HS12-1.5	CONSULT FACTORY	
2"	HS12-2	CONSULT FACTORY	
2½"	HS12-2.5	50	120
3"	HS12-3	60	120
3½"	HS12-3.5	70	120
4"	HS12-4	80	120

▼ Manfactured Items ▼

Diameter: ¼" (.249/.245) ⅜" (.374/.370) ½" (.499/.495)
Maximum Amperage: **4** **6** **10**

Sheath Length	Cat. No.	Min. Watts	Max. Volts	Cat. No.	Min. Watts	Max. Volts	Cat. No.	Min. Watts	Max. Volts
1"	HS25-1	70	120	HS37-1	70	120			
1½"	HS25-1.5	70	120	HS37-1.5	80	120	HS50-1.5	110	240
2"	HS25-2	100	120	HS37-2	120	240	HS50-2	160	240
2½"	HS25-2.5	130	120	HS37-2.5	160	240	HS50-2.5	210	240
3"	HS25-3	150	240	HS37-3	200	240	HS50-3	270	240
3½"	HS25-3.5	180	240	HS37-3.5	240	240	HS50-3.5	330	240
4"	HS25-4	210	240	HS37-4	280	240	HS50-4	380	240
4½"	HS25-4.5	240	240	HS37-4.5	320	240	HS50-4.5	430	240
5"	HS25-5	260	240	HS37-5	360	240	HS50-5	490	240
5½"	HS25-5.5	290	240	HS37-5.5	400	240	HS50-5.5	550	240
6"	HS25-6	320	240	HS37-6	440	240	HS50-6	600	240
6½"	HS25-6.5	350	240	HS37-6.5	480	240	HS50-6.5	650	240
7"	HS25-7	380	240	HS37-7	520	240	HS50-7	700	240
7½"	HS25-7.5	410	240	HS37-7.5	560	240	HS50-7.5	750	240
8"	HS25-8	440	240	HS37-8	600	240	HS50-8	800	240
8½"	HS25-8.5	470	240	HS37-8.5	640	240	HS50-8.5	850	240
9"	HS25-9	500	240	HS37-9	680	240	HS50-9	900	240
9½"	HS25-9.5	530	240	HS37-9.5	720	240	HS50-9.5	950	240
10"	HS25-10	560	240	HS37-10	760	240	HS50-10	1000	240
10½"	HS25-10.5	590	240	HS37-10.5	800	240	HS50-10.5	1050	240
11"	HS25-11	620	240	HS37-11	840	240	HS50-11	1100	240
11½"	HS25-11.5	650	240	HS37-11.5	880	240	HS50-11.5	1150	240
12"	HS25-12	680	240	HS37-12	920	240	HS50-12	1200	240

▼ IN STOCK ITEMS ▼

Diameter: ¼"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
1"	HS25-1	100	120	250	.02
1¼"	HS25-1.25	100	120	165	.02
1½"	HS25-1.5	70	120	85	.02
1½"	HS25-1.5	100	120	125	.02
1½"	HS25-1.5	120	120	150	.02
2"	HS25-2	100	120	85	.03
2"	HS25-2	150	120	125	.03
2"	HS25-2	200	240	173	.03
2½"	HS25-2.5	135	120	85	.03
2½"	HS25-2.5	185	120	115	.03

Diameter: ¼" (continued)

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
2½"	HS25-2.5	250	120	159	.03
2½"	HS25-2.5	250	240	159	.03
3"	HS25-3	75	120	38	.04
3"	HS25-3	170	120	90	.04
3"	HS25-3	220	120	115	.04
3"	HS25-3	300	120	156	.04
3"	HS25-3	300	240	156	.04
3½"	HS25-3.5	50	120	21	.04
3½"	HS25-3.5	65	120	27	.04
3½"	HS25-3.5	200	120	85	.04

Cartridge Heaters

Superwatt® High Watt Density

CARTRIDGE

▼ IN STOCK ITEMS (Continued) ▼

Diameter: ¼" (continued)

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
3½"	HS25-3.5	200	240	85	.04
3½"	HS25-3.5	260	120	110	.04
3½"	HS25-3.5	260	240	110	.04
4"	HS25-4		120	21	.04
4"	HS25-4	75	120	27	.04
4"	HS25-4	100	120	27	.04
4"	HS25-4	235	120	85	.04
4"	HS25-4	235	240	85	.04
4"	HS25-4	300	120	110	.04
4"	HS25-4	300	240	110	.04
4"	HS25-4	400	120	150	.04
4"	HS25-4	400	240	150	.04
4½"	HS25-4.5	70	120	21	.05
4½"	HS25-4.5	90	120	27	.05
4½"	HS25-4.5	270	120	85	.05
4½"	HS25-4.5	270	240	85	.05
4½"	HS25-4.5	350	120	110	.05
4½"	HS25-4.5	350	240	110	.05
5"	HS25-5	75	120	21	.06
5"	HS25-5	100	120	28	.06
5"	HS25-5	305	120	85	.06
5"	HS25-5	305	240	85	.06
5"	HS25-5	400	120	115	.06
5"	HS25-5	400	240	115	.06
6"	HS25-6	100	120	23	.06
6"	HS25-6	400	120	94	.06
6"	HS25-6	400	240	94	.06
7"	HS25-7	90	120	18	.12
7"	HS25-7	300	120	69	.12
7"	HS25-7	300	240	69	.12

Diameter: ⅜"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
1"	HS37-1	100	120	165	.04
1¼"	HS37-1.25	100	120	110	.04
1¼"	HS37-1.25	150	120	165	.04
1½"	HS37-1.5	25	120	22	.05
1½"	HS37-1.5	50	120	26	.05
1½"	HS37-1.5	100	120	90	.05
1½"	HS37-1.5	100	240	90	.05
1½"	HS37-1.5	150	120	125	.05
1½"	HS37-1.5	200	120	105	.05
1½"	HS37-1.5	200	240	105	.05

Diameter: ⅜" (continued)

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
2"	HS37-2	40	120	21	.06
2"	HS37-2	50	120	27	.06
2"	HS37-2	60	120	34	.06
2"	HS37-2	150	120	85	.06
2"	HS37-2	150	240	85	.06
2"	HS37-2	200	120	110	.06
2"	HS37-2	200	240	110	.06
2"	HS37-2	250	120	135	.06
2"	HS37-2	250	240	135	.06
2½"	HS37-2.5	50	120	21	.07
2½"	HS37-2.5	75	120	31	.07
2½"	HS37-2.5	200	120	85	.07
2½"	HS37-2.5	200	240	85	.07
2½"	HS37-2.5	300	120	125	.07
2½"	HS37-2.5	300	240	125	.07
3"	HS37-3	60	120	21	.08
3"	HS37-3	100	120	25	.08
3"	HS37-3	250	120	85	.08
3"	HS37-3	250	240	85	.08
3"	HS37-3	400	120	135	.08
3"	HS37-3	400	240	135	.08
3½"	HS37-3.5	75	120	21	.09
3½"	HS37-3.5	300	120	85	.09
3½"	HS37-3.5	450	120	130	.18
3½"	HS37-3.5	300	240	85	.09
4"	HS37-4	90	120	21	.10
4"	HS37-4	125	120	30	.10
4"	HS37-4	350	120	85	.10
4"	HS37-4	350	240	85	.10
4"	HS37-4	500	120	120	.10
4"	HS37-4	500	240	120	.10
5"	HS37-5	125	120	23	.11
5"	HS37-5	500	240	95	.11
6"	HS37-6	150	120	22	.13
6"	HS37-6	600	120	90	.13
6"	HS37-6	600	240	90	.13
9½"	HS37-9.5	250	120	24	.19
9½"	HS37-9.5	1000	240	96	.19
10"	HS37-10	250	120	22	.20
10"	HS37-10	1000	240	90	.20
12"	HS37-12	250	120	19	.22
12"	HS37-12	1000	240	79	.22

• Lengths longer than those listed may be ordered.

Phone: 978-777-0070 ■ Fax: 978-774-2409

Cartridge Heaters

Superwatt® High Watt Density

▼ IN STOCK ITEMS (Continued) ▼

Diameter: ½"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
1½"	HS50-1.5	35	120	21	.07
1½"	HS50-1.5	135	120	85	.07
1½"	HS50-1.5	135	240	85	.07
1½"	HS50-1.5	335	120	210	.07
2"	HS50-2	50	120	21	.08
2"	HS50-2	200	120	85	.08
2"	HS50-2	200	240	85	.08
2"	HS50-2	400	120	165	.08
2½"	HS50-2.5	70	120	21	.09
2½"	HS50-2.5	120	120	37	.09
2½"	HS50-2.5	270	120	85	.09
2½"	HS50-2.5	270	240	85	.09
2½"	HS50-2.5	470	120	150	.09
2½"	HS50-2.5	470	240	150	.09
3"	HS50-3	85	120	21	.10
3"	HS50-3	135	120	34	.10
3"	HS50-3	335	120	85	.10
3"	HS50-3	335	240	85	.10
3"	HS50-3	535	120	135	.10

Diameter: ½" (continued)

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
3"	HS50-3	535	240	135	.10
4"	HS50-4	120	120	21	.11
4"	HS50-4	470	120	85	.11
4"	HS50-4	470	240	85	.11
5"	HS50-5	125	120	17	.13
5"	HS50-5	500	120	70	.13
5"	HS50-5	500	240	70	.13
6"	HS50-6	185	120	21	.15
6"	HS50-6	735	120	85	.15
6"	HS50-6	735	240	85	.15
8"	HS50-8	250	120	21	.17
8"	HS50-8	1000	120	85	.17
8"	HS50-8	1000	240	85	.17
10"	HS50-10	300	120	20	.22
10"	HS50-10	1200	240	80	.22
12"	HS50-12	500	120	28	.40
12"	HS50-12	2000	240	112	.40
14"	HS50-14	575	120	27	.48
14"	HS50-14	2300	240	110	.48

▼ Manfactured Items ▼

Diameter:	⅝" (.624/.620)			¾" (.749/.745)			1" (.999/.993)		
Maximum Amperage:	20			28			30		
Sheath Length	Cat. No.	Min. Watts	Max. Volts	Cat. No.	Min. Watts	Max. Volts	Cat. No.	Min. Watts	Max. Volts
1½"	HS62-1.5	130	240						
2″	HS62-2	200	240						
2½"	HS62-2.5	270	240	HS75-2.5	330	240			
3"	HS62-3	340	240	HS75-3	410	240	HS1.0-3	475	240
3½"	HS62-3.5	410	240	HS75-3.5	495	240	HS1.0-3.5	570	240
4"	HS62-4	480	240	HS75-4	575	240	HS1.0-4	665	240
4½"	HS62-4.5	550	240	HS75-4.5	660	240	HS1.0-4.5	760	240
5″	HS62-5	620	240	HS75-5	740	240	HS1.0-5	855	240
5½"	HS62-5.5	690	240	HS75-5.5	825	240	HS1.0-5.5	950	240
6″	HS62-6	760	240	HS75-6	910	240	HS1.0-6	1045	240
6½"	HS62-6.5	830	240	HS75-6.5	980	240	HS1.0-6.5	1140	240
7″	HS62-7	900	240	HS75-7	1075	240	HS1.0-7	1235	240
7½"	HS62-7.5	970	240	HS75-7.5	1150	240	HS1.0-7.5	1330	240
8″	HS62-8	1040	240	HS75-8	1240	240	HS1.0-8	1425	240
8½"	HS62-8.5	1110	240	HS75-8.5	1325	240	HS1.0-8.5	1520	240
9"	HS62-9	1180	240	HS75-9	1400	240	HS1.0-9	1615	240
9½"	HS62-9.5	1250	240	HS75-9.5	1475	240	HS1.0-9.5	1710	240
10″	HS62-10	1320	240	HS75-10	1560	240	HS1.0-10	1805	240
10½"	HS62-10.5	1390	240	HS75-10.5	1645	240	HS1.0-10.5	1900	240
11″	HS62-11	1460	240	HS75-11	1730	240	HS1.0-11	1995	240
11½"	HS62-11.5	1530	240	HS75-11.5	1820	240	HS1.0-11.5	2090	240
12″	HS62-12	1600	240	HS75-12	1890	240	HS1.0-12	2185	240
14"	HS62-14	1740	240	HS75-14	2050	240	HS1.0-14	2545	240
16″	HS62-16	1880	240	HS75-16	2210	240	HS1.0-16	2920	240
18″	HS62-18	2020	240	HS75-18	2370	240	HS1.0-18	3300	240
20″	HS62-20	2090	240	HS75-20	2450	240	HS1.0-20	3675	240

Cartridge Heaters

Superwatt® High Watt Density

CARTRIDGE

▼ IN STOCK ITEMS ▼

Diameter: 5/8"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
2"	HS62-2	65	120	21	.13
2"	HS62-2	250	120	85	.13
2"	HS62-2	250	240	85	.13
2½"	HS62-2.5	85	120	21	.15
2½"	HS62-2.5	335	120	85	.15
2½"	HS62-2.5	335	240	85	.15
3"	HS62-3	105	120	21	.17
3"	HS62-3	415	120	85	.17
3"	HS62-3	415	240	85	.17
4"	HS62-4	145	120	21	.20
4"	HS62-4	585	120	85	.20
4"	HS62-4	585	240	85	.20
6"	HS62-6	230	120	21	.30
6"	HS62-6	920	120	85	.30
6"	HS62-6	920	240	85	.30
8"	HS62-8	250	120	17	.40
8"	HS62-8	375	120	25	.40
8"	HS62-8	1000	240	70	.40
8"	HS62-8	1500	240	100	.40
10"	HS62-10	400	120	21	.70
10"	HS62-10	1600	240	85	.70
12"	HS62-12	435	120	20	.80
12"	HS62-12	1750	240	80	.80
14"	HS62-14	925	120	35	.79
14"	HS62-14	3700	240	140	.79
16"	HS62-16	625	120	21	.91
16"	HS62-16	1125	120	37	.91
16"	HS62-16	2500	240	82	.91
16"	HS62-16	4500	240	148	.91
18"	HS62-18	750	120	22	1.03
18"	HS62-18	3000	240	87	1.03
20"	HS62-20	875	120	23	1.25
20"	HS62-20	3500	240	92	1.25

Diameter: 3/4"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
6"	HS75-6	250	120	20	.44
6"	HS75-6	1000	240	80	.44
6"	HS75-6	1500	240	115	.44
8"	HS75-8	375	120	21	.58
8"	HS75-8	500	120	27	.58
8"	HS75-8	1500	240	85	.58
8"	HS75-8	2000	240	110	.58
10"	HS75-10	500	120	22	.85
10"	HS75-10	2000	240	90	.85
12"	HS75-12	550	120	20	1.00
12"	HS75-12	2200	240	80	1.00
14"	HS75-14	1125	120	35	1.03
14"	HS75-14	2500	240	79	1.03
14"	HS75-14	4500	240	142	1.03
16"	HS75-16	1125	120	32	1.14
16"	HS75-16	4700	240	129	1.14
18"	HS75-18	1250	120	30	1.25
18"	HS75-18	5000	240	122	1.25

Cartridge Heaters

Superwatt® High Watt Density

Obtaining maximum heat transfer and long life.

Fit

High watt density heaters require careful fit to insure optimum performance and long life. Hotwatt recommends that installation holes not be drilled and reamed over .002" or larger than the nominal hole size required. The heaters are sized so that they never exceed .005" less than the nominal diameter and always at least .001" under the nominal diameter for a slide fit. These close fits insure rapid heat transfer from the heater and also help keep the unit as cool as possible, which contributes to long life. See chart A for allowable watt densities at different fit tolerances and operating temperatures.

Cycling

Rapid cycling of heaters from very low to very high temperatures shortens their life considerably. It is recommended therefore, that care be taken to compute the correct wattage for any given installation. Optimum wattage should result in a 50/50 off/on cycle. For very high temperature operation (over 750°F), off/on control might well be replaced by input voltage regulation through variable transformers or silicon rectifiers so that great temperature fluctuations in the heater wire are minimized.

Location of temperature control point

When thermostats are used, the sensing element ought not to be placed further than ½" away from the heater wherever possible. Location further away could conceivably cause the unit to run too hot and thereby shorten life.

Wattage

Minimum wattage is based on 60 watts per square inch. Units with lower watt densities may be manufactured for special conditions such as high temperature or vibration. Minimum wattage available can be determined using the following formula and the values in Table 1:

$$\text{Minimum Watts} = \frac{\text{Voltage Squared}}{\text{Ohms/inch x Heated Length}}$$

Table 1: Maximum allowable Ohms per inch by diameter.

Superwatt Diameter	Maximum Ohms per Inch of Heated Length
⅛"	500
¼"	600
⅜"	800
½"	600
⅝"	500
¾"	400
1"	300

Voltage

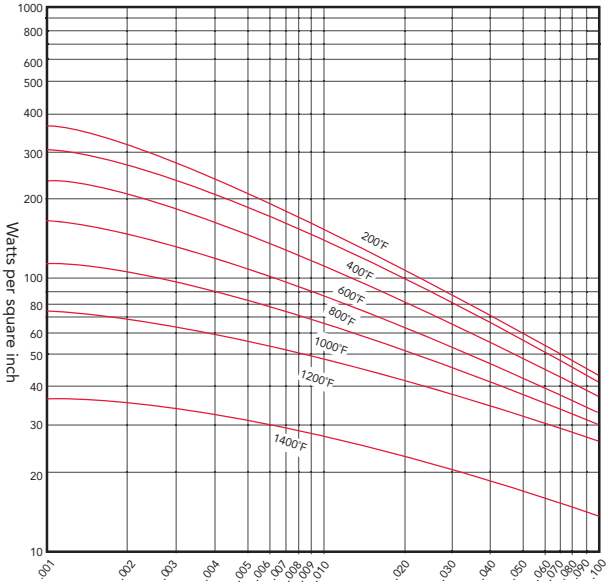
Standard Voltage is either 120V or 240V. Other voltages are available.

Termination

All units up to 1" diameter, within published amperage limits, are manufactured with 6" (type SF1) leads. 1" diameter units are manufactured with 6" (type SF2). Longer length leads are available.

Stock units supplied with 12" leads.

Graph A: Maximum watts/sq. in. with various increasing temperatures and hole tolerances.



Hole size over nominal fractional size

The watt densities are based on a unit installed in mild steel. Different materials affect the above values i.e. the lower the thermal conductivity of the material, the lower the maximum allowable watts per square inch.

Formula for determination of allowable element wattage:

Element Wattage: 3.142 x Diameter x Heated Length x Maximum watts/square inch from Graph A.

Formula for determination of watts/sq.in:

$$\textbf{Watts/sq. in.} = \frac{\text{Unit Wattage}}{\text{3.142 x Diameter x Heated Length}}$$

Heated Length is ½" less than sheath length

Tolerances

Wattage tolerances is +5% -10% at rated voltage. Length tolerances are ±2% with a ±1/16" minimum. Length tolerances apply to element sheath length.

Camber tolerances for units up to 12" long is .005" per six inch length. For units over 12" long, tolerance is .020" per foot of length. This value varies as the square of the length in feet. (i.e.—a 36" unit has a camber tolerance of .020" x $(3)^2$ = .180"). Normally camber does not present a problem since the unit will flex enough to fit a straight, close fit hole.

How To Order

After determining the wattage required and the line voltage available: determine the physical space available for heaters and the number of heaters required.
Review Stock List for In-Stock Items.

Specify: catalog number, wattage, voltage, lead type, and special features if required.

Example: HS37-4.25/375W120V/SF1-18/SF26

Cartridge Heaters

Metric Low to High Watt Density

U.L. Recognized – E56973
C.S.A. Certified 016386-0-000

▼ Manfactured Items ▼

Features:

- Both Standard (MS) and Superwatt® (MH) constructions are available.
- Wattages other than those listed are available.
- Made in U.S.A.

Diameter: 6 MM (5.87-5.97) Maximum Amp. 3.5

Length/mm	Catalog No.	Min. Watts	Max. Watts
40	MS6-40	10	30
50	MS6-50	10	40
60	MS6-60	10	50
70	MS6-70	10	60
80	MS6-80	10	70
90	MS6-90	10	80
100	MS6-100	10	90
110	MS6-110	10	100
120	MS6-120	10	110
130	MS6-130	10	120
140	MS6-140	10	130
150	MS6-150	10	140

Diameter: 6.5 MM (6.38-6.48) Max. Amps.MS3.5,MH4

Length/mm	Catalog No.	Min. Watts	Max. Watts
40	MS6.5-40	10	50
40	MH6.5-40	60	*
50	MS6.5-50	10	65
50	MH6.5-50	70	*
60	MS6.5-60	10	75
60	MH6.5-60	90	*
70	MS6.5-70	10	90
70	MH6.5-70	105	*
80	MS6.5-80	10	110
80	MH6.5-80	130	*
90	MS6.5-90	10	125
90	MH6.5-90	145	*
100	MS6.5-100	10	145
100	MH6.5-100	165	*
110	MS6.5-110	10	160
110	MH6.5-110	185	*
120	MS6.5-120	10	170
120	MH6.5-120	205	*
130	MS6.5-130	10	185
130	MH6.5-130	225	*
140	MS6.5-140	10	200
140	MH6.5-140	240	*
150	MS6.5-150	10	215
150	MH6.5-150	260	*

Diameter: 8 MM (7.87-7.98) Max. Amp. 6

Length/mm	Catalog No.	Min. Watts	Max. Watts
40	MS8-40	10	60
50	MS8-50	10	75
60	MS8-60	10	95
70	MS8-70	10	115
80	MS8-80	10	135
90	MS8-90	10	155
100	MS8-100	10	170
110	MS8-110	10	190
120	MS8-120	10	215
130	MS8-130	10	230
140	MS8-140	10	250
150	MS8-150	10	270

Diameter: 10 MM (9.85-9.96) Max. Amps.6

Length/mm	Catalog No.	Min. Watts	Max. Watts
40	MS10-40	10	65
40	MH10-40	75	*
50	MS10-50	10	90
50	MH10-50	105	*
60	MS10-60	10	115
60	MH10-60	135	*
70	MS10-70	10	135
70	MH10-70	165	*
80	MS10-80	10	165
80	MH10-80	195	*
90	MS10-90	10	190
90	MH10-90	225	*
100	MS10-100	10	210
100	MH10-100	255	*
110	MS10-110	10	235
110	MH10-110	285	*
120	MS10-120	10	260
120	MH10-120	315	*
130	MS10-130	10	285
130	MH10-130	345	*
140	MS10-140	10	310
140	MH10-140	370	*
150	MS10-150	10	335
150	MH10-150	400	*
160	MS10-160	10	355
160	MH10-160	430	*
170	MS10-170	10	380
170	MH10-170	460	*
180	MS10-180	10	405
180	MH10-180	490	*

Cartridge Heaters

Metric Low to High Watt Density

▼ Manfactured Items ▼

Diameter: 12 MM (11.86-11.96) Max. Amp. 6

Length/mm	Catalog No.	Min. Watts	Max. Watts
40	MS12-40	10	75
50	MS12-50	10	105
60	MS12-60	10	135
70	MS12-70	10	165
80	MS12-80	10	190
90	MS12-90	10	220
100	MS12-100	10	250
110	MS12-110	10	280
120	MS12-120	10	310
130	MS12-130	10	335
140	MS12-140	10	365
150	MS12-150	10	395
160	MS12-160	10	420
170	MS12-170	10	450
180	MS12-180	10	480

Diameter: 12.5 MM (12.34-12.47) Max. Amp.10

Length/mm	Catalog No.	Min. Watts	Max. Watts
40	MS12.5-40	10	85
40	MH12.5-40	100	*
50	MS12.5-50	10	115
50	MH12.5-50	135	*
60	MS12.5-60	10	145
60	MH12.5-60	175	*
70	MS12.5-70	10	175
70	MH12.5-70	210	*
80	MS12.5-80	10	205
80	MH12.5-80	245	*
90	MS12.5-90	10	235
90	MH12.5-90	285	*
100	MS12.5-100	10	265
100	MH12.5-100	325	*
110	MS12.5-110	10	295
110	MH12.5-110	355	*
120	MS12.5-120	10	335
120	MH12.5-120	390	*
130	MS12.5-130	10	350
130	MH12.5-130	430	*
140	MS12.5-140	10	385
140	MH12.5-140	465	*
150	MS12.5-150	10	415
150	MH12.5-150	500	*
160	MS12.5-160	10	445
160	MH12.5-160	535	*
170	MS12.5-170	10	475
170	MH12.5-170	575	*
180	MS12.5-180	10	500
180	MH12.5-180	605	*

Diameter: 13 MM (12.85-12.98) Max. Amp.10

Length/mm	Catalog No.	Min. Watts	Max. Watts
40	MH13-40	105	*
50	MH13-50	140	*
60	MH13-60	180	*
70	MH13-70	215	*
80	MH13-80	255	*
90	MH13-90	295	*
100	MH13-100	330	*
110	MH13-110	370	*
120	MH13-120	405	*
130	MH13-130	445	*
140	MH13-140	480	*
150	MH13-150	520	*
160	MH13-160	560	*
170	MH13-170	600	*
180	MH13-180	635	*
190	MH13-190	675	*
200	MH13-200	710	*

Diameter: 15 MM (14.86-14.99) Max. Amp.10

Length/mm	Catalog No.	Min. Watts	Max. Watts
40	MS15-40	10	90
50	MS15-50	10	135
60	MS15-60	10	170
70	MS15-70	10	205
80	MS15-80	10	245
90	MS15-90	10	275
100	MS15-100	10	315
110	MS15-110	10	350
120	MS15-120	10	390
130	MS15-130	10	425
140	MS15-140	10	460
150	MS15-150	10	500
160	MS15-160	10	535
170	MS15-170	10	570
180	MS15-180	10	605
190	MS15-190	10	640
200	MS15-200	10	670

* Maximum wattage is determined by heater fit and operating temperature of the part to be heated using the watt density formula and values from graph A on page 15.

Cartridge Heaters

Metric Low to High Watt Density

▼ Manfactured Items ▼

Diameter: 16 MM (15.82-15.95) Max. Amps.MS10, MH20

Length/mm	Catalog No.	Min. Watts	Max. Watts
40	MS16-40	10	105
40	MH16-40	130	*
50	MS16-50	10	140
50	MH16-50	175	*
60	MS16-60	10	180
60	MH16-60	220	*
70	MS16-70	10	220
70	MH16-70	270	*
80	MS16-80	10	260
80	MH16-80	315	*
90	MS16-90	10	300
90	MH16-90	360	*
100	MS16-100	10	335
100	MH16-100	410	*
110	MS16-110	10	375
110	MH16-110	455	*
120	MS16-120	10	415
120	MH16-120	500	*
130	MS16-130	10	450
130	MH16-130	550	*
140	MS16-140	10	490
140	MH16-140	595	*
150	MS16-150	10	530
150	MH16-150	640	*
160	MS16-160	10	570
160	MH16-160	690	*
170	MS16-170	10	605
170	MH16-170	735	*
180	MS16-180	10	645
180	MH16-180	780	*
190	MS16-190	10	680
190	MH16-190	830	*
200	MS16-200	10	720
200	MH16-200	875	*

Diameter: 17.5 MM (17.27-17.47) Max. Amp.15

Length/mm	Catalog No.	Min. Watts	Max. Watts
40	MS17.5-40	10	105
50	MS17.5-50	10	155
60	MS17.5-60	10	195
70	MS17.5-70	10	235
80	MS17.5-80	10	280
90	MS17.5-90	10	315
100	MS17.5-100	10	360
110	MS17.5-110	10	400
120	MS17.5-120	10	440
130	MS17.5-130	10	485
140	MS17.5-140	10	525
150	MS17.5-150	10	565
160	MS17.5-160	10	605
170	MS17.5-170	10	650
180	MS17.5-180	10	690
190	MS17.5-190	10	730
200	MS17.5-200	10	770

Diameter: 20 MM (19.76-19.96) Max. Amp.15

Length/mm	Catalog No.	Min. Watts	Max. Watts
40	MS20-40	40	120
50	MS20-50	40	180
60	MS20-60	40	225
70	MS20-70	40	275
80	MS20-80	40	320
90	MS20-90	40	365
100	MS20-100	40	420
110	MS20-110	40	465
120	MS20-120	40	515
130	MS20-130	40	560
140	MS20-140	40	610
150	MS20-150	40	660
160	MS20-160	40	705
170	MS20-170	40	755
180	MS20-180	40	800
190	MS20-190	40	840
200	MS20-200	40	900

* Maximum wattage is determined by heater fit and operating temperature of the part to be heated using the watt density formula and values from graph A on page 15.

Wattage

Wattages other than those listed are available. Consult factory.

Voltage

Standard voltages are either 120V or 240V. Other voltages are available.

Tolerances

Wattage tolerance is +5%, -10% at rated voltage.

Diameter is always .001" less, but not more than .009" less, than the nominal (fractional) heater diameter.

Length tolerances are ±2% with a ±1/16" minimum. Should tighter dimensions be required, Hotwatt can provide closer control.

How to Order

After determining the wattage required and the line voltage available, determine the physical space available for heaters and the numbers of heaters required.

Review Special Features, see page 22-27.

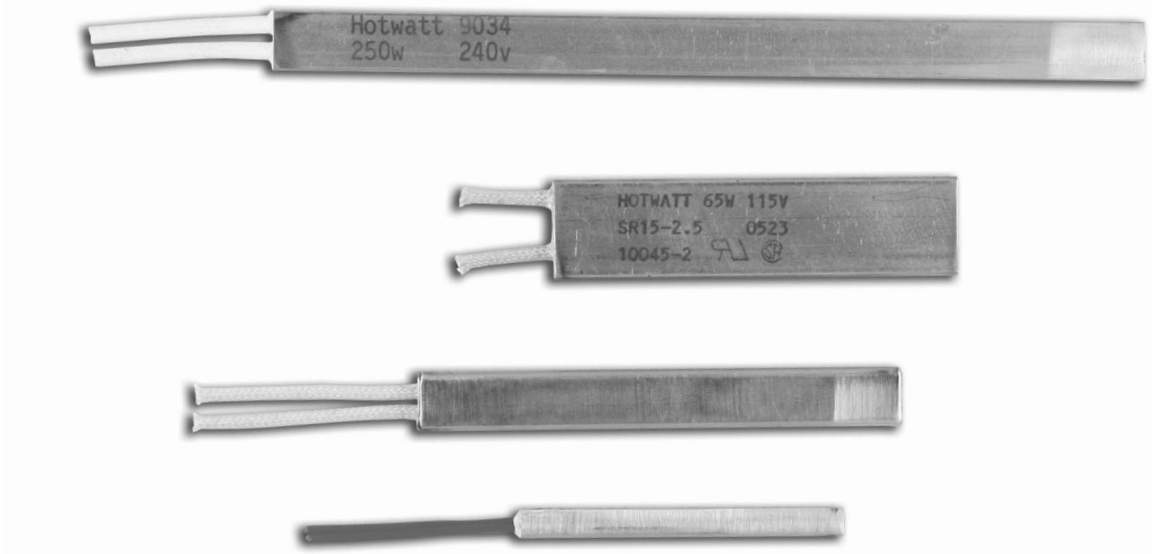
Specify: catalog number, wattage, voltage, lead length and special features required.

Example: MS17.5-110/400W220V/SF1-6.

Cartridge Heaters

Square and Rectangular Low to Medium Watt Density

U.L. Recognized – E56973
C.S.A. Certified 016386-0-000

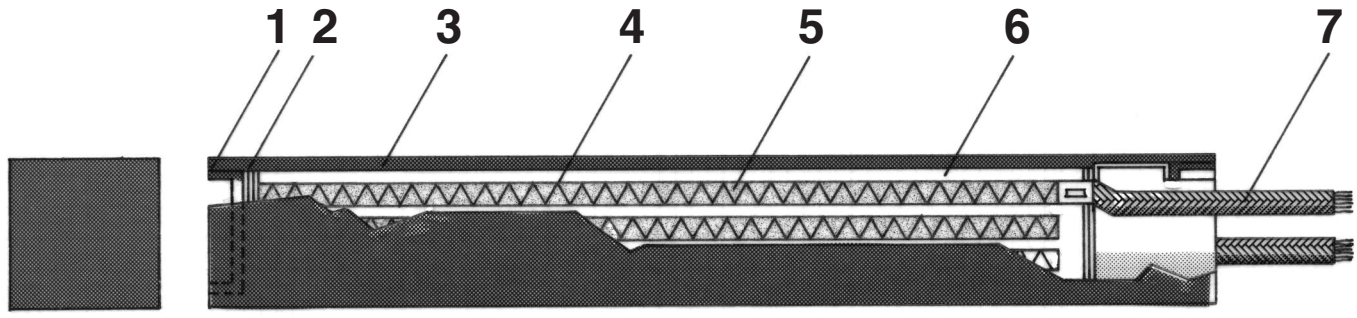


Features:

- The Hotwatt Square and Rectangular Cartridge Heater is designed to distribute maximum heat within a desired area. Because they are completely enclosed, square units will furnish more usable heat for a given wattage than a comparable strip heater attached to the exterior of a mold, platen or other equipment.
- The units are inserted in a milled slot, permitting greater lengths than would be feasible with a drilled or reamed hole. Close dimensional tolerances are held to permit intimate fit for best transfer to surrounding medium.
- Heating elements arranged just beneath outside surface for maximum heat transfer, minimum wire temperature, and faster heating.
- Maximum surface temperatures up to 1200˚F (649°C). Designations are etched on the sheath to presrve accurate shape.
- Long, trouble free service.
- Made in U.S.A.

Construction:

1. Sealed end.
2. Mica.
3. Series 300 stainless steel sheath for non-oxidizing, stable service with cavities machined for them.
4. Element wire situated in close proximity to outside surface for maximum heat transfer, minimum wire temperature and faster heating.
5. Magnesium oxide packing.
6. Ceramic element support.
7. Teflon insulated leads: ¼" square.
   Fiberglass insulated leads: ⅜" to ½" square, ¼" x ⅝" and ¼" x 1" rectangular.



Cartridge Heaters

Square—Low to Medium Watt Density

▼ Manfactured Items ▼

Square

Size: ⅛" x ⅛" (.124/.120 x .124/.120)
Maximum Amperage: **1** Not UL/CSA

Sheath Length	Cat. No.	Min. Watts	Max. Watts
1"	SS12-1	10	15
2"	SS12-2	10	35
3"	SS12-3	10	55
4"	SS12-4	10	75
5"	SS12-5	10	95
6"	SS12-6	10	115
7"	SS12-7	10	135
8"	SS12-8	10	155
9"	SS12-9	10	175
10"	SS12-10	10	195
11"	SS12-11	10	215
12"	SS12-12	10	235

For longer lengths, compute wattage at: **10 watts per linear ½"**
• Lengths longer than those listed may be ordered.

Square

Size: ¼" (.249/.245 x .249/.245) ⅜" (.374/.370 x .374/.370) ½" (.499/.495 x .499/.495)
Maximum Amperage: **3.5** **6** **10**

Sheath Length	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts
2"	SS25-2	10	60	SS37-2	10	90	SS50-2	10	130
3"	SS25-3	10	100	SS37-3	10	150	SS50-3	10	210
4"	SS25-4	10	150	SS37-4	10	210	SS50-4	10	300
6"	SS25-6	10	225	SS37-6	10	330	SS50-6	10	500
8"	SS25-8	10	350	SS37-8	10	450	SS50-8	10	700
10"	SS25-10	10	450	SS37-10	10	570	SS50-10	10	850
12"	SS25-12	10	550	SS37-12	10	690	SS50-12	10	1000
16"	SS25-16	10	750	SS37-16	10	930	SS50-16	10	1280
18"	SS25-18	10	840	SS37-18	10	1050	SS50-18	10	1440
24"	SS25-24	10	840	SS37-24	10	1410	SS50-24	10	1920

For longer lengths, compute wattage at: **840 watts max.** **30 watts per linear ½"** **40 watts per linear ½"**
• Lengths longer than those listed may be ordered.

Wattage

Minimum Wattage
The following table should be used to determine the allowable voltage for low wattage miniature elements:

Size:	⅛" Square				⅜6" Square			
Length	30v	60v	120v	230v	30v	60v	120v	230v
1"	.6w	2.5w	10w	NA	.8w	3w	12w	NA
1½"	.6w	2.5w	10w	NA	.5w	2w	8w	30w
2"	.5w	2w	8w	27w	.4w	1.5w	6w	22w

NA = Not Available

Voltage

Standard voltage is either 120V or 240V. Other voltages are available.

Termination

All units within published amperage limits are manufactured with 6" (type SF1) leads; longer length leads are available. Standard insulation on ¼" square units is Teflon (200°C). Fiberglass (250°C) is standard on all other sizes.

Phone: 978-777-0070 ■ Fax: 978-774-2409

Cartridge Heaters

Rectangular—Low to Medium Watt Density

▼ Manfactured Items ▼

Rectangular

Size: ⅛" x ¼" (.124/.120 x .249/.245) ⅛" x ⅜" (.124/.120 x .374/.370)
Maximum Amperage: **2** **3.5**

Sheath Length	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts
1"	SR14-1	10	20	SR13-1	10	35
2"	SR14-2	10	55	SR13-2	10	90
3"	SR14-3	10	85	SR13-3	10	140
4"	SR14-4	10	110	SR13-4	10	190
5"	SR14-5	10	135	SR13-5	10	240
6"	SR14-6	10	170	SR13-6	10	290
7"	SR14-7	10	200	SR13-7	10	340
8"	SR14-8	10	230	SR13-8	10	390
9"	SR14-9	10	260	SR13-9	10	440
10"	SR14-10	10	290	SR13-10	10	490
11"	SR14-11	10	320	SR13-11	10	540
12"	SR14-12	10	350	SR13-12	10	590

For longer lengths, compute wattage at: **15 watts per linear ½"** **25 watts per linear ½"**

• Lengths longer than those listed may be ordered.

Rectangular

Size: ¼" x ⅝" (.249/.245 x .624/.620) ¼" x 1" (.249/.245 x .999/.993)
Maximum Amperage: **6** **10**

Sheath Length	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts
1"	SR15-1	10	35	SR16-1	10	50
2"	SR15-2	10	100	SR16-2	10	150
3"	SR15-3	10	175	SR16-3	10	300
4"	SR15-4	10	250	SR16-4	10	400
5"	SR15-5	10	320	SR16-5	10	500
6"	SR15-6	10	455	SR16-6	10	600
7"	SR15-7	10	560	SR16-7	10	700
8"	SR15-8	10	640	SR16-8	10	800
9"	SR15-9	10	720	SR16-9	10	900
10"	SR15-10	10	800	SR16-10	10	1000
11"	SR15-11	10	880	SR16-11	10	1100
12"	SR15-12	10	960	SR16-12	10	1200
16"	SR15-16	10	1280	SR16-16	10	1600
18"	SR15-18	10	1440	SR16-18	10	1800
24"	SR15-24	10	1440	SR16-24	10	2400

For longer lengths, compute wattage at: **35 watts per linear ½"** **50 watts per linear ½"**

• Lengths longer than those listed may be ordered.

Tolerances

Wattage tolerances are held to +5%, -10% at rated voltage. Width and height are always .001" less but not more than .010" less than the nominal (fractional) heater size; length tolerances are ±2% with a ±1/16" minimum. This sizing is maintained so that all units are a slide fit into a standard milled slot of the size required. Thermal action will expand the unit to a snug fit for best heat conduction.

How to Order

After determining the wattage required and the line voltage available, determine the physical space available for heaters and the numbers of heaters required.

Review Special Features, see page 22-27.

Specify: catalog number, wattage, voltage, lead length and special features required.

Example: SR16-7.5/750W240V/SF1-48

Cartridge Heaters

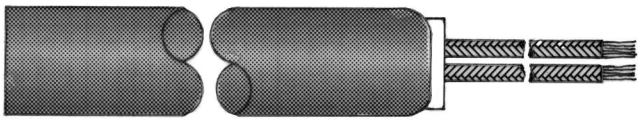
Special Features

Electric Heater Special Features and Modifications

The following is an outline of Special Features and Modifications available with Hotwatt Electric Heating Elements. It applies to all Standard, Superwatt, Square and Rectangular Cartridge Heaters and Immersion Heaters. Catalog Numbers have been assigned to all special features and modifications. Please provide an adequate description to avoid confusion when a special feature applies to more than one size or item. Special features for other heaters are covered in each specific section.

Lead Configurations

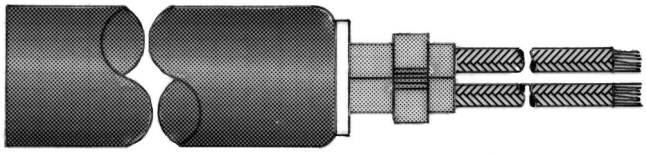
SF1: Flexible leads for applications where leads can be bent close to end of unit. See specific unit size for maximum allowable amperage.



Standard on:
- In-Stock Standard and Superwatt Cartridge.
- Standard Cartridge: ⅛" to ¾" and 1.9" and 2⅜" diameter.
- Superwatt Cartridge: ¼" to ¾" diameter.
- Square and Rectangular: all sizes.
- Immersion: ¼" to ¾" and 1.9", and 2⅜" diameter.

Available on:
- Standard Cartridge: 15⁄16" to 1¼" diameter.
- Immersion: 1" and 1¼" diameters.

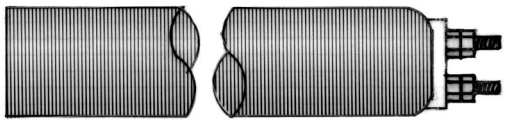
SF2: Leads for application where repairable leads are desired or when unit amperage will not allow the use of Type SF-1 leads.



Standard on:
- Superwatt Cartridge: 1" diameter.

Available on:
- Standard Cartridge: 3⁄16" to ¾" diameter.
- Immersion: ¼" to ¾" diameter.

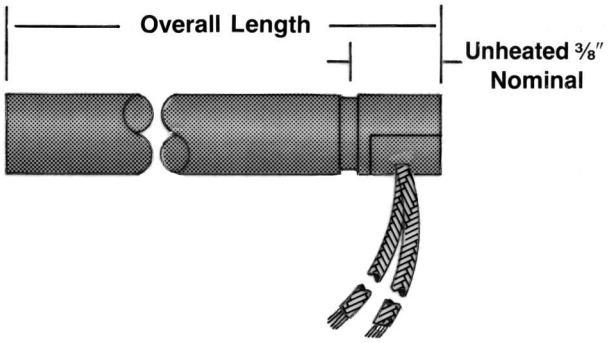
SF3: Post terminals.



Standard on:
- Standard Cartridge: 15⁄16" to 1¼" diameter.
- Immersion: 1" to 1¼" diameter.

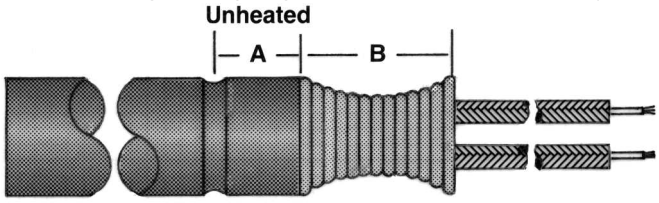
Available on:
- Standard Cartridge: ¾" diameter.
- Immersion: ¾" diameter.

SF4: Leads for application where lead space is minimum and it is desirable to bring leads out at right angles to sheath. Specify overall length of heater when ordering.



Available on:
- Standard Cartridge: 3⁄16" to ¾" diameter.
- Superwatt Cartridge: ¼" to ¾" diameter.
- Square and Rectangle Cartridge: All sizes.

SF5: Lead spring protector. Leads reinforced with steel spring for applications where excessive flexing is encountered. Standard spring length is 1" on ¼" to ½" diameters and 1½" on ⅜" to ¾" diameters. Longer spring lengths are available. Consult factory.



Cat. No.	Unit Dia.	A	B
SF5A	¼"	¼"	1"
SF5B	⅜"	¼"	1"
SF5C	½"	¼"	1"
SF5D	⅝"	½"	1½"
SF5E	¾"	½"	1½"

Available on:
- Standard Cartridge: ¼" to ¾" diameter.
- Superwatt Cartridge: ¼" to ¾" diameter.

SF6: Ground wire.

Available on:
- All products.

SF7: Fiberglass sleeving. Additional sleeving over leads for protection. Leads are normally 2" longer than sleeve.

SF7A: Common sleeve. Single sleeve over both leads.

SF7B: Individual sleeve. Single sleeve over each lead. Specify length of sleeve.

Available on:
- All products.

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Cartridge Heaters

Special Features

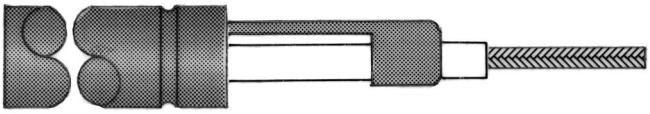
SF8: Silicone rubber sleeving. Additional sleeving over leads for protection and moisture resistance.

SF8A: Common sleeve. Single sleeve over both leads.

SF8B: Individual sleeve. Single sleeve over each lead. Specify length of sleeve. Leads are normally 2" longer than sleeve.

Available on:
- All products with leads.

SF9: Strain relief clip for leads subject to strain and pull.



Available on:
- Standard Cartridge: ¼" to ¾" diameter with Type SF1 leads only.
- Superwatt Cartridge: ¼" to ¾" diameter with Type SF1 leads only.

SF10: Ceramic bead insulation for leads subject to high temperatures up to 1000°F. Specify lengths of beads required when ordering.

Available on:
- All products with leads.

Lead End Termination

SF11: Lugs, rings, quick connect terminals attached to the end of lead wires. Specify terminal type and size when ordering. Special terminals are available.

Available on:
- All products with leads.

SF11A: Ring terminals. Specify size: #6, #8, #10.



SF11B: Straight quick connect terminals. Specify male or female and size: 3/16" or ¼".



SF11C: Flag quick connect terminals. Specify male or female and size: 3/16" or ¼".



SF11D: Spade terminals. Specify size: #6, #8, #10.



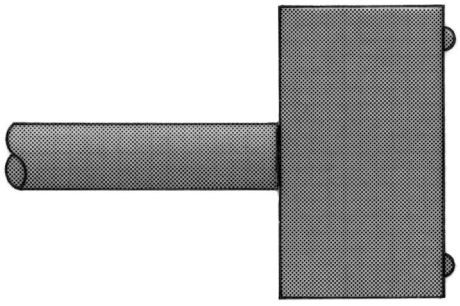
SF12: Male dead front armored plug. May be mounted directly to heater.

Available on:
- Products with leads. Consult factory for availability.
- Ground wire (SF6) should be specified when using any 3 prong plug.

SF12-P1: 2 prong/straight blade/2 pole/2wire/ UL&CSA Listed/NEMA 1-15P/125 volts/15 amps.	
SF12-P2: 2 prong/twist lock/2 pole/2 wire/UL Listed/ NEMA L1-15P/125 volts/15 amps.	
SF12-P3: 3 prong/twist lock/2 pole/3 wire/ UL&CSA Listed/NEMA L6-15P/250 volts/15 amps.	
SF12-P4: 3 prong/twist lock/2 pole/3 wire/ UL &CSA Listed/NEMA L6-20/250 volts/20 amps.	
SF12-P5: 3 prong/straight blade/2 pole/3 wire/ UL&CSA Listed/NEMA 5-15P/125 volts/20 amps.	

SF13: Enclosures for protection of electrical connections.

SF13A: General purpose box. NEMA No. 1. 2¾" x 1½" x 1½".

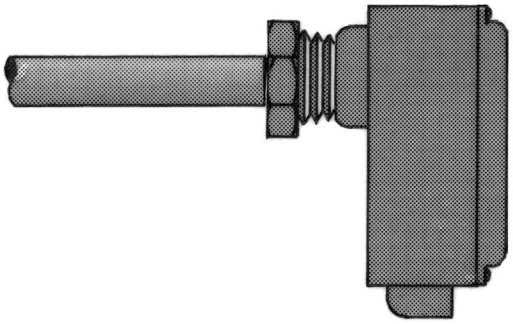


Available on:
- Standard Cartridge: ⅜" to 1" diameter.
- Superwatt Cartridge: ⅜" to 1" diameter.

Cartridge Heaters

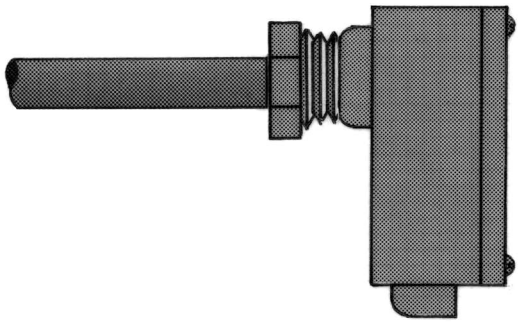
Special Features

SF13B: Moisture resistant box. Mounted on NPT fitting.



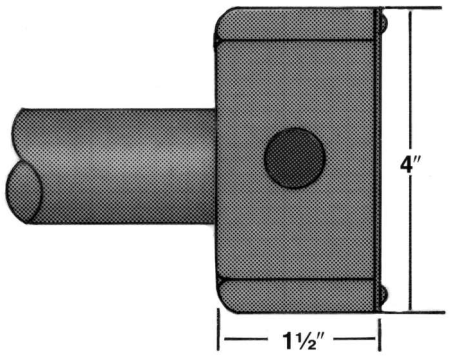
Available on:
- Standard Cartridge: ⅜" to 1¼" diameter.
- Superwatt Cartridge: ⅜" to 1" diameter.

SF13C: Explosion resistant box. Mounted on NPT fitting.



Available on:
- Standard Cartridge: ⅜" to 1¼" diameter.
- Superwatt Cartridge: ⅜" to 1" diameter.

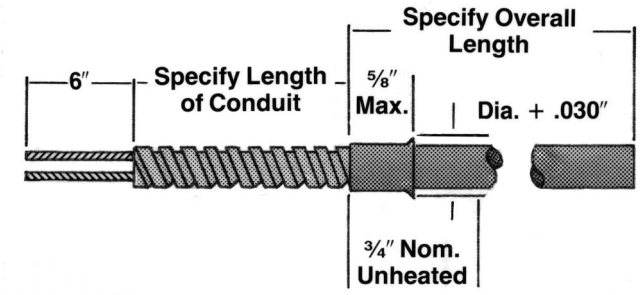
SF13D: General purpose box. NEMA No. 1. Rust resistant steel. 4" octagonal.



Available on:
- Standard Cartridge:1¼" to 2⅜" diameter.

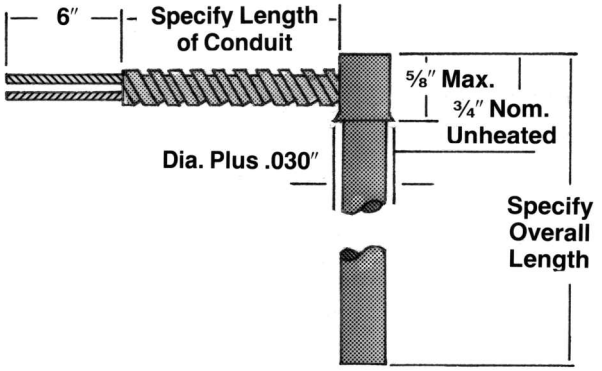
Lead Protection

SF14: Flexible, stainless steel conduit for straight leads.



Available on:
- All products with leads: 3/16" to 1¼" diameter.

SF15: Flexible, stainless steel conduit for right angle leads.

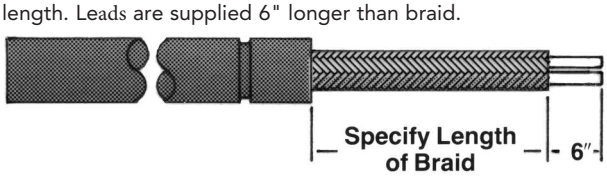


Standard Conduit Sizes

Unit Size	Conduit O.D.	Min. Bend Diam.
3/16"-¼"	.244 nominal	1.31" inside
⅜"	.350 nominal	1.93" inside
½"-⅝"	.381 nominal	2.12" inside
¾" & up	.500 nominal	2.25" inside

Available on:
- Standard Cartridge: 3/16" to 1¼" diameter.
- Superwatt Cartridge: ¼" to 1" diameter.
- Square Cartridge: ¼" to ½" diameter.

SF16: Stainless steel, flexible braid for straight leads. Specify braid length. Leads are supplied 6" longer than braid.



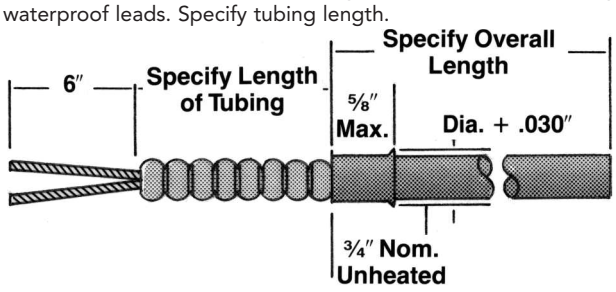
Available on:
- Standard Cartridge: ⅜" to ¾" diameter.
- Superwatt Cartridge: ⅜" to ¾" diameter.
- Square and Rectangular: ⅜" and ½" square. (¼" x ⅝" and ¼" x 1" rectangular).

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Cartridge Heaters

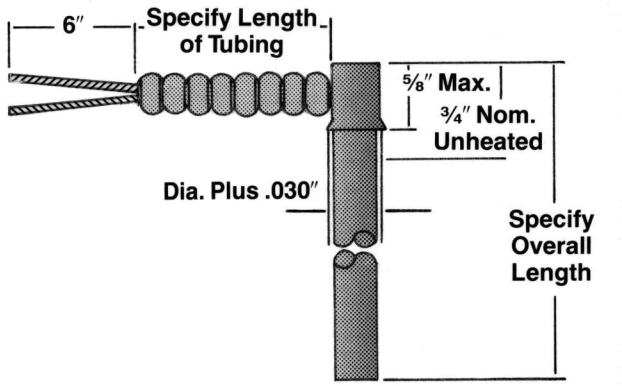
Special Features

SF17: Convoluted bronze tubing. Flexible sealed tubing for waterproof leads. Specify tubing length.



Available on:
- Standard Cartridge: ⅜" to 1¼" diameter.
- Superwatt Cartridge: ⅜" to 1" diameter.
- Square Cartridge: ⅜" and ½" square.
- Immersion Heater: ⅜" to 1¼" diameter.

SF18: Right angle convoluted bronze tubing.



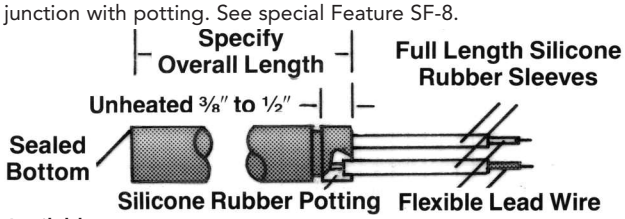
Available on:
- Standard Cartridge: ⅜" to ¾" diameter.
- Superwatt Cartridge: ⅜" to ¾" diameter.
- Square Cartridge: ⅜" and ½" square.

SF19: Straight solid copper extension. Specify length when ordering. Leads are 6" longer than tubing.

Available on:
- Standard Cartridge: ¼" to ¾" diameter.
- Superwatt Cartridge: ¼" and ¾" diameter.

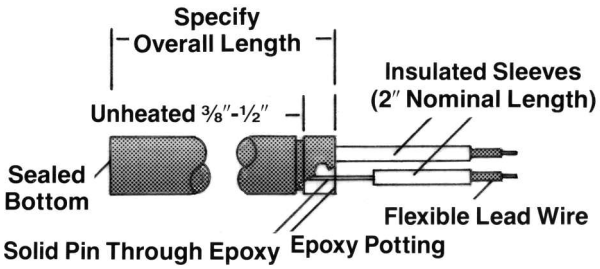
Sealing and Potting Lead End for Adverse Environmental Conditions

SF20: Silicon rubber potting for moisture proof application to 400°F (204 °C) in potting area. Silicon rubber sleeving must be used in conjunction with potting. See special Feature SF-8.



Available on:
- Standard Cartridge: 3/16" to 2⅜" diameter.
- Superwatt Cartridge: ¼" to 1" diameter.
- Square and Rectangular: All sizes except ⅛" square.
- Immersion Heater: All sizes.

SF21: Epoxy potting for moisture proof applications to 265°F (129°C) in potting area.



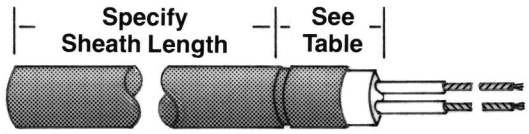
Available on:
- Standard Cartridge: ¼" to 2⅜" diameter.
- Superwatt Cartridge: ¼" to 1" diameter.
- Square and Rectangular: All sizes except ⅛" square.
- Immersion Heater: All sizes.

SF22: Teflon end seal for moisture applications to 400°F (204°C).

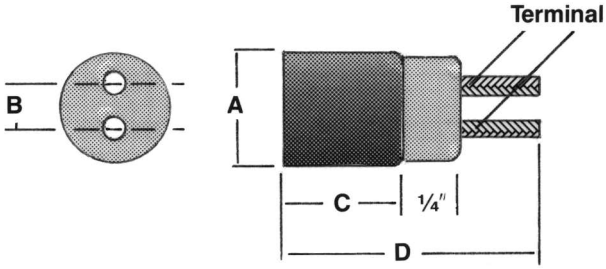


Available on:
- Standard Cartridge: ⅛" to ¾" diameter.
- Superwatt Cartridge: ¼" to ¾" diameter.

SF23: Ceramic to metal seals for hermetic sealing and vacuum applications to 1000°F (538°C).



Available on:
- Standard Cartridge: ⅜" to ¾" diameter.
- Superwatt Cartridge: ⅜" to ¾" diameter.
- Immersion Heater: ⅜" to ¾" diameter.



SF23: Table of Dimensions

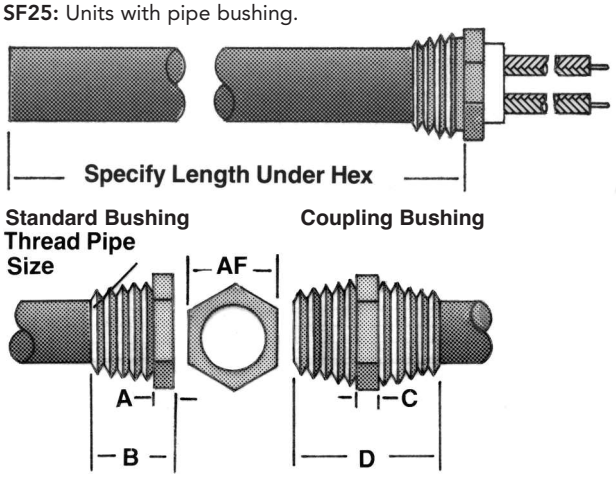
Cat. No. Unit Diameter	A	B	C	D
SF23-A	⅜"	.148"	½"	1"
SF23-B	½"	.180"	17/32"	1 5/32"
SF23-C	⅝"	.238"	9/16"	1 3/16"
SF23-D	¾"	.304"	19/32"	1 7/32"

Cartridge Heaters

Special Features

Attaching Fittings

SF25: Units with pipe bushing.



Heater O.D.	Pipe Thread NPT Size	A	B	C	D	AF
¼"	⅛"	⅛"	½"	3⁄16"	15⁄16"	7⁄16"
⅜"	¼"	⅛"	9⁄16"	3⁄16"	1 1⁄16"	⅝"
½"	⅜"	3⁄16"	⅝"	¼"	1 ⅛"	11⁄16"
⅝"	½"	3⁄16"	¾"	¼"	1 ⅜"	⅞"
¾"	¾"	¼"	⅞"	⅜"	1 ⅝"	1 ⅛"
15⁄16" & 1"	1"	¼"	15⁄16"	½"	1 ⅞"	1 ⅜"
1 ¼"	1 ¼"	5⁄16"	1 1⁄32"	½"	1 15⁄16"	1 ¾"
1.9"	2"	9⁄16"	1 7⁄16"	NA	NA	2 ½"
2 ⅜"	2 ½"	⅝"	1 ¾"	NA	NA	3"

Brass Bushings

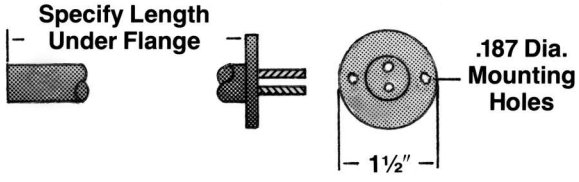
SF25A: Single Brass.
SF25B: Coupling Brass.

Stainless Steel Bushings

SF25C: Single Stainless Steel.
SF25D: Coupling Stainless Steel.

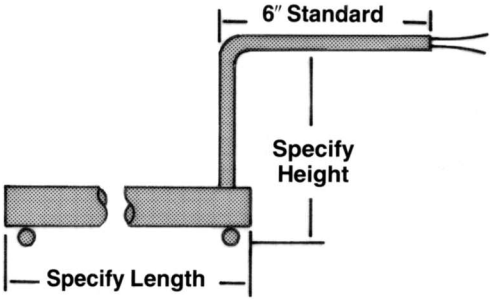
Available on:
- Standard Cartridge: ¼" to 2⅜" diameter.
- Superwatt Cartridge: ¼" to 1" diameter.

SF26: Units with flanges. Mounting hold centers for ¼" to ⅝" diameter is 1⅛" and for ¾" diameter is 1 3⁄32". Special flange sizes available upon request.



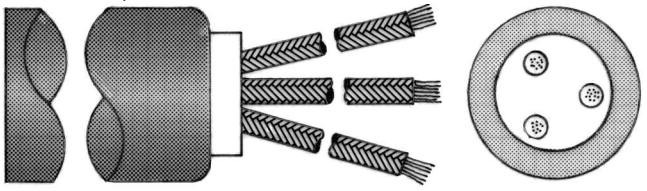
Available on:
- Standard Cartridge: ¼" to ¾" diameter.
- Superwatt Cartridge: ¼" to ¾" diameter.

SF27: Stainless steel riser and support feet for over the side immersion heaters.



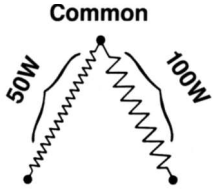
Special Electrical Features

SF28: Three phase heaters.



Available on:
- Standard Cartridge: ⅜" to 2⅜" diameter.
- Superwatt Cartridge: ⅜" to 1" diameter.
- Immersion Heater: ⅜" to 2⅜" diameter.
- Square Cartridge: ⅜" to ½" square.

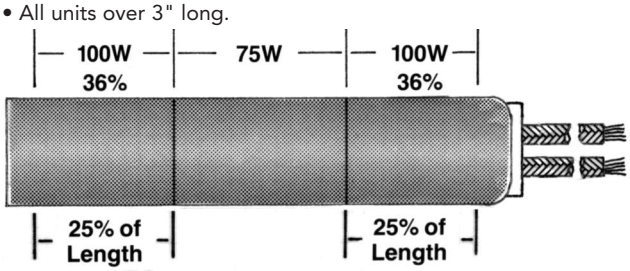
SF29: Multiple heat; when a single unit with multiple wattages is necessary. Some uses of these units include: quick heat-up with a standby circuit for maintenance of low temperature; providing different wattages when there is a wide variation in thermal loads; and replacing more expensive rheostats or powerstats for wattage control.



Available on:
- Standard Cartridge: ⅜" to 2⅜" diameter.
- Superwatt Cartridge: ⅜" to 1" diameter.
- Immersion Heater: ⅜" to 2⅜" diameter.
- Square Cartridge: ⅜" to ½" square.

SF30: Special wattage distribution for units requiring different concentrations of wattage over their heated length. Distribution should be specified as a percentage of wattage over a percentage of length, i.e. 36⁄25.

Available on:
- All units over 3" long.



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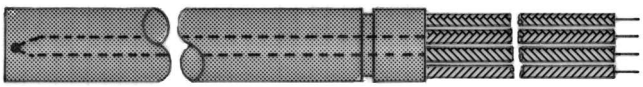
Cartridge Heaters

Special Features

SF31: Built in thermocouple. Junction at bottom of heater.

Ungrounded thermocouple:
- SF31-JU - Iron/Constantan - Type J
- SF31-KU - Chromel/Alumel - Type K

Grounded thermocouple:
- SF31-JG - Iron/Constantan - Type J
- SF31-KG - Chromel/Alumel - Type K



Available on:
- Standard Cartridge: ⅜" to 2⅜" diameter.
- Superwatt Cartridge: ¼" to 1" diameter.
- Square Cartridge: ⅜" to ½" square.
- Rectangular Cartridge: ¼" by 1" rectangular.
- Immersion Heater: ⅜" to 2⅜" diameter.

SF32: High voltage heaters from 300V to 600V. Consult factory for availability on items.

Maximum Voltage/Unit Size

Diameter	⅝"	¾"	1"	1¼"	1.90"	2⅜"
Std. Cart.	480V	480V	480V	600V	600V	600V
Superwatt	480V	480V	480V	NA	NA	NA
Immersion	480V	480V	480V	600V	600V	600V

Other Physical Features

SF33: Double end units. One terminal at end. Especially suitable for heating: warming closets, ovens, press heads, drying cabinets, platens and plates. Double end units (post type terminals at each end) can be installed in reamed holes or in machined grooves. The standard sheath material is stainless steel and cannot be bent or formed. Available with SF1 or SF3 terminations.



Available on:
- Standard Cartridge: ⅜" to ¾" and 1¼" diameter.
- Square Cartridge: ½" square only.

SF34: Odd sizes: 7/16", 9/16", 11/16", 13/16", and ⅞" diameter. Stainless steel sheath.

Available on:
- Standard cartridge construction only.

SF36: Centerless ground on diameter for precision fit. Termination must be Type SF2 or SF3. Tolerance on diameter ±.0005.

Available on:
- Standard Cartridge: ¼" to 1¼" diameter.
- Superwatt Cartridge: ¼" to 1" diameter.

Finished diameters after grinding will be:

¼" = .2450	¾" = .7430
⅜" = .3700	15/16" = .9300
½" = .4950	1" = .9930
⅝" = .6200	1¼" =1.240

SF37: Special alloy sheathing. Consult factory for availability before ordering.

SF37A: 347 Stainless Steel.

SF37B: 321 Stainless Steel.

SF37C: Inconel.

SF37D: Titanium.

Available on:
- Standard Cartridge: ¼" to 1¼" diameter.
- Immersion Heater: All sizes.

SF38: Passivated finish for corrosion resistance.

Available on:
- All Immersion Heaters.

SF39: Teflon coating for corrosive conditions. Termination must be type SF2 or SF3.

Available on:
- Standard Cartridge: 3/16" to 1¼" diameter.
- Square or Rectangular: All sizes (except ⅛" square).
- Immersion Heater: All sizes.

Cartridge Heaters

Immersion

U.L. Recognized-E56973
C.S.A. Certified – 016386-0-000

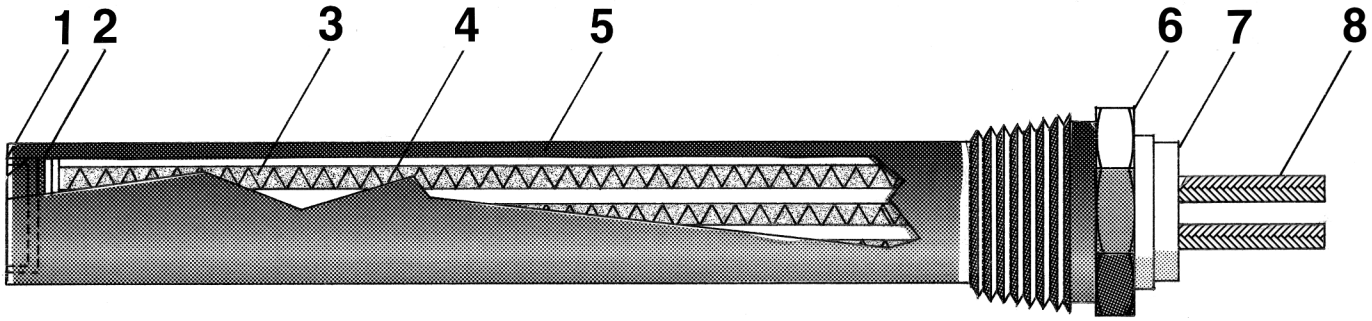


Features:

- The Hotwatt Immersion Heater may be supplied with various junction boxes for additional terminal or lead protection.
- For corrosive environments, units can be supplied in other special alloys best suited to the operating conditions.
- The lead end of the unit may be sealed for extreme environmental conditions.
- Units may be supplied for three phase or three heat operation.
- Made in U.S.A.

Construction:

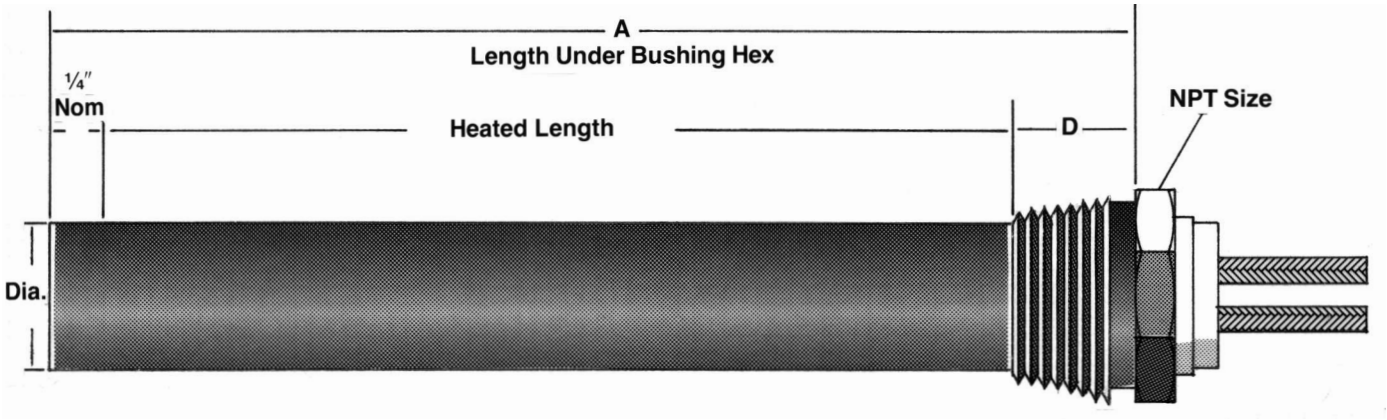
1. Welded end.
2. Mica.
3. Magnesium oxide packing.
4. Element wire situated in close proximity to outside surface for maximum heat transfer and minimum internal temperature while preserving good dielectric qualities.
5. Series 316 stainless steel sheath.
6. Mounting bushing.
7. Ceramic cap.
8. Flexible stranded nickel alloy insulated leads or rust resistant post terminals.



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Cartridge Heaters

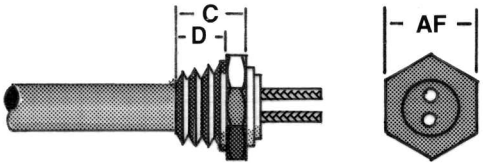
Immersion



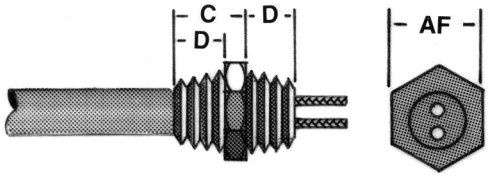
Available Bushings: Must be specified after catalog number.

Brass Bushings

SF25A: Single

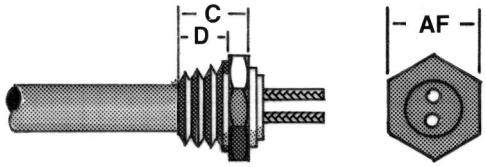


SF25B: Coupling Head

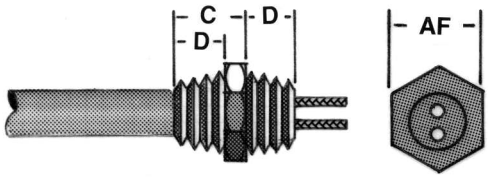


Stainless Steel Bushings

SF25C: Single



SF25D: Coupling Head



▼ Manfactured Items ▼

¼" Diameter

NPT Size: ⅛"
Standard Termination: 6" Leads (SF1-6)
Maximum Amperage: 3.5
AF: 7/16"
C: ½"
D: ⅜"

Length A	Catalog Number	Maximum Wattage in Water
2"	EM25-2	115
3"	EM25-3	185
4"	EM25-4	255
5"	EM25-5	325
6"	EM25-6	395
7"	EM25-7	465

⅜" Diameter

NPT Size: ¼"
Standard Termination: 6" Leads (SF1-6)
Maximum Amperage: 6.0
AF: 5/8"
C: 9/16"
D: 7/16"

Length A	Catalog Number	Maximum Wattage in Water
2"	EM37-2	130
3"	EM37-3	240
4"	EM37-4	345
5"	EM37-5	450
6"	EM37-6	555
7"	EM37-7	660

Cartridge Heaters

Immersion

▼ Manfactured Items ▼

½" Diameter

NPT Size: ⅜"
Standard Termination: 6" Leads (SF1-6)
Maximum Amperage: 10
AF: 11⁄16" **C:** ⅝" **D:** 7⁄16"

Length A	Catalog Number	Maximum Wattage in Water
3"	EM50-3	360
4"	EM50-4	505
5"	EM50-5	635
6"	EM50-6	765
7"	EM50-7	895
8"	EM50-8	1030

⅝" Diameter

NPT Size: ½"
Standard Termination: 6" Leads (SF1-6)
Maximum Amperage: 10
AF: ⅞" **C:** ¾" **D:** 9⁄16"

Length A	Catalog Number	Maximum Wattage in Water
3"	EM62-3	430
4"	EM62-4	605
5"	EM62-5	785
6"	EM62-6	1060
7"	EM62-7	1135
8"	EM62-8	1310

¾" Diameter

NPT Size: ¾"
Standard Termination: 6" Leads (SF1-6)
Maximum Amperage: 15
AF: 1⅛" **C:** ⅞" **D:** ⅝"

Length A	Catalog Number	Maximum Wattage in Water
4"	EM75-4	705
5"	EM75-5	915
6"	EM75-6	1130
7"	EM75-7	1340
8"	EM75-8	1555
9"	EM75-9	1765

1" Diameter

NPT Size: 1"
Standard Termination: 8-32 Screw and Nut (SF3)
Maximum Amperage: 25
AF: 1⅜" **C:** 15⁄16" **D:** 11⁄16"

Length A	Catalog Number	Maximum Wattage in Water
5"	EM1.0-5	1195
6"	EM1.0-6	1495
7"	EM1.0-7	1795
8"	EM1.0-8	2095
9"	EM1.0-9	2395
10"	EM1.0-10	2695

1¼" Diameter

NPT Size: 1¼"
Standard Termination: 10-32 Screw and Nut (SF3) **Maximum Amperage:** 30
AF: 1¾" **C:** 1 1⁄32" **D:** 23⁄32"

Length A	Catalog Number	Maximum Wattage in Water
6"	EM1.2-6	1690
7"	EM1.2-7	2145
8"	EM1.2-8	2600
10"	EM1.2-10	3055
12"	EM1.2-12	3505
14"	EM1.2-14	3960

1.9" Diameter

NPT Size: 2"
Standard Termination: 6" Leads (SF1-6)
Maximum Amperage: 40
AF: 2½" **C:** 1 1⁄16" **D:** 11⁄16"

Length A	Catalog Number	Maximum Wattage in Water
10"	EM1.9-10	4200
12"	EM1.9-12	5000
16"	EM1.9-16	6700
20"	EM1.9-20	8400
24"	EM1.9-24	10000
30"	EM1.9-30	12600

2.3" Diameter

NPT Size: 2½"
Standard Termination: 6" Leads (SF1-6)
Maximum Amperage: 50
AF: 3" **C:** 1¾" **D:** ⅞"

Length A	Catalog Number	Maximum Wattage in Water
12"	EM2.3-12	6000
18"	EM2.3-18	9000
24"	EM2.3-24	12000
30"	EM2.3-30	15000
36"	EM2.3-36	18000
42"	EM2.3-42	21000

- Above wattages are based on a unit operating immersed in water. For heating other materials, see table for recommended maximum watt densities.
- Lengths between and longer than those listed may be ordered.
- **See page 148 for Suggested Watt Density and see page 152-155 for Sheath Materials.**
- See next page for stock items

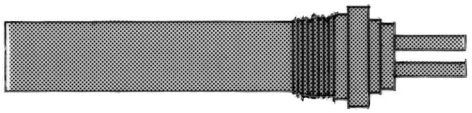
Cartridge Heaters

Immersion

▼ IN STOCK ITEMS ▼

Immersion Heaters

Supplied with: Type SF1 leads, Type SF3S terminals
U.L. Recognized — E56973 C.S.A. Certified — LR-16386



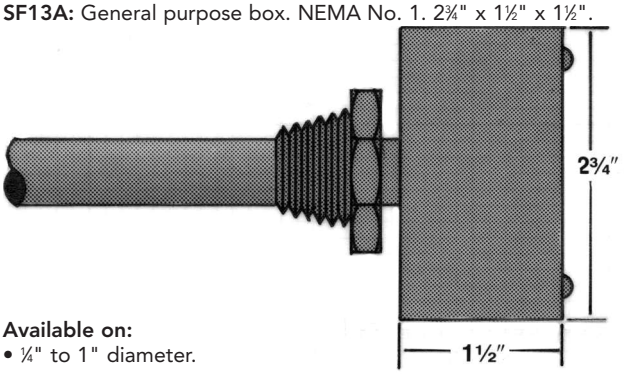
Length	Cat. No.	Dia.	Wattage	Voltage	Watts/in²	Weight	Lead Const.	Fittings
6"	EM62-6/SF25C	⅝"	100	120	9	.40	12" w/epoxy seal	½"NPT
6"	EM62-6/SF25C	⅝"	400	120	37	.40	12" w/epoxy seal	½"NPT
6"	EM62-6/SF25C	⅝"	400	240	37	.40	12" w/epoxy seal	½"NPT
6"	EM75-6/SF25C	¾"	125	120	9	.50	12" w/epoxy seal	¾"NPT
6"	EM75-6/SF25C	¾"	500	120	38	.50	12" w/epoxy seal	¾"NPT
6"	EM75-6/SF25C	¾"	500	240	38	.50	12" w/epoxy seal	¾"NPT
11"	EM1.2-11/SF25C	1¼"	250	120	6	2.75	S&N w/box & epoxy seal	1¼"NPT
11″	EM1.2-11/SF25C	1¼"	1000	120	24	2.75	S&N w/box & epoxy seal	1¼"NPT
11"	EM1.2-11/SF25C	1¼"	1000	240	24	2.75	S&N w/box & epoxy seal	1¼"NPT

Cartridge Heaters

Immersion

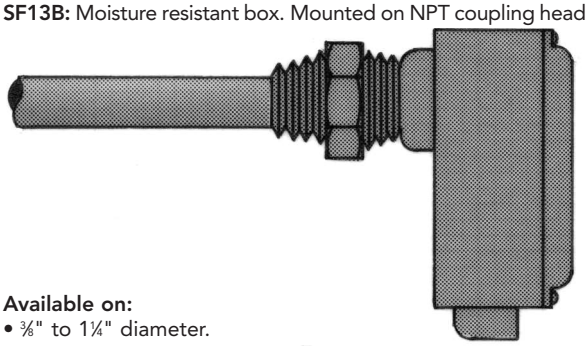
Terminal Enclosure Options

SF13A: General purpose box. NEMA No. 1. 2¾" x 1½" x 1½".



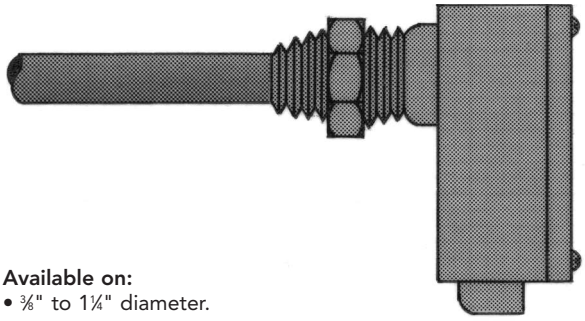
Available on:
- ¼" to 1" diameter.

SF13B: Moisture resistant box. Mounted on NPT coupling head fitting.



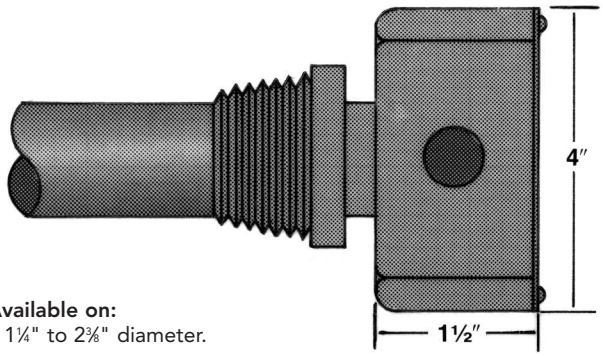
Available on:
- ⅜" to 1¼" diameter.

SF13C: Explosion resistant box. Mounted on NPT coupling head fitting.



Available on:
- ⅜" to 1¼" diameter.

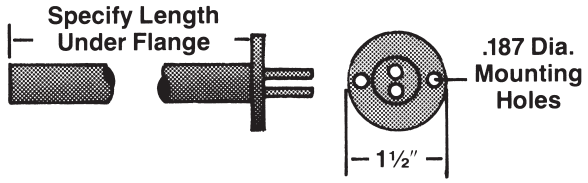
SF13D: General purpose box. NEMA No. 1. Rust resistant steel 4" octagonal.



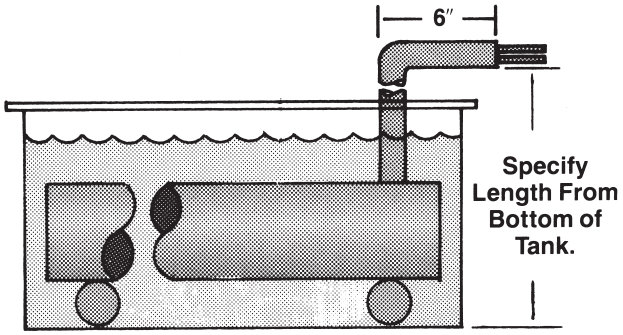
Available on:
- 1¼" to 2⅜" diameter.

Installation Options

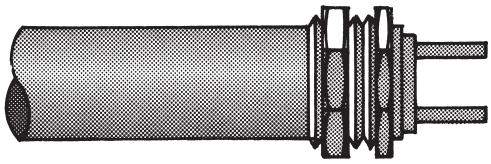
SF26: Stainless steel flange. Mounting hole centers for ¼" to ⅝" diameters is 1⅛" and for ¾" diameter is 1⅝". Special flange sizes available upon request.



SF27: Stainless steel riser and support feet for over the side immersion heaters. Consult factory for availability.



XS76: Straight thread with nut. Specify thread size and if bushing is to be standard (hex outside vessel) or inverted (hex inside vessel).



Voltage

Standard voltages are either 120V or 240V. Other voltages are available.

Tolerances

Wattage tolerance is +5%, -10% at rated voltage.

Length tolerances are ±2% with a ±1/16" minimum.

How to Order

After determining the wattage required and the line voltage available, determine the physical space available for heaters and the numbers of heaters required.

Review page 31 for stock items.

Review other special features, see page 22-27.

Specify: catalog number, wattage, voltage, lead type, bushing type, and special features required.

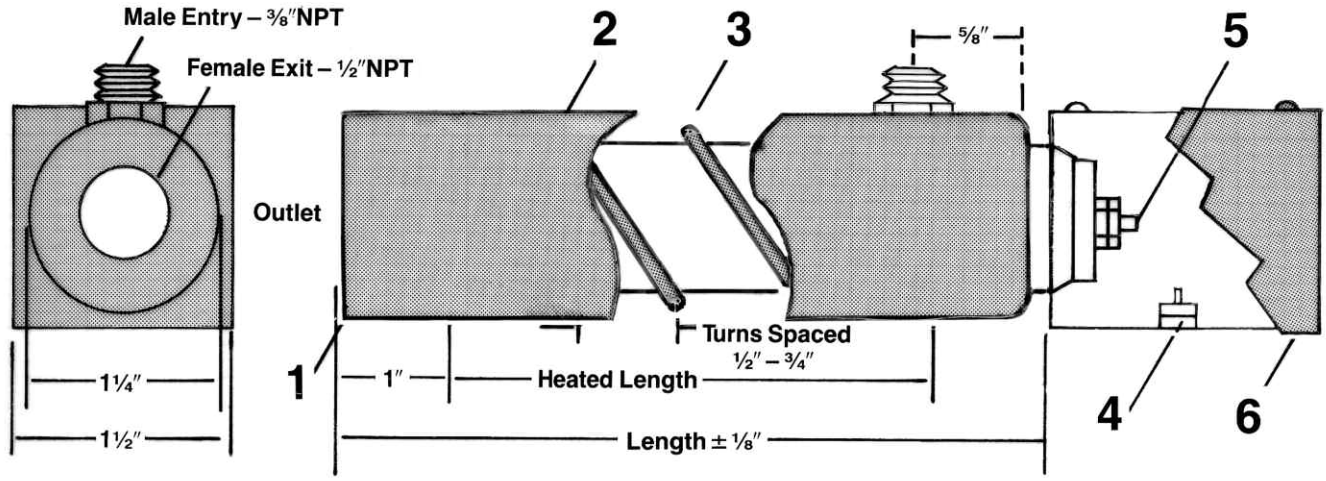
Example: EM62-6/700W240V/SF1-12/SF13A/SF25B.

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Cartridge Heaters

Special Immersion

Mini Circulation



Features:

- The Miniature Circulation Heater is a packaged heater for heating small volumes of liquids as in photographic developer solutions, chemicals, dyes and inks.
- Constructed of 316 series stainless steel.
- Pressures to 100 psig.

Construction:

1 Heliarc weld.

2 Stainless steel sheath.

3 Liquid turbulator wire.

4 Ground post.

5 Post terminals.

6 Connection box. 2¾" x 1½" x 1½".

Specifications

▼ Manfactured Items ▼

Maximum Amperage: 20

Cross Sectional Flow Area: .152 Sq. In.

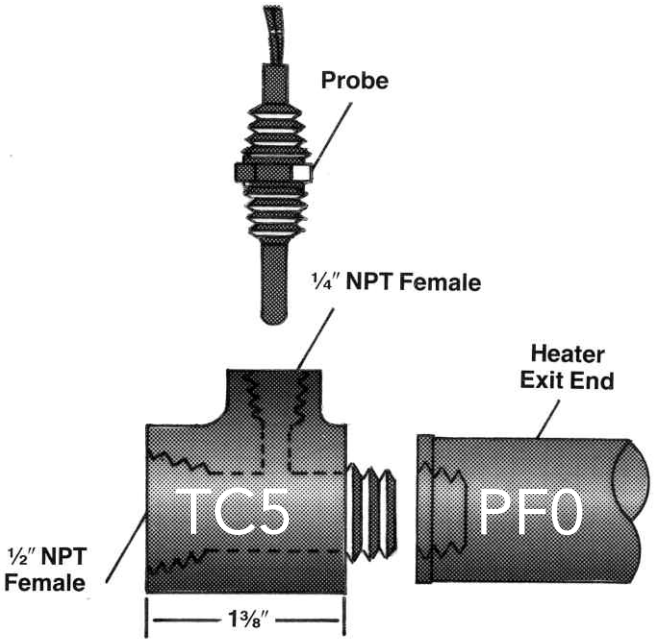
Sizes: Length	Heated Length	Catalog No.	Maximum Wattage
6"	4"	PFO-6	600
8"	6"	PFO-8	900
10"	8"	PFO-10	1200
12"	10"	PFO-12	1500
18"	16"	PFO-18	2400

Above wattages area based on 50 watts per square inch for use with water at low flow. Higher flow rates and/or different liquids will effect allowable watt densities. Consult factory.

Sizes between those listed and larger in diameter are available. Consult factory.

Temperature Control

Thermocouple mounting fitting is available for use with the standard miniature circulation heater. The fitting is threaded into the exit end as shown below. Specify TC-5 fitting. See pages 131-134 for details on temperature controllers and probes.



* Thermistor adapter and catalog number TH-1 must be used for thermistor probe mounting in the TC5 fitting.

Cartridge Heaters

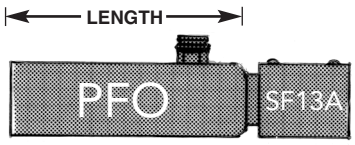
Special Immersion

▼ IN STOCK ITEMS ▼

Pure Flow Air Heaters

Supplied with: Type SF3S terminals Type SF13A enclosure

Length	Cat. No.	Dia.	Wattage	Voltage	Watts/ Linear Inch	Weight	Terminals
6"	PFO-6	1¼"	100	120	23	1.00	S&N w/enclosure
6"	PFO-6	1¼"	400	120	91	1.00	S&N w/enclosure
6"	PFO-6	1¼"	400	240	91	1.00	S&N w/enclosure
8"	PFO-8	1¼"	150	120	23	1.18	S&N w/enclosure
8"	PFO-8	1¼"	600	120	94	1.18	S&N w/enclosure
8"	PFO-8	1¼"	600	240	94	1.18	S&N w/enclosure
10"	PFO-10	1¼"	250	120	30	1.37	S&N w/enclosure
10"	PFO-10	1¼"	1000	120	120	1.37	S&N w/enclosure
10"	PFO-10	1¼"	1000	240	120	1.37	S&N w/enclosure
12"	PFO-12	1¼"	300	120	29	1.55	S&N w/enclosure
12"	PFO-12	1¼"	1200	120	115	1.55	S&N w/enclosure
12"	PFO-12	1¼"	1200	240	115	1.55	S&N w/enclosure





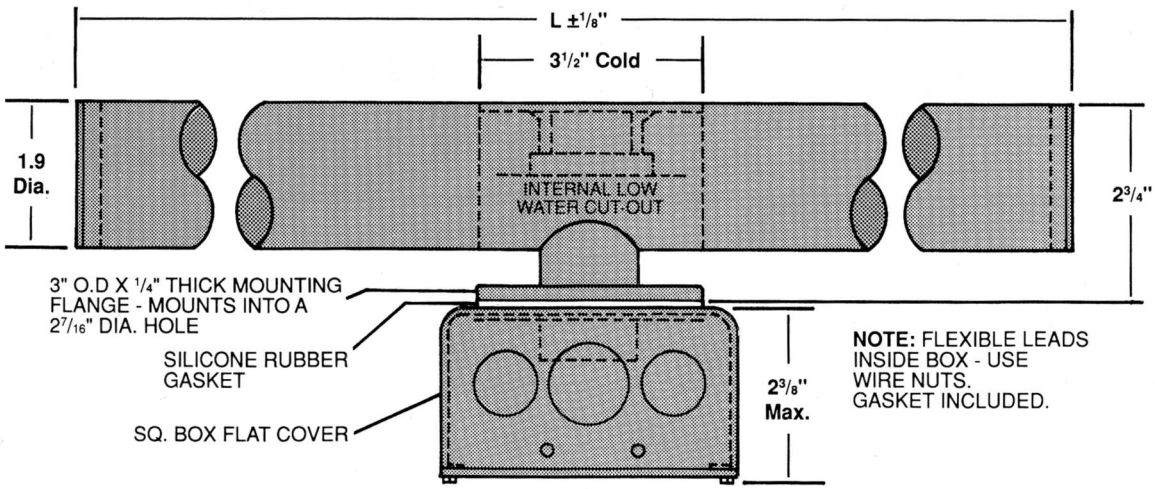
Phone: 978-777-0070 ■ Fax: 978-774-2409

Cartridge Heaters

Special Immersion

U.L. Recognized-E56973





Applications:

- Restaurant Steam Tables
- Humidifiers
- Water Tanks
- UL Recognized component. - E56973
- Food Cookers
- Process Water Heaters

Features:

- All stainless steel with heliarc welds — No copper or braze material in contact with water.
- Patented—Low water protected—Automatic internal high limit—Shuts off heater, then resets itself.
- Flexible hook-up leads for wire nuts.
- Easy to clean.
- Easy mounting through a 2 7/16" diameter (2" knockout) hole in bottom or side of tank — No need for mounting fittings.
- Other sizes and ratings available — Consult factory.

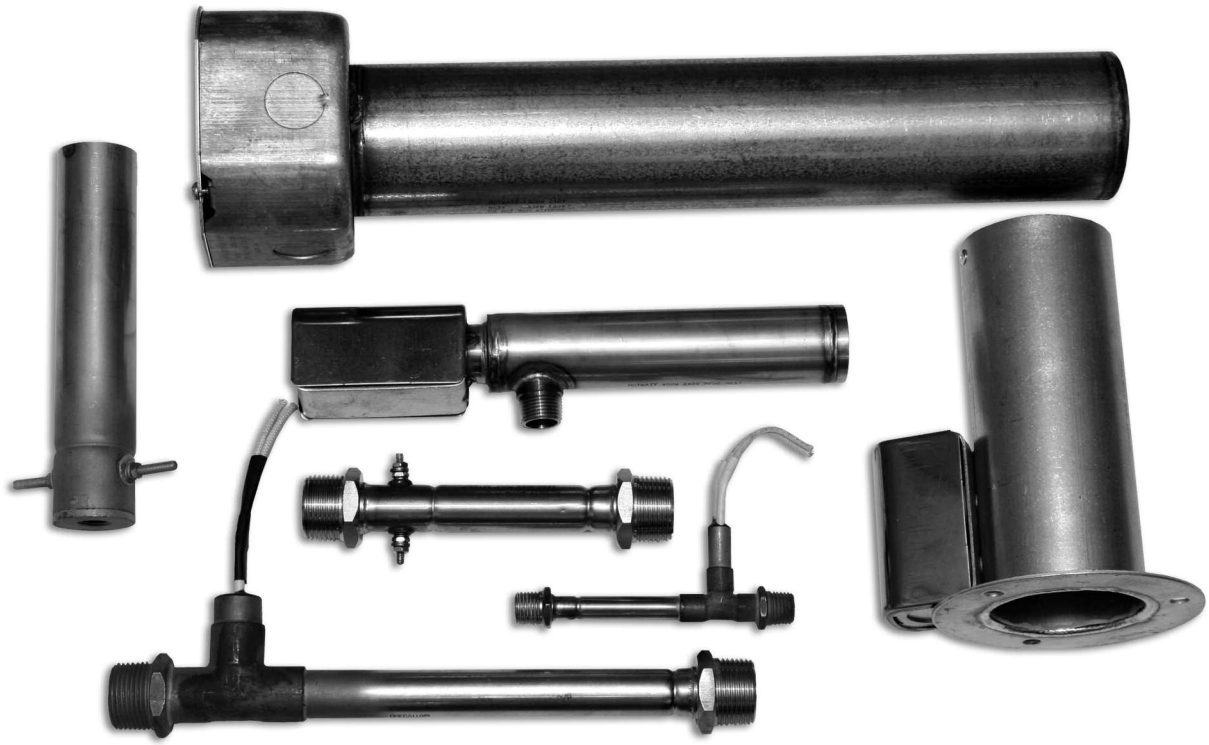
▼ Manfactured Items ▼

L Dim	Catalog Number	K.W.	Volts	Line Amps	Phase
8	WB1511	1.5	120	12.5	1
8	WB1521	1.5	208	7.2	1
8	WB1541	1.5	240	6.3	1
12	WB3011	3	120	25.0	1
12	WB3021	3	208	14.4	1
12	WB3041	3	240	12.5	1
14	WB4021	4	208	19.2	1
14	WB4041	4	240	16.7	1
14	WB4051	4	480	8.3	1
18	WB5021	5	208	24.0	1
18	WB5041	5	240	20.8	1
18	WB5051	5	480	10.4	1
18	WB5023	5	208	13.9	3
18	WB5043	5	240	12.0	3
18	WB5053	5	480	6.0	3
22	WB7023	7	208	19.4	3
22	WB7043	7	240	16.8	3
22	WB7053	7	480	8.4	3

How To Order

- Specify Catalog Number from table above.

Air Process Heaters



Applications

Baking, Drying, Laminating, Metal Working, Packaging, Plastic Welding, Preheating, Sealing, Soldering, Shrink Fitting, Synthetic Fabric Sewing.

Features

- The Air Process heater will provide hot air and gas up to 1000°F(540°C) with infinite control by varying the voltage and air velocity supplied. Units are fitted with a tubing "T" for convenient power lead outlet, while larger diameters can be supplied with post terminals on the sheath for direct electrical connections.
- For easier installation, Hotwatt can supply male or female NPT threaded fittings, hose adapters, flanges, or custom fittings to your specifications.
- Made in U.S.A.

Multiple Heat

Whenever it is necessary to have a single unit incorporate two or more different wattages, Hotwatt will provide air heaters from ⅝" diameter and up with multiple circuits. Some uses of these units include: quick heat-up, standby circuits for maintenance of low temperatures, providing different wattages when there is a wide variation in thermal loads, and replacing more expensive variable powerstats for wattage control.

Tolerances

Wattage tolerances are held to +5, -10% or better at the voltage specified.

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Air Process Heaters

Tee Type — ⅜" to 1¼" diameter

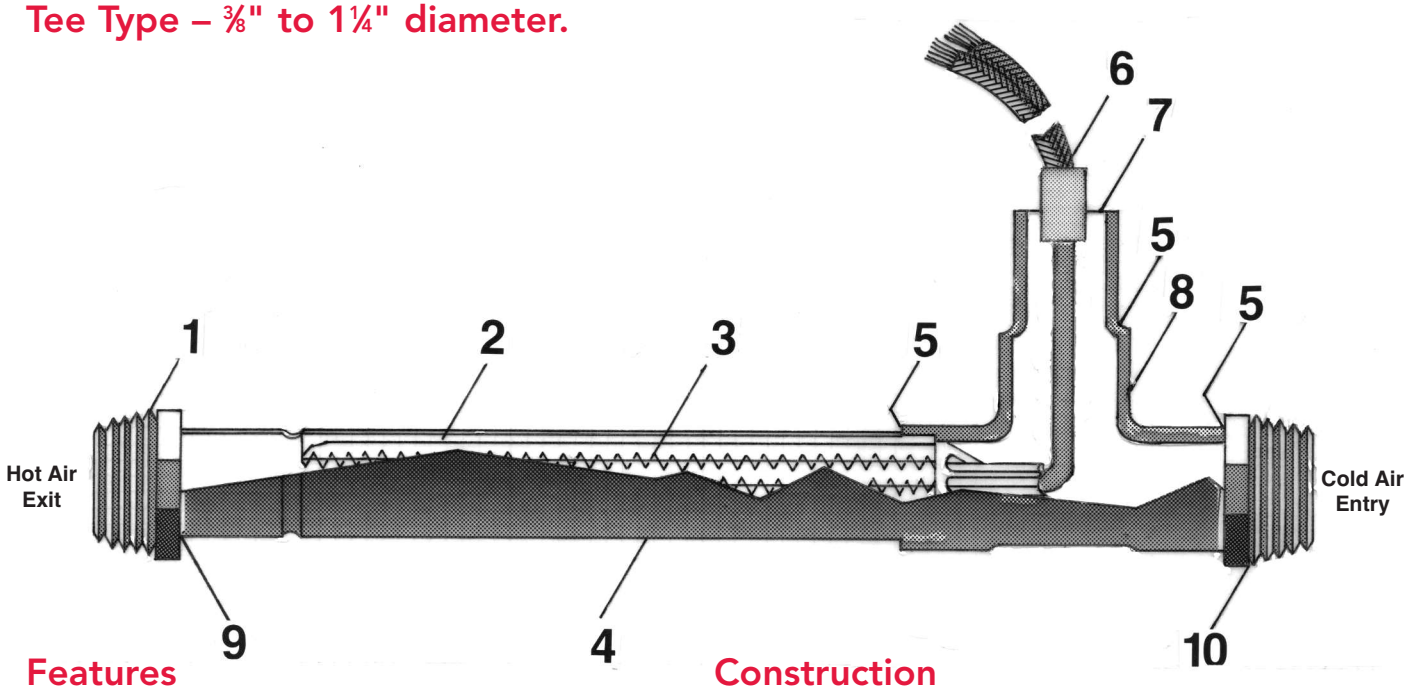
Air Heater Selection

- Determine the volume of air or gas(SCFM) you will be heating.
- Determine temperature rise in degrees Fahrenheit(ΔT°F).
- Calculate wattage required as follows:

$$\text{Watts} = \frac{\text{SCFM} \times \Delta T°F}{3}$$

- Take into consideration the physical size requirements of your application and determine from the specifications chart for each size, the air heater best suited for your application. High watt densities shown in the specifications charts are subject to factory approval due to resistance wire limitations.
- For temperature control, see page 54 and131-134.

Tee Type – ⅜" to 1¼" diameter.



Features

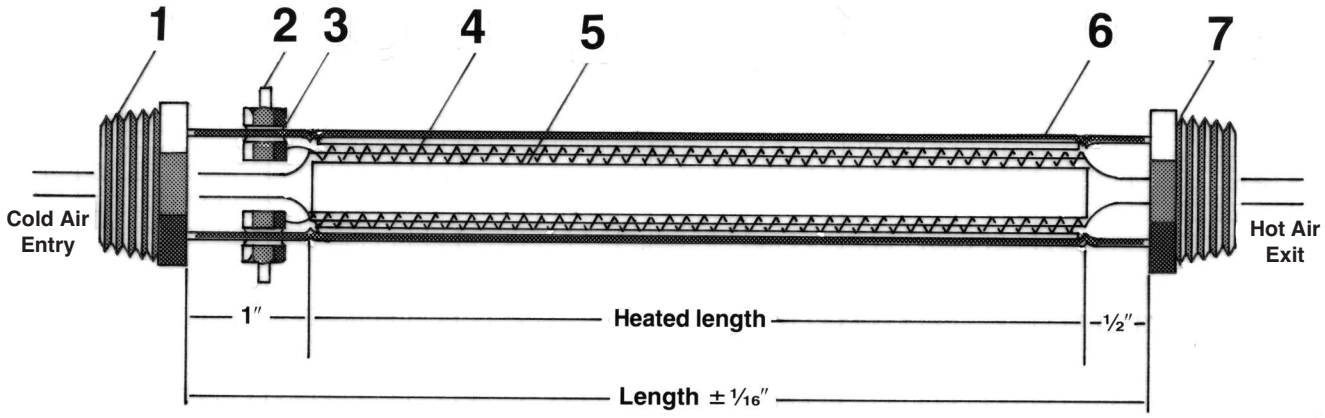
- Exit air temperatures to 1000°F (540°C).
- Standard pressure rating is 80 psig at room temperature.
- May be used with recirculating air up to 250°F (121°C).
- Designed for horizontal use.
- For use with clean, dry air.
- Made in U.S.A.

Construction

1 **Optional** stainless steel bushing.
2 Ceramic coil support.
3 Resistance element.
4 Stainless steel sheath.
5 Silver solder.
6 Fiberglass insulated leads.
7 Epoxy seal.
8 Copper tee.
9 Heliarc weld.
10 **Optional** brass bushing.

Air Process Heaters

Alternate Style – ¾" to 1¼" diameter.



Features

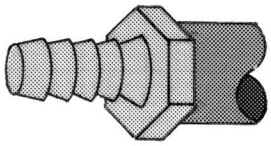
- Low pressure applications.
- Post type terminals.
- Specify 'SF3' for alternate style.

Construction

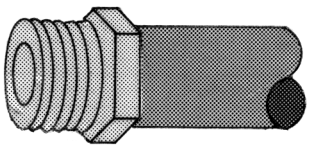
1 **Optional** brass bushing.
2 Post terminals.
3 Mica insulation.
4 Resistance element.
5 Ceramic coil support.
6 Stainless steel sheath.
7 **Optional** st. st. bushing.

Optional Fittings

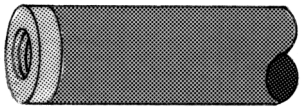
HF: Hose adapter (entry only).



MF: Male fittings.



FF: Female fittings.



How To Order

After determining the wattage required for application, select heater based upon physical space available, maximum SCFM, temperature, and pressure as shown on the following pages.

Tee Type Air Heaters are supplied with 6" (SF2) leads, all other models with Post (SF3) terminals. Longer leads are available upon request. Specify length required if other than standard.

Review stock list for in-stock items.

Specify: catalog number, wattage, voltage, and special features if required. Be sure to specify optional fitting number as suffix to base catalog number.

Example: AH50-5MF/300W120V/SF2-36.

Special Features Available.

Phone: 978-777-0070 ■ Fax: 978-774-2409

Air Process Heaters

⅜" Diameter – Horizontal use only

Construction

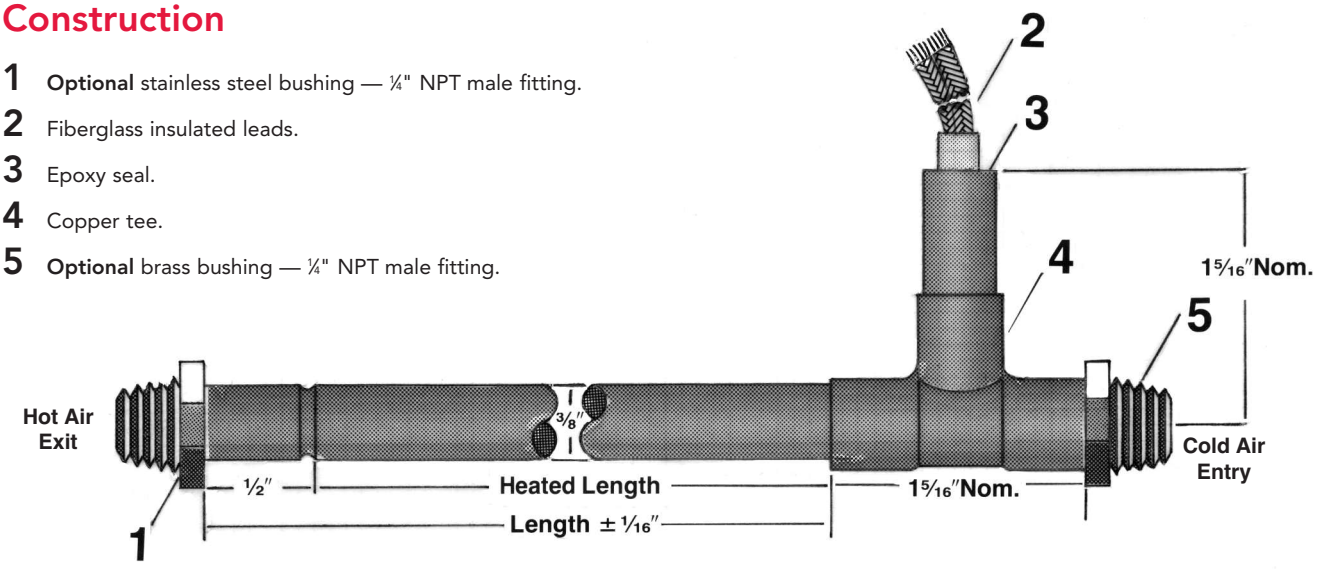
1 **Optional** stainless steel bushing — ¼" NPT male fitting.

2 Fiberglass insulated leads.

3 Epoxy seal.

4 Copper tee.

5 **Optional** brass bushing — ¼" NPT male fitting.



▼ Manfactured Items ▼

Specifications

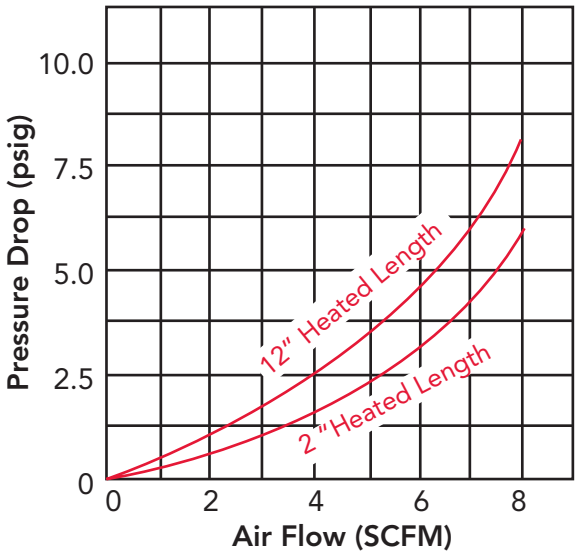
Maximum Amperage: 6

Cross Sectional Flow Area: .03 sq. in.

Maximum CFM: 8

CFM	Max. Watts/linear in of heated length
1	60
2	60
4	100
6	150
8	200

Pressure rating: 80 psig.



Sizes

Diameter: ⅜"

Length	Heated Length	Cat. No. w/o fittings	Cat. No. w/Male NPT fittings
2"	1½"	AH37-2	AH37-2MF
3"	2½"	AH37-3	AH37-3MF
4"	3½"	AH37-4	AH37-4MF
5"	4½"	AH37-5	AH37-5MF
6"	5½"	AH37-6	AH37-6MF
7"	6½"	AH37-7	AH37-7MF
8"	7½"	AH37-8	AH37-8MF
9"	8½"	AH37-9	AH37-9MF
10"	9½"	AH37-10	AH37-10MF

Special Features Available

MF: ¼" NPT male fittings (add MF to catalog number).

HF: Hose adapter on entry and only (add HF to catalog number and specify I.D. of hose).

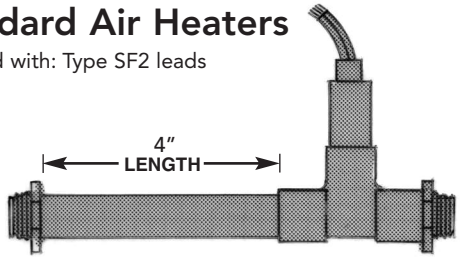
AIR

Air Process Heaters

▼ IN STOCK ITEMS ▼

Standard Air Heaters

Supplied with: Type SF2 leads



Length	Cat. No.	Dia.	Wattage	Voltage	Watts/ Linear Inch	Weight	Lead Length	Fittings
4"	AH37-4	⅜"	50	120	14	.12	12"	
4"	AH37-4MF	⅜"	50	120	14	.18	12"	¼" NPT
4"	AH37-4	⅜"	200	120	57	.12	12"	
4"	AH37-4MF	⅜"	200	120	57	.18	12"	¼" NPT
4"	AH37-4	⅜"	200	240	57	.12	12"	
4"	AH37-4MF	⅜"	200	240	57	.18	12"	¼" NPT

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Air Process Heaters

½" Diameter – Horizontal use only

Construction

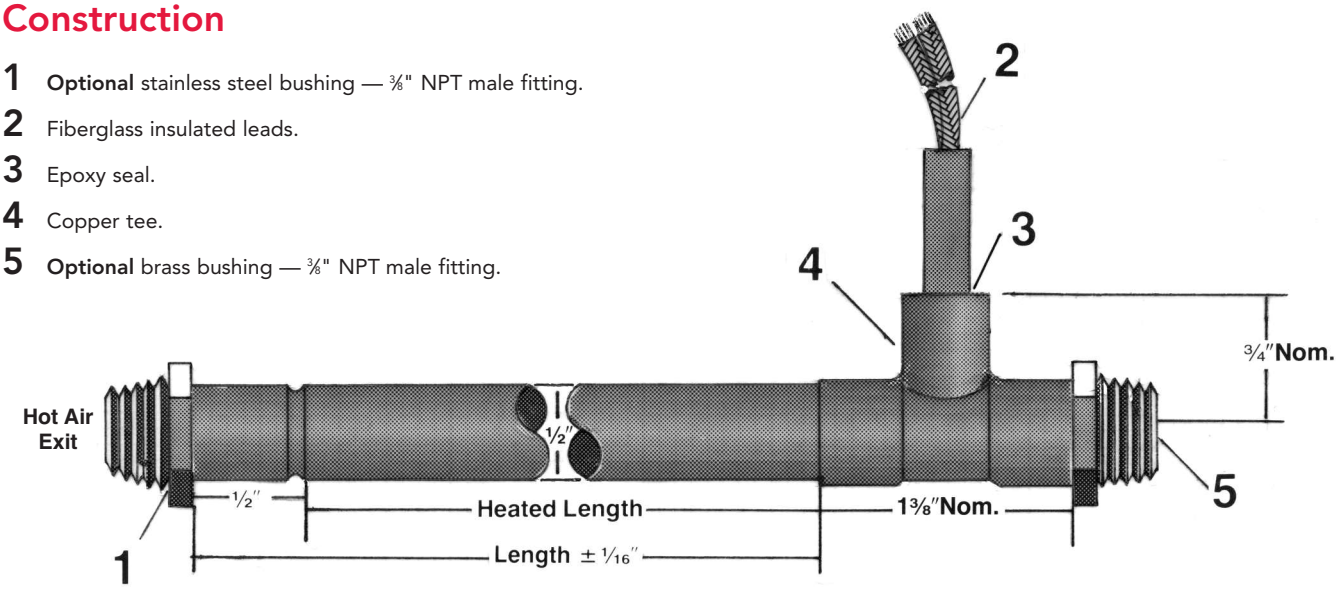
1 **Optional** stainless steel bushing — ⅜" NPT male fitting.

2 Fiberglass insulated leads.

3 Epoxy seal.

4 Copper tee.

5 **Optional** brass bushing — ⅜" NPT male fitting.



▼ Manfactured Items ▼

Specifications

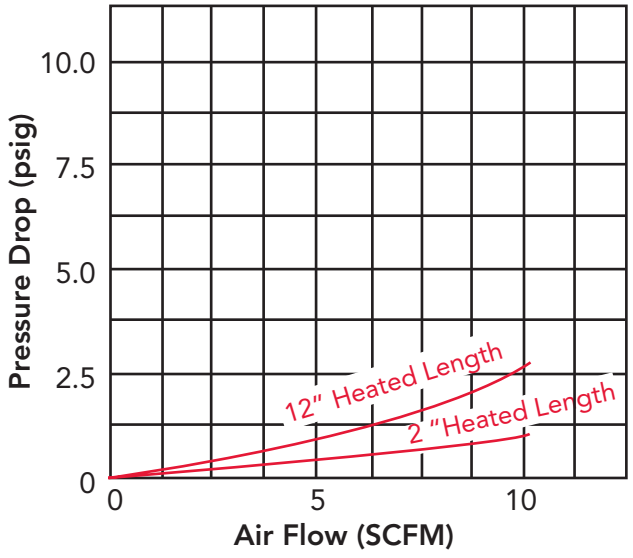
Maximum Amperage: 10

Cross Sectional Flow Area: .036 sq. in.

Maximum CFM: 10

CFM	Max. Watts/linear in of heated length
1	80
2	80
4	100
6	150
8	200
10	250

Pressure rating: 80 psig.



Sizes

Diameter: ½"

Length	Heated Length	Cat. No. w/o fittings	Cat. No. w/Male NPT fittings
2"	1½"	AH50-2	AH50-2MF
3"	2½"	AH50-3	AH50-3MF
4"	3½"	AH50-4	AH50-4MF
5"	4½"	AH50-5	AH50-5MF
6"	5½"	AH50-6	AH50-6MF
7"	6½"	AH50-7	AH50-7MF
8"	7½"	AH50-8	AH50-8MF
9"	8½"	AH50-9	AH50-9MF
10"	9½"	AH50-10	AH50-10MF

Special Features Available

MF: ⅜" NPT male fittings (add MF to catalog number).

FF: ⅛" NPT female fittings (add FF to catalog number).

HF: Hose adapter on entry end only (add HF to catalog number and specify I.D. of hose).

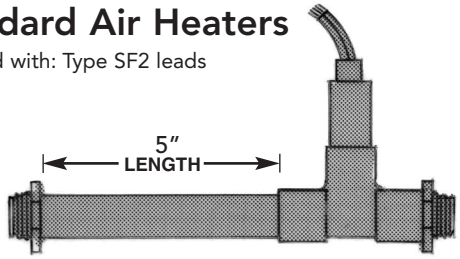
AIR

Air Process Heaters

▼ IN STOCK ITEMS ▼

Standard Air Heaters

Supplied with: Type SF2 leads



Length	Cat. No.	Dia.	Wattage	Voltage	Watts/ Linear Inch	Weight	Lead Length	Fittings
5"	AH50-5	½"	100	120	22	.18	12"	
5"	AH50-5MF	½"	100	120	22	.25	12"	⅜" NPT
5"	AH50-5	½"	400	120	88	.18	12"	
5"	AH50-5MF	½"	400	120	88	.25	12"	⅜" NPT
5"	AH50-5	½"	400	240	88	.18	12"	
5"	AH50-5MF	½"	400	240	88	.25	12"	⅜" NPT

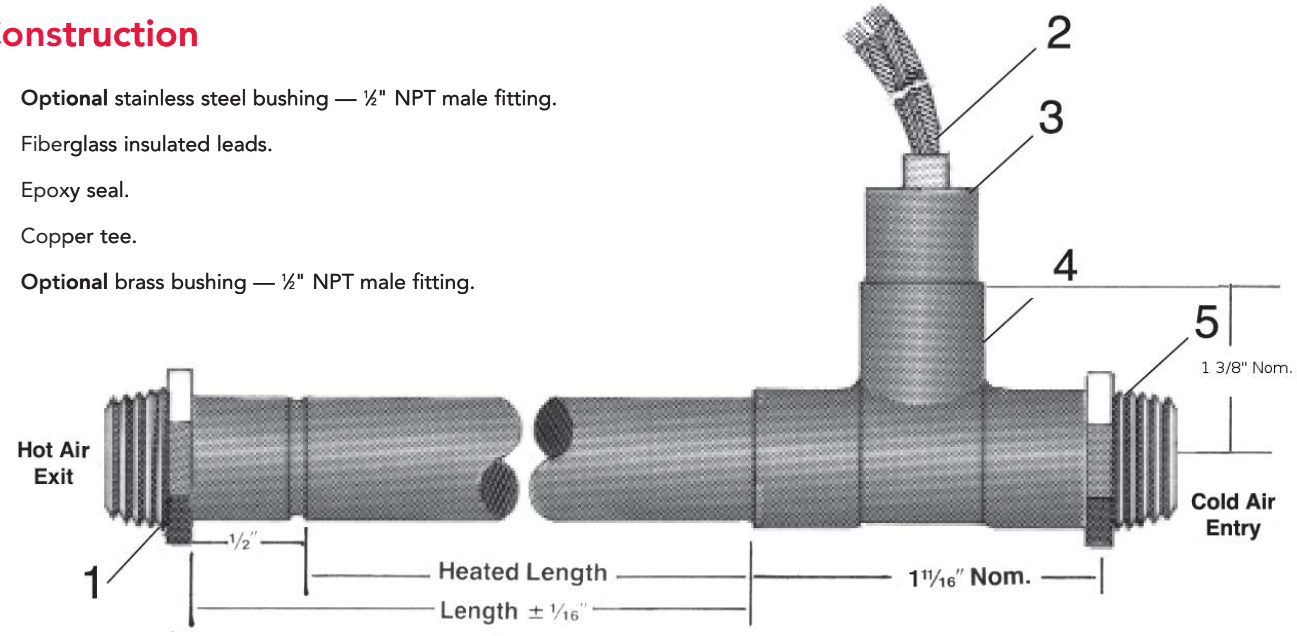
Phone: 978-777-0070 ■ Fax: 978-774-2409

Air Process Heaters

⅝" Diameter – Horizontal use only

Construction

1. **Optional** stainless steel bushing — ½" NPT male fitting.
2. Fiberglass insulated leads.
3. Epoxy seal.
4. Copper tee.
5. **Optional** brass bushing — ½" NPT male fitting.



▼ Manfactured Items ▼

Specifications

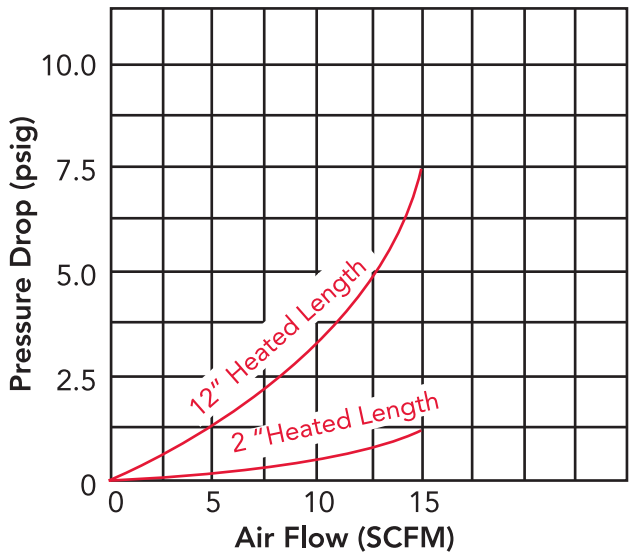
Maximum Amperage: 15

Cross Sectional Flow Area: .072 sq. in.

Maximum CFM: 15

CFM	Max. Watts/linear in of heated length
1	100
2	100
4	100
6	150
8	200
10	250
15	375

Pressure rating: 80 psig.



Sizes

Diameter: ⅝"

Length	Heated Length	Cat. No. w/o fittings	Cat. No. w/Male NPT fittings
3"	2½"	AH62-3	AH62-3MF
4"	3½"	AH62-4	AH62-4MF
5"	4½"	AH62-5	AH62-5MF
6"	5½"	AH62-6	AH62-6MF
7"	6½"	AH62-7	AH62-7MF
8"	7½"	AH62-8	AH62-8MF
9"	8½"	AH62-9	AH62-9MF
10"	9½"	AH62-10	AH62-10MF
12"	11½"	AH62-12	AH62-12MF

Special Features Available

MF: ½" NPT male fittings (add MF to catalog number).

FF: ¼" NPT female fittings (add FF to catalog number).

HF: Hose adapter on entry and only (add HF to catalog number and specify I.D. of hose).

SF-28: Three Phase

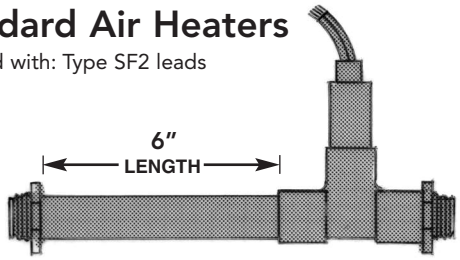
SF-29: Multiple Heat circuits — Specify wattages

Air Process Heaters

▼ IN STOCK ITEMS ▼

Standard Air Heaters

Supplied with: Type SF2 leads



Length	Cat. No.	Dia.	Wattage	Voltage	Watts/ Linear Inch	Weight	Lead Length	Fittings
6"	AH62-6	⅝"	165	120	30	.35	12"	
6"	AH62-6MF	⅝"	165	120	30	.70	12"	½" NPT
6"	AH62-6	⅝"	650	120	118	.35	12"	
6"	AH62-6MF	⅝"	650	120	118	.70	12"	½" NPT
6"	AH62-6	⅝"	650	240	118	.35	12"	
6"	AH62-6MF	⅝"	650	240	118	.70	12"	½" NPT

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Air Process Heaters

¾" Diameter – Horizontal use only

Construction

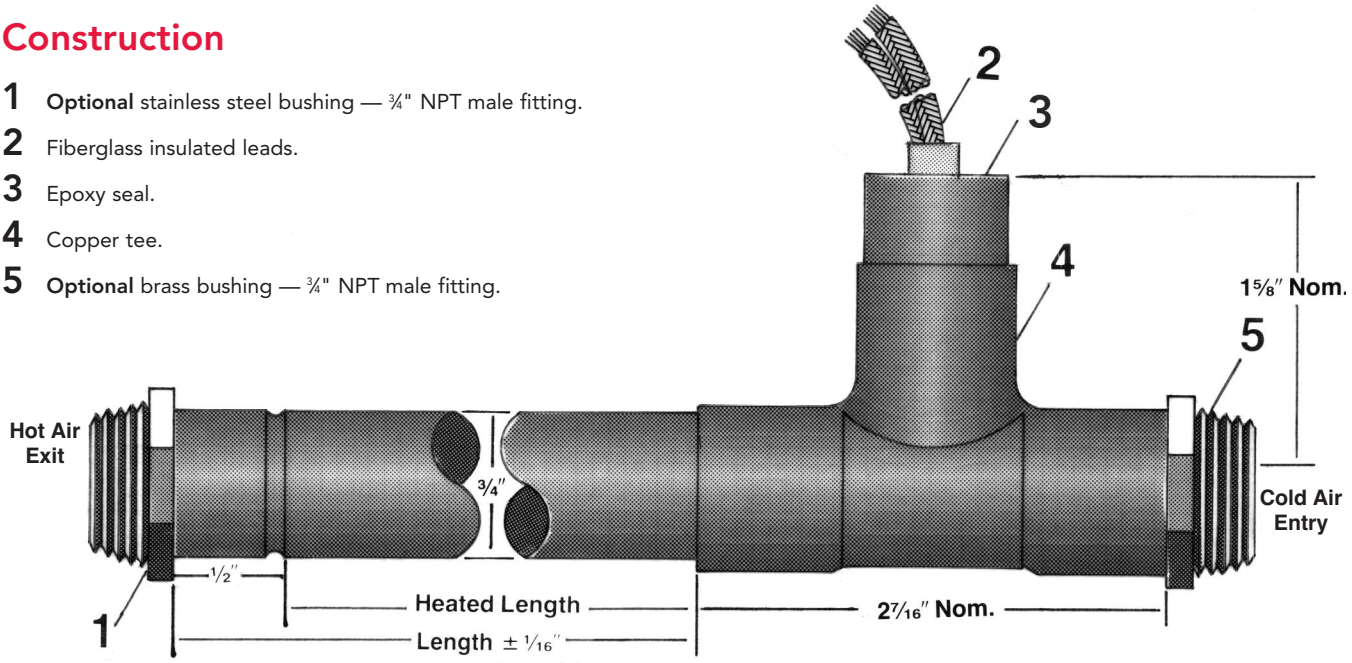
1 **Optional** stainless steel bushing — ¾" NPT male fitting.

2 Fiberglass insulated leads.

3 Epoxy seal.

4 Copper tee.

5 **Optional** brass bushing — ¾" NPT male fitting.



▼ Manfactured Items ▼

Specifications

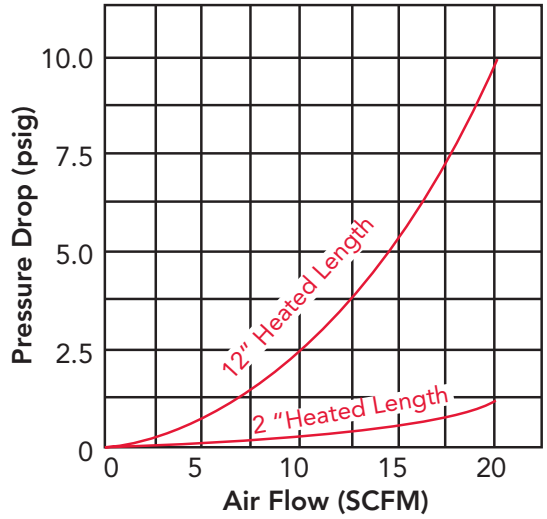
Maximum Amperage: 20

Cross Sectional Flow Area: .126 sq. in.

Maximum CFM: 20

CFM	Max. Watts/linear in of heated length
1	120
2	120
4	120
6	150
8	200
10	250
15	375
20	500

Pressure rating: 80 psig.



Sizes

Diameter: ¾"

Length	Heated Length	Cat. No. w/o fittings	Cat. No. w/Male NPT fittings
3"	2½"	AH75-3	AH75-3MF
4"	3½"	AH75-4	AH75-4MF
5"	4½"	AH75-5	AH75-5MF
6"	5½"	AH75-6	AH75-6MF
7"	6½"	AH75-7	AH75-7MF
8"	7½"	AH75-8	AH75-8MF
9"	8½"	AH75-9	AH75-9MF
10"	9½"	AH75-10	AH75-10MF
12"	11½"	AH75-12	AH75-12MF

Special Features Available

MF: ¾" NPT male fittings (add MF to catalog number).

FF: ¼" NPT female fittings (add FF to catalog number).

HF: Hose adapter on entry and only (add HF to catalog number and specify I.D. of hose).

SF-3: Alternate style — Post terminals

SF-28: Three Phase

SF-29: Multiple Heat circuits — Specify wattages

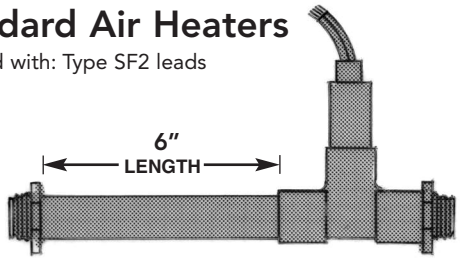
SF-32: High voltage (above 250V — consult factory)

Air Process Heaters

▼ IN STOCK ITEMS ▼

Standard Air Heaters

Supplied with: Type SF2 leads



Length	Cat. No.	Dia.	Wattage	Voltage	Watts/ Linear Inch	Weight	Lead Length	Fittings
6"	AH75-6	¾"	190	120	34	.43	12"	
6"	AH75-6MF	¾"	190	120	34	.68	12"	¾" NPT
6"	AH75-6	¾"	750	120	136	.43	12"	
6"	AH75-6MF	¾"	750	120	136	.68	12"	¾" NPT
6"	AH75-6	¾"	750	240	136	.43	12"	
6"	AH75-6MF	¾"	750	240	136	.68	12"	¾" NPT

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Air Process Heaters

1¼" Diameter – Horizontal use only

Construction

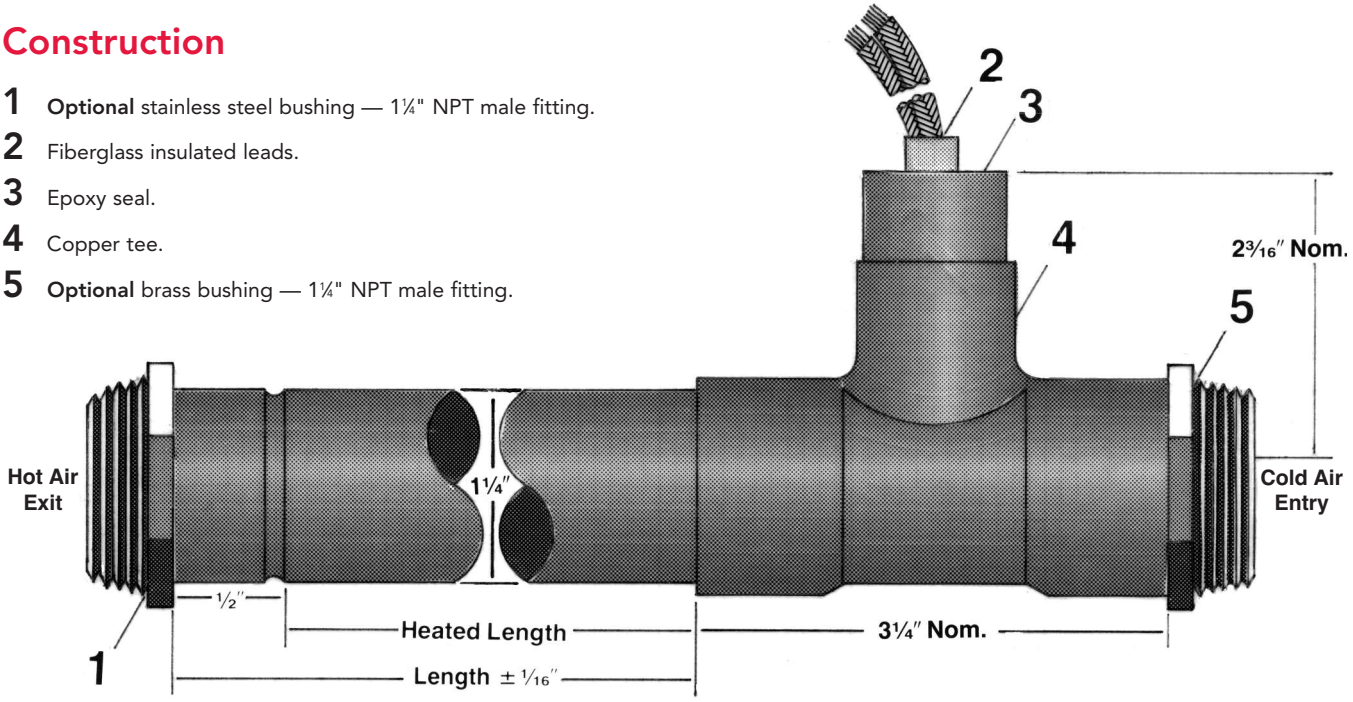
1 **Optional** stainless steel bushing — 1¼" NPT male fitting.

2 Fiberglass insulated leads.

3 Epoxy seal.

4 Copper tee.

5 **Optional** brass bushing — 1¼" NPT male fitting.



▼ Manfactured Items ▼

Specifications

Maximum Amperage: 25

Cross Sectional Flow Area: .348 sq. in.

Maximum CFM: 50

CFM	Max. Watts/linear in of heated length
1	200
2	200
4	200
6	200
8	200
10	250
15	375
20	500
25	625
30	750
35	875
40	1000
50	1250

Pressure rating: 80 psig.

Special Features Available

MF: 1¼" NPT male fittings (add MF to catalog number).

FF: ½" NPT female fittings (add FF to catalog number).

HF: Hose adapter on entry and only (add HF to catalog number and specify I.D. of hose).

SF-3: Alternate style — Post terminals

SF-28: Three Phase

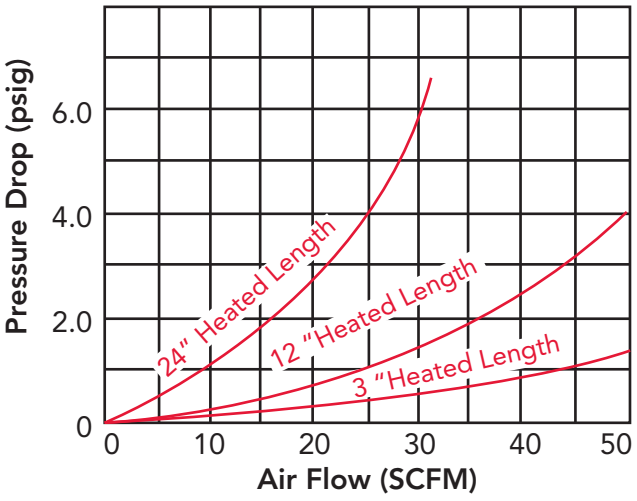
SF-29: Multiple Heat circuits — Specify wattages

SF-32: High voltage (above 250V — consult factory)

Sizes

Diameter: 1¼"

Length	Heated Length	Cat. No. w/o fittings	Cat. No. w/Male NPT fittings
4"	3½"	AH1.2-4	AH1.2-4MF
5"	4½"	AH1.2-5	AH1.2-5MF
6"	5½"	AH1.2-6	AH1.2-6MF
7"	6½"	AH1.2-7	AH1.2-7MF
8"	7½"	AH1.2-8	AH1.2-8MF
9"	8½"	AH1.2-9	AH1.2-9MF
10"	9½"	AH1.2-10	AH1.2-10MF
12"	11½"	AH1.2-12	AH1.2-12MF
14"	13½"	AH1.2-14	AH1.2-14MF

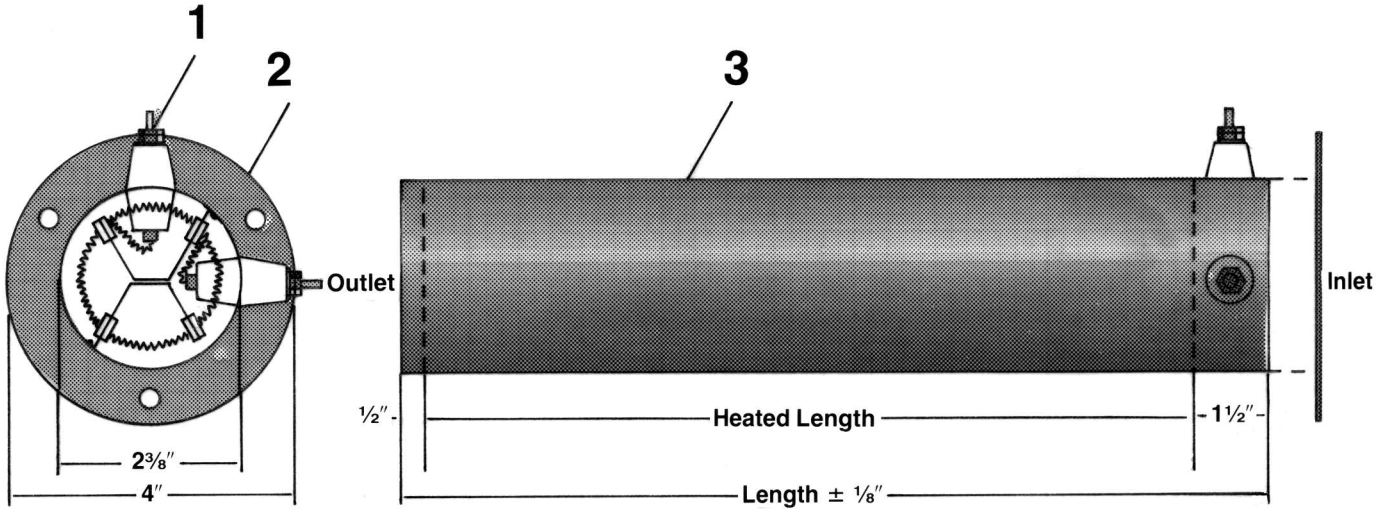


AIR

Air Process Heaters

Maximum Flow

U.L. Recognized - E56973
CSA Certified - 016386-0-000



Features

- This Maximum Flow Air Heater design is encased within a 2⅜" O.D. tube with a cross frame heating element for minimum resistance to air flow. It has a practical operating range of up to 200CFM with temperatures to to 600°F (315°C).
- For easier mounting. Hotwatt can supply a 4"O.D. mounting flange on one or both ends.
- The heater is available in either aluminum or stainless steel.
- Its design features include a nickel-chrome heating element insulated by ceramic beads on a stainless steel support frame, firmly secured to the inside of the tube.
- Designed for high volume and moderate temperature.
- Low pressure for use with blowers and recirculating air.
- Made in U.S.A.

Specifications

Maximum Amperage: 15
Cross Sectional Flow Area: 3.5 sq. in.

Aluminum Sheath		Stainless Steel Sheath	
CFM	Max. Watts/linear in. of heated length	CFM	Max. Watts/linear in. of heated length
1	150	1	150
2	150	2	150
4	150	4	150
6	150	6	150
8	150	8	150
10	150	10	150
20	175	20	250
30	275	30	375
40	350	40	475
50	450	50	600
60	525		

Applications

Baking, Drying, Packaging, and preheating.

Construction

1 Post Terminals.

2 **Optional** flanges–4"O.D. with three 9/32" diameter holes equally spaced on 3.250 circle–one or both ends.

3 Standard aluminum sheath – optional stainless steel sheath.

▼ Manfactured Items ▼

Sizes

Length	Heated Length	Cat. No.	Cat. No. 4" O.D. flange at entry end only
6"	4"	MA0-6	MA0-6F1
8"	6"	MA0-8	MA0-8F1
10"	8"	MA0-10	MA0-10F1
12"	10"	MA0-12	MA0-12F1
14″	12″	MA0-14	MA0-14F1
18"	16"	MA0-18	MA0-18F1
24"	22"	MA0-24	MA0-24F1

• 3 Phase not available in this unit.
Consult factory for:
Current ratings above 15 amps.
Wattages above 300 watts per linear inch.
Longer lengths and larger sizes available.

Special Features:

Add suffix to catalog number

F1: Optional flange inlet end.

F2: Optional flanges each end.

SF37: Stainless steel sheath.

Phone: 978-777-0070 ■ Fax: 978-774-2409

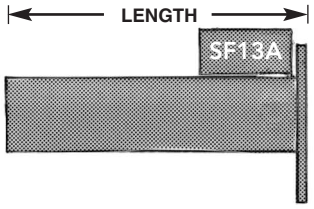
Air Process Heaters

Maximum Flow

▼ IN STOCK ITEMS ▼

Maximum Flow Heaters: with standard entry flange.

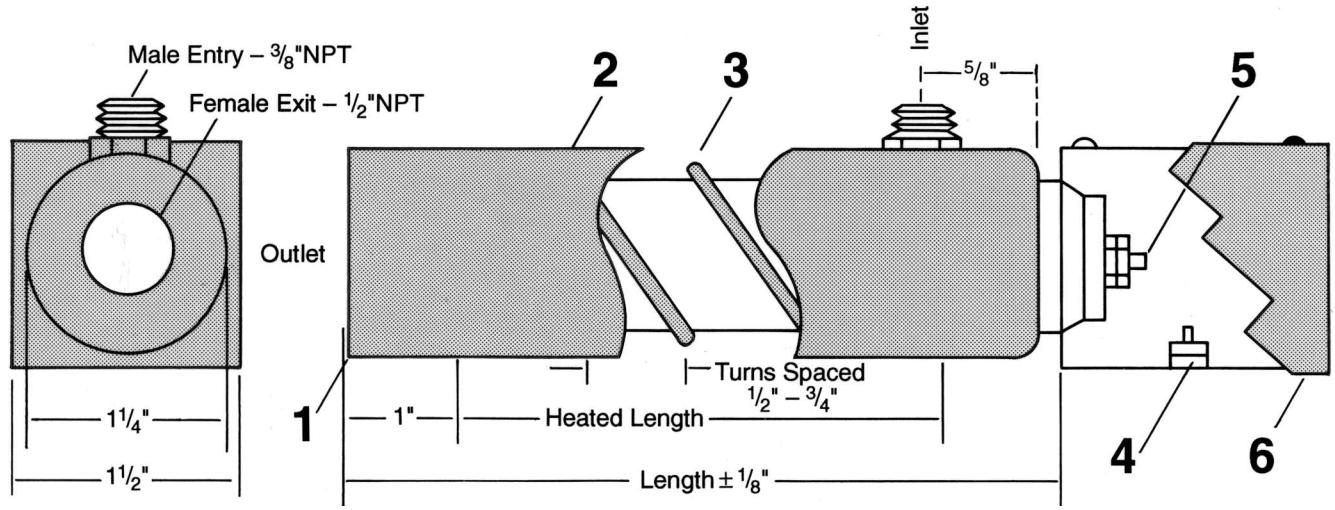
Supplied with: Type SF3 terminals. Type SF13A enclosure.



Length	Cat. No.	Dia.	Wattage	Voltage	Watts/ Linear Inch	Weight	Terminals
6"	MA0-6F1	2⅜"	600	120	150	1.00	S&N w/enclosure
10"	MA0-10F1	2⅜"	1000	120	125	1.25	S&N w/enclosure
12"	MA0-12F1	2⅜"	375	120	38	1.50	S&N w/enclosure
12"	MA0-12F1	2⅜"	1500	240	150	1.50	S&N w/enclosure
14"	MA0-14F1	2⅜"	500	120	42	1.75	S&N w/enclosure
14"	MA0-14F1	2⅜"	2000	240	166	1.75	S&N w/enclosure

Air Process Heaters

Pure Flow



AIR

Features

- The Pure Flow Air Heater is designed for applications where clean air is necessary, as in laboratories and environmental testing areas.
- This heater is unique in supplying non-contaminated heated air. The stream of air is heated by passing over an enclosed heated surface rather than directly over exposed resistance elements. This method assures that no foreign matter will enter the stream of flow.
- Constructed of 316 Stainless Steel.
- It has an operating range of up to 15 CFM with temperatures to 800°F (430°C).
- For temperature control, see page 54 and 131-134.
- Pressure rating: 100 psig.
- Made in U.S.A.

Construction

1 Heliarc weld.

2 Stainless steel sheath.

3 Air turbulator wire.

4 Ground post.

5 Post terminals.

6 Connection box. 2 ¾" x 1½" x 1½". NEMA1.

Specifications

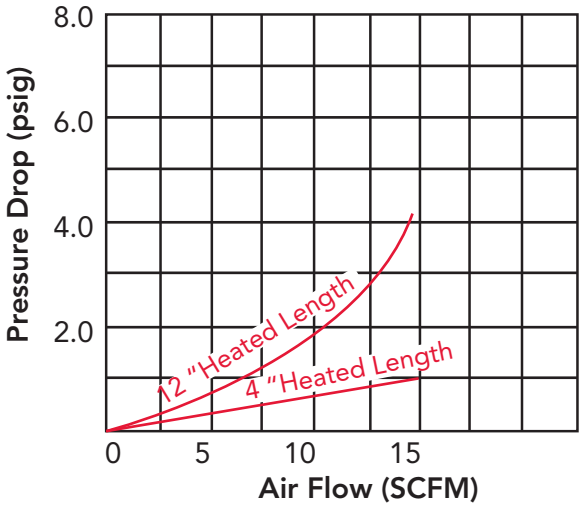
Maximum Amperage: 20

Cross Sectional Flow Area: .152 sq. in.

Maximum CFM: 15

CFM	Max. Watts/linear in of heated length
1	75
2	100
4	150
6	200
8	200
10	250
15	275

Pressure rating: 100 psig.



▼ Manfactured Items ▼

Sizes

Length	Heated Length	Catalog No.
6"	4"	PFO-6
8"	6"	PFO-8
10"	8"	PFO-10
12"	10"	PFO-12
18"	16"	PFO-18
24"	22"	PFO-24

Phone: 978-777-0070 ■ Fax: 978-774-2409

Air Process Heaters

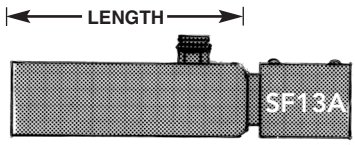
Pure Flow

▼ IN STOCK ITEMS ▼

Pure Flow Air Heaters

Supplied with: Type SF3S terminals Type SF13A enclosure

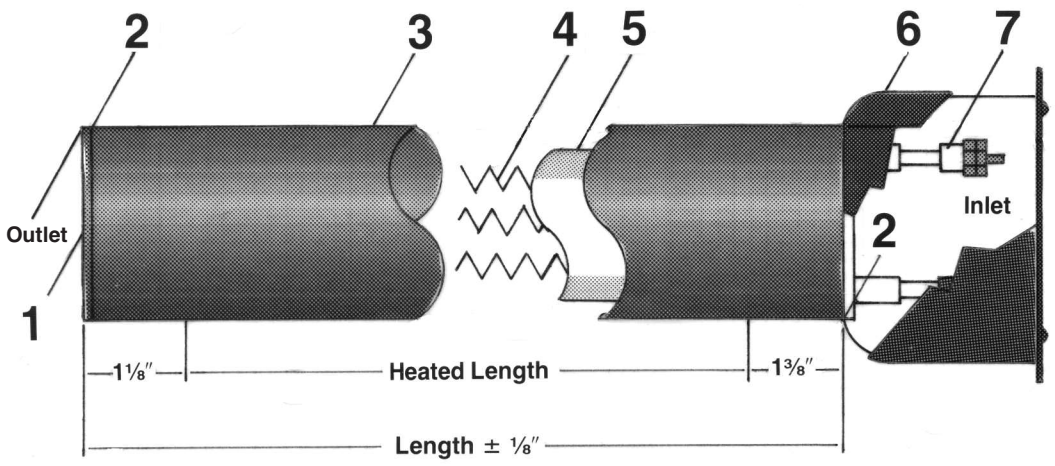
Length	Cat. No.	Dia.	Wattage	Voltage	Watts/ Linear Inch	Weight	Terminals
6"	PFO-6	1¼"	100	120	23	1.00	S&N w/enclosure
6"	PFO-6	1¼"	400	120	91	1.00	S&N w/enclosure
6"	PFO-6	1¼"	400	240	91	1.00	S&N w/enclosure
8"	PFO-8	1¼"	150	120	23	1.18	S&N w/enclosure
8"	PFO-8	1¼"	600	120	94	1.18	S&N w/enclosure
8"	PFO-8	1¼"	600	240	94	1.18	S&N w/enclosure
10"	PFO-10	1¼"	250	120	30	1.37	S&N w/enclosure
10"	PFO-10	1¼"	1000	120	120	1.37	S&N w/enclosure
10"	PFO-10	1¼"	1000	240	120	1.37	S&N w/enclosure
12"	PFO-12	1¼"	300	120	29	1.55	S&N w/enclosure
12"	PFO-12	1¼"	1200	120	115	1.55	S&N w/enclosure
12"	PFO-12	1¼"	1200	240	115	1.55	S&N w/enclosure

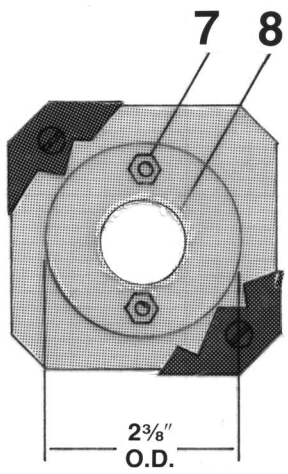


Air Process Heaters

Heavy Duty–Horizontal use only







Features

- This high temperature, moderate volume air heater is principally designed for continuous high temperature operations up to 1200°F (650°C), while supplying a good flow rate up to and in excess of 50 CFM.
- This heater is especially suited for vacuum and pressure environments, as well as other applications where a heavy duty construction is desirable.
- Its design features include a nickel chromium heating element supported inside of a high quality ceramic core. Its outside sheath is stainless steel with heliarc welded and fittings. Its terminals are a high quality ceramic-to-metal especially designed for heavy loads and high pressures.
- Designed for moderate volume and high temperatures.
- Pressure rating is 100 psig at room temperature. Higher pressure ratings are available. Consult factory.
- For temperature control, see page 54 and pages 131-134.
- Made in U.S.A.

Construction

1 1" NPT female outlet.

2 Heliarc weld.

3 Stainless steel sheath.

4 Resistance coil.

5 Ceramic coil support.

6 Connection box - 4" Octagonal-Nema 1.

7 Ceramic to metal seal with terminals.

8 ½" NPT female air inlet.

Air Process Heaters

Heavy Duty

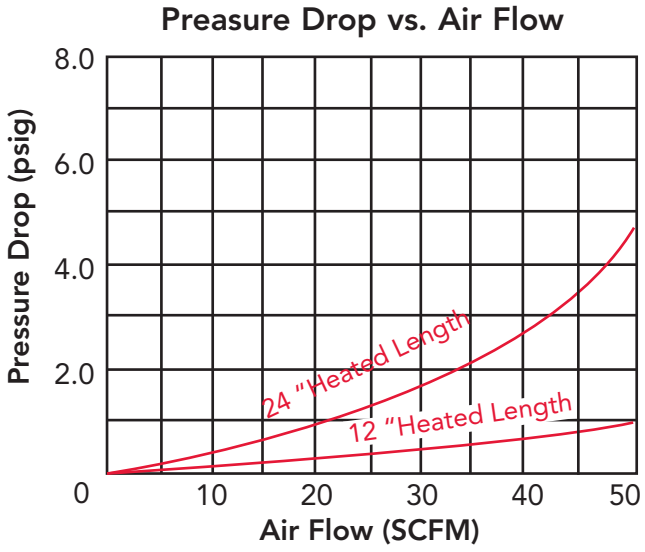
Specifications

Maximum Amperage: 30

Cross Sectional Flow Area: .69 sq. in.

CFM	Max. Watts/linear in of heated length
1	150
2	150
4	150
6	150
8	150
10	150
15	200
20	250
25	300
30	350
35	400
40	475
45	525
50	575
55	625

Pressure rating: 100 psig.



Size

Lengths are available from 6"-36". Standard entry is ½" NPT female and the standard exit is 1" NPT female.

▼ Manfactured Items ▼

Size

Length	Heated Length	Catalog No.
6"	3½"	HA2-6
8"	5½"	HA2-8
10"	7½"	HA2-10
12"	9½"	HA2-12
18"	15½"	HA2-18
24"	21½"	HA2-24

Special Features

SF-28 Three Phase
SF-29 Multiple Heat Circuits - Specify Wattages
SF-32 High Voltage

Consult Factory For:
Lengths longer than those listed
Current ratings above 30 amps.

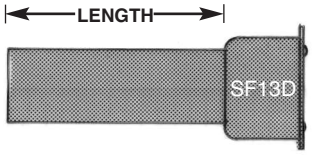
AIR

▼ IN STOCK ITEMS ▼

Heavy Duty Air Heaters

Supplied with: Type SF3S terminals Type SF13D enclosure

Length	Cat. No.	Dia.	Wattage	Voltage	Watts/ Linear Inch	Weight	Terminals
12"	HA2-12	2⅜"	375	120	40	7.0	S&N w/enclosure
12"	HA2-12	2⅜"	1500	240	158	7.0	S&N w/enclosure
24"	HA2-24	2⅜"	750	120	35	12.5	S&N w/enclosure
24"	HA2-24	2⅜"	3000	240	140	12.5	S&N w/enclosure



Air Process Heaters

Temperature Sensing

Thermocouple fittings are available for standard air heaters with male fittings 5/8" diameter and larger as well as Heavy Duty and Pure Flow types. The fittings are threaded into the exit end of the air heater and accept coupling type probes. They are designed to sense the exit air temperature. See pages 131 through 134 for details on probes and temperature controls.

Fittings – Stainless Steel

Cat.No.	A-NPT	B-NPT	C	D	E	F
TC-5	½"	½"	1⅜"	1⅛"	.562"	9⁄16"
TC-75	¾"	¾"	1½"	1⅜"	.625"	7⁄16"
TC-1	1"	1"	1¾"	1⅝"	.687"	⅜"
TC-125	1¼"	1¼"	2"	2"	.719"	¼"

Selection Chart

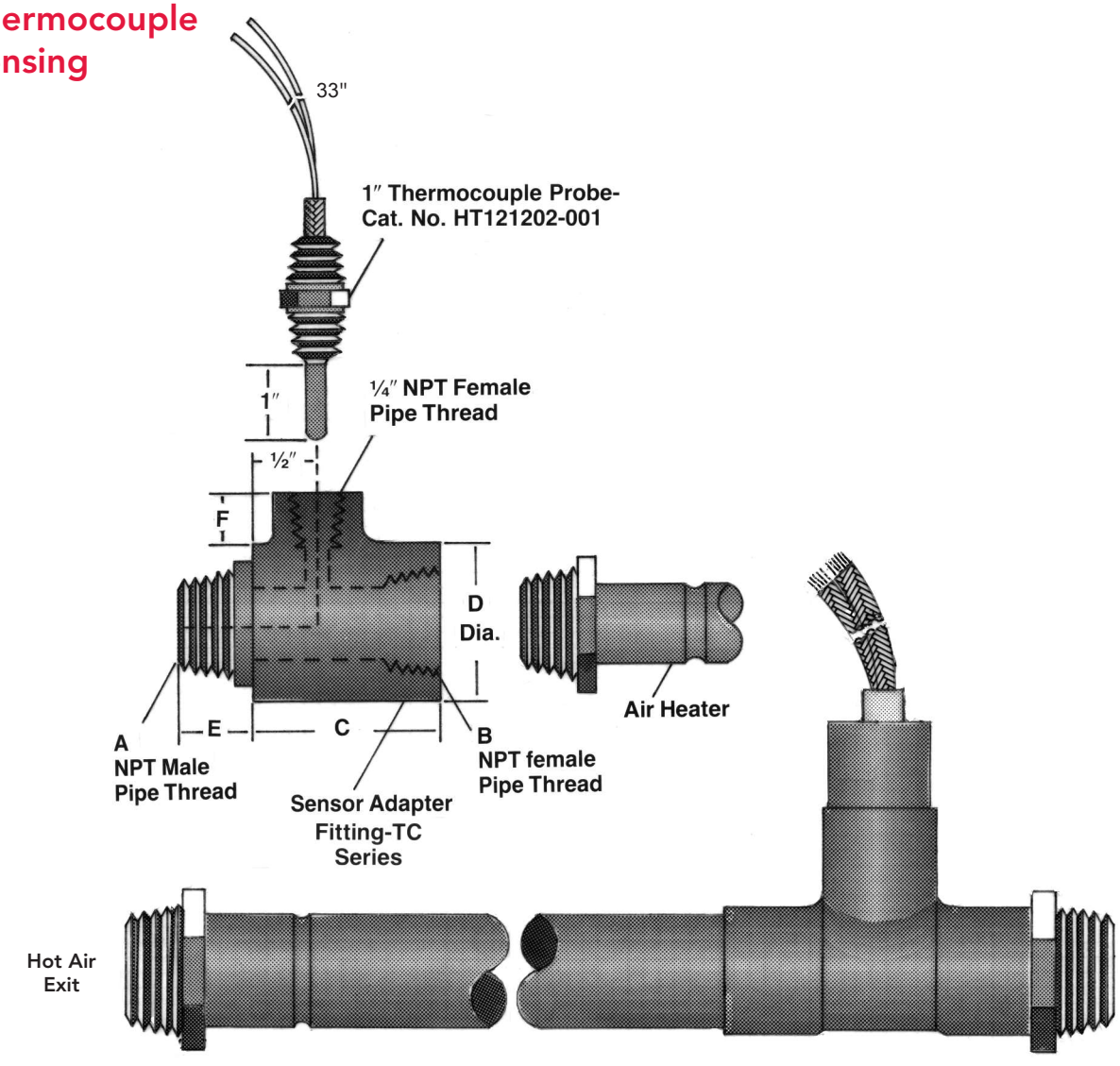
Heater Type	Fitting
⅝" dia.	TC-5
¾" dia.	TC-75
1¼" dia.	TC-125
Heavy Duty	TC-1
Pure Flow	TC-5

How To Order

Example: TC-5/HT-121202-001

AIR

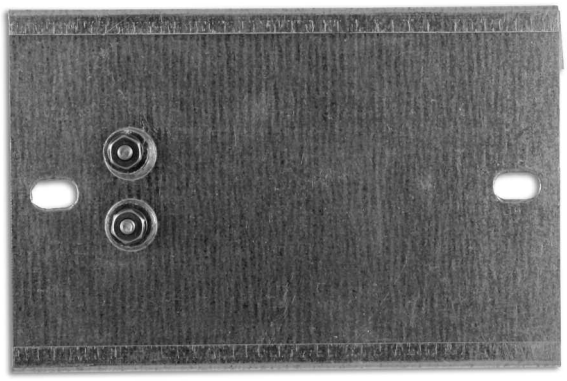
Thermocouple Sensing



Phone: 978-777-0070 ■ Fax: 978-774-2409

Strip Heaters

Mica Insulated



U.L. Recognized-E56973 **C.S.A. Certified** – 016386-0-000

Applications

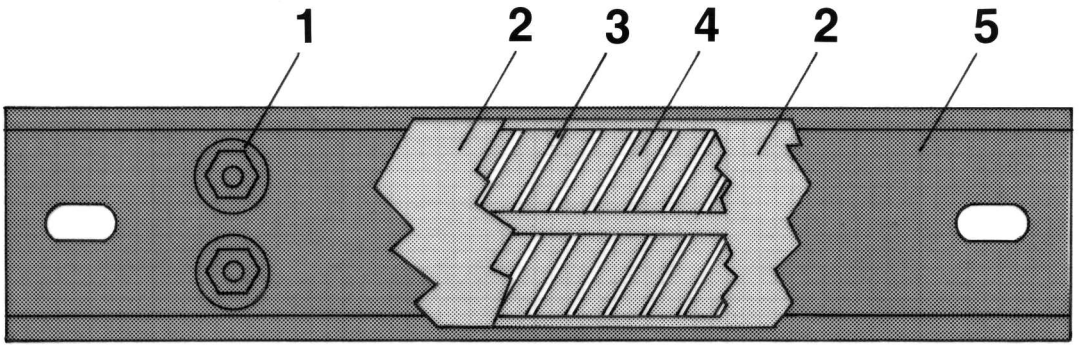
Dies, Cylinders, Kettles, Molds, Process Machines, Platens, Tanks, or other applications where controlled heating is needed.

Features

- Strip heaters may be used single or in groups to provide the required amount of heat.
- For maximum distribution, it is recommended that the strip heaters be clamped securely to the area to be heated to prevent distortion or unequal expansion.
- Made in U.S.A.

Construction

1. Post terminals.
2. Mica insulator.
3. Resistance Ribbon Wire.
4. Mica Element Support.
5. Rust Resistant Steel Sheath.



Strip Heaters

Mica Insulated

▼ Manfactured Items ▼

Width:	1"			1½"			2"		
Overall Length	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts
4"	ST1-4	50	100	ST1.5-4	50	150	ST2-4	50	195
6"	ST1-6	50	155	ST1.5-6	50	250	ST2-6	50	315
8"	ST1-8	50	230	ST1.5-8	50	340	ST2-8	50	435
12"	ST1-12	50	345	ST1.5-12	50	520	ST2-12	50	675
18"	ST1-18	50	520	ST1.5-18	50	790	ST2-18	50	1035
24"	ST1-24	50	700	ST1.5-24	50	1060	ST2-24	50	1395

Width:	2½"			3"			4"		
Overall Length	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts	Cat. No.	Min. Watts	Max. Watts
4"	ST2.5-4	50	215	ST3-4	50	230	ST4-4	50	300
6"	ST2.5-6	50	350	ST3-6	50	400	ST4-6	50	540
8"	ST2.5-8	50	515	ST3-8	50	590	ST4-8	50	780
12"	ST2.5-12	50	775	ST3-12	50	940	ST4-12	50	1250
18"	ST2.5-18	50	1250	ST3-18	50	1480	ST4-18	50	2000
24"	ST2.5-24	50	1700	ST3-24	50	2000	ST4-24	50	2700

• Standard termination is Type SSA. For units under 1½" wide, standard termination is Type FO.

STRIP

Wattages

The above chart is based on a watt density of 30 watts per square inch of surface.

The watt density should be varied, depending on operating temperatures in accordance with the following table.

Operating Temperature	Watts/square in.
300°F (149°C)	40
400°F (204°C)	30
500°F (260°C)	21
600°F (316°C)	12
700°-900°F (371-482°C) (Max.)	10

To compute wattage, multiply length (less 1") x width x watts per square inch based on above table. On units with mounting holes, reduce by an additional 2" when computing wattage.

Voltage

Standard voltages are either 120V or 240V. Other voltages are available.

Tolerances

Width: ±.03"

Thickness: .187" Nominal

Length: Up to 24", ±1/16"
24" to 48", ±⅛" Lengths over 48", consult factory.

Terminal Height: ¾" nominal

Wattage tolerances are held to +5%, -10% at rated voltage.

Mounting Holes

Units are supplied without mounting holes. ½" x 5/16" mounting holes, one each end, may be supplied if specified. Hole center is ½" from end. Terminals are 1¼" from end on types SSA, SSB and SO on units with mounting holes. Other mounting hole sizes and locations available. Consult factory.

How To Order

Specify: quantity, width, length, wattage, voltage, terminal arrangement, mounting holes and cutouts if any. Detail cutouts, and mounting holes (if any) on dimensional drawing.

Example: ST1.5-10/300W120V/SSA/standard mounting holes.

Strip Heaters
Mica Insulated

Optional Terminations

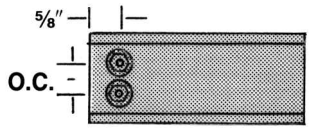
Stainless Steel Post

Up to 2¼" wide: 6-32 x 1" maximum, ⅝" on center.

2¼" wide and wider: 8-32 x 1" maximum, ¾" on center.

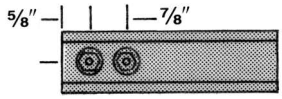
Type SSA: Parallel one end.

- **Available on:** 1½" and wider.



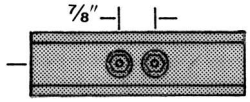
Type SSB: Tandem one end.

- **Available on:** 1½" and wider.



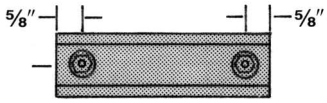
Type SC: Centered post terminals.

- **Available on:** 1½" and wider.



Type SO: Opposite ends.

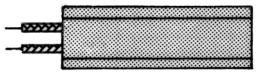
- **Available on:** 1" and wider.



High Temperature Insulated Leads

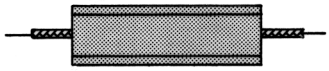
Type FS: Insulated leads at one end.

- **Available on:** 1½" and wider.



Type FO: Insulated leads at opposite ends.

- **Available on:** 1" and wider.



STRIP

Strip Heaters

Ceramic Insulated



U.L. Recognized-E56973 **C.S.A. Certified** – 016386-0-000

Applications

Dies, Molds, Plastic Forming and Sealing. Tank and Kettle Heating.

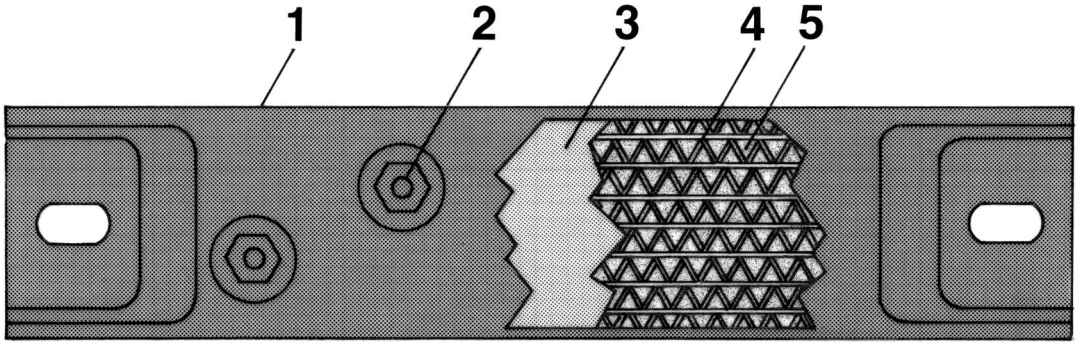
For specific applications, correctly rated elements should be used to prevent overheating and to ensure long life. A guide to correct watt densities for specific applications is shown on the next page.

Features

- The Hotwatt Stainless Steel Strip Heater provides clean, dependable heat with sheath temperatures up to 1200°F (649°C) and watt densities up to 40 watts per square inch.
- Because of the seamless stainless steel sheath, Hotwatt Ceramic Insulated Strip Heaters are dimensionally stable in milled slots.
- Made in U.S.A.

Construction

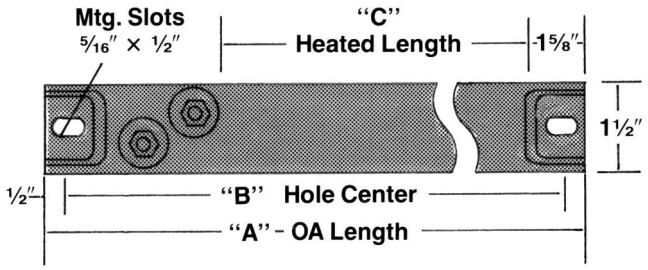
1. Seamless stainless steel sheath.
2. Post terminals.
3. Ceramic element support.
4. Element wire situated in close proximity to outside surface for maximum heat transfer and minimum internal temperature while preserving good dielectric qualities.
5. Magnesium oxide packing.

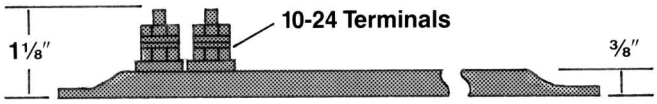


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Strip Heaters

Ceramic Insulated





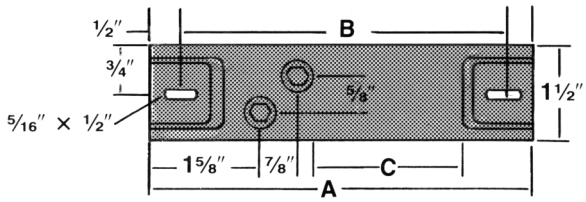
▼ Manfactured Items ▼

Cat.No.	"A"	"B"	"C"	Min. Watts	Max. Watts
CS-5.5	5½"	4½"	1"	50	180
CS-7.5	7½"	6½"	3"	50	360
CS-8	8"	7"	2¾"	50	430
CS-9.5	9½"	8½"	4¼"	50	510
CS-10.5	10½"	9½"	5¼"	50	630
CS-12	12"	11"	7¼"	50	810
CS-14	14"	13"	9¼"	50	1050
CS-15.2	15¼"	14¼"	10"	50	1200
CS-16.2	16¼"	15¼"	11"	50	1320
CS-18	18"	17"	12¾"	50	1530
CS-19.5	19½"	18½"	14¼"	50	1710
CS-21	21"	20"	15¾"	50	1890
CS-23.7	23¾"	22¾"	18½"	50	2220
CS-25.5	25½"	24½"	20¼"	50	2430
CS-26.7	26¾"	25¾"	21½"	50	2580
CS-28.2	28¼"	27¼"	23"	75	2760
CS-30	30"	29"	24¾"	75	2970
CS-30.5	30½"	29½"	25¼"	75	3030
CS-33.5	33½"	32½"	28¼"	75	3390
CS-35.7	35¾"	34¾"	30½"	75	3660
CS-38.5	38½"	37½"	33¼"	100	3990
CS-42.5	42½"	41½"	37¼"	100	4320
CS-47.7	47¾"	46¾"	42½"	100	4320
CS-50.5	50½"	49¼"	45¼"	100	4320
CS-53.7	53¾"	52¾"	48½"	100	4320
CS-63.7	63¾"	62¾"	50½"	100	4320

- Maximum wattage limited by 18 amp maximum at 240 volts for catalog numbers CS-42.5 and longer. Any wattage is available between minimum and maximum without effecting price.
- Unit lengths between and longer than those listed may be ordered.
- Standard termination is Type OF. Units under 8" long, standard termination is SSA.

Standard Termination

Type OF: Offset at one end.



Application	Max. Watts/sq. in.
Platen heating	
Up to 300°F (149°C)	40
300° - 600°F (149°C-316°C)	20
600° - 800°F (316°C-427°C)	15

Formulas for Determination of Watt Density

$$\text{Watts/sq in} = \frac{\text{Total unit wattage}}{\text{C (heated length)} \times 3}$$

Optional Terminations

See page 61.

STRIP

Strip Heaters

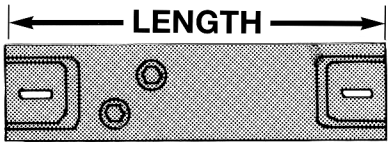
Ceramic Insulated

▼ IN STOCK ITEMS ▼

Strip Heaters – Stainless steel sheath

Supplied with: Type OF terminals, except CS-5.5, which is SSA
U.L. Recognized — E56973

C.S.A. Certified – 016386-0-000



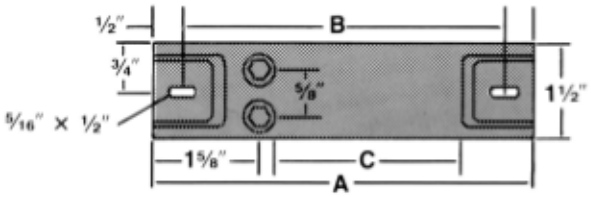
Length	Cat. No.	Wattage	Voltage	Watts/in²	Weight	Mounting Hole Center
5½"	CS5.5	40	120	12	.37	4½"
5½"	CS5.5	150	120	50	.37	4½"
5½"	CS5.5	150	240	50	.37	4½"
8"	CS8	60	120	7	.56	7"
8"	CS8	80	120	10	.56	7"
8"	CS8	250	120	30	.56	7"
8"	CS8	250	240	30	.56	7"
8"	CS8	330	120	40	.56	7"
8"	CS8	330	240	40	.56	7"
10½"	CS10.5	75	120	5	.69	9½"
10½"	CS10.5	300	120	19	.69	9½"
10½"	CS10.5	300	240	19	.69	9½"
12"	CS12	125	120	6	.81	11"
12"	CS12	190	120	9	.81	11"
12"	CS12	500	120	25	.81	11"
12"	CS12	500	240	25	.81	11"
12"	CS12	750	120	37	.81	11"
12"	CS12	750	240	37	.81	11"
15¼"	CS15.2	125	120	4	1.12	14¼"
15¼"	CS15.2	500	120	16	1.12	14¼"
15¼"	CS15.2	500	240	16	1.12	14¼"
18"	CS18	190	120	5	1.37	17"
18"	CS18	310	120	8	1.37	17"
18"	CS18	750	120	20	1.37	17"
18"	CS18	750	240	20	1.37	17"
18"	CS18	1250	120	32	1.37	17"
18"	CS18	1250	240	32	1.37	17"
23¾"	CS23.7	250	120	4	1.69	22¾"
23¾"	CS23.7	450	120	8	1.69	22¾"
23¾"	CS23.7	1000	120	18	1.69	22¾"
23¾"	CS23.7	1000	240	18	1.69	22¾"
23¾"	CS23.7	1800	240	32	1.69	22¾"
30"	CS30	500	120	7	2.35	29"
30"	CS30	2000	240	27	2.35	29"
35¾"	CS35.7	625	120	7	2.43	34¾"
35¾"	CS35.7	2500	240	27	2.43	34¾"

Strip Heaters
Ceramic Insulated

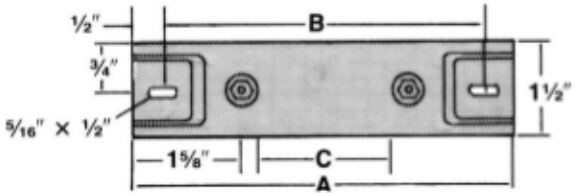
Optional Terminations

Type SSA: Parallel at one end.

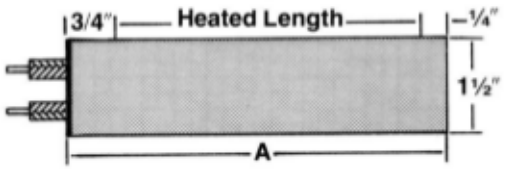
Heated length ("C") is ⅜" longer



Type SO: One each end. Heated length ("C") is 1" shorter.

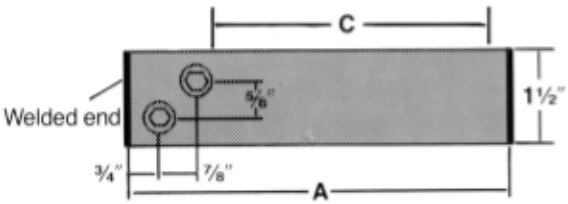


Type SF1: Flexible high temperature insulated leads. Specify length. Opposite end of unit may be standard closure with mounting hole or any of the optional closures. (Blunt end, XS54, shown.) Suitable for use to 480V. Lead end may be sealed for moisture resistance.

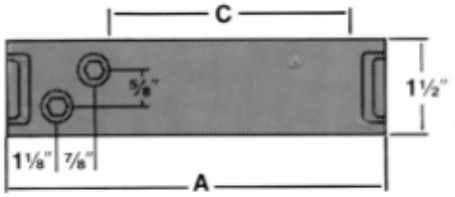


Optional End Closures

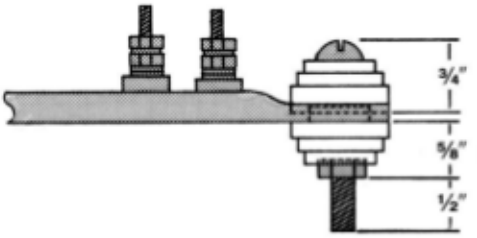
XS-54: Blunt end. Welded each end with no mounting holes. May be used with Type OF, SSA, or SO terminals. Heated length ("C") is 3" longer.



XS-83: Short crimp. At each end with no mounting holes. May be used with Type OF, SSA, or SO terminals. Heated length ("C") is 1" longer.



XS-84: Secondary insulating bushings. Required when units are connected in series on voltages above 300V. Sheath must be isolated. Requires enlarged (½" x ¾") mounting hole each end. May be used with Type OF, SSA, or SO terminals.



Tolerances

Width: 1.500, ±.020

Length: Up to 24", ±1/16"
24" and over, ±⅛"

Thickness: .375, ±.020

Wattage tolerances are held to +5%, -10% at rated voltage.

Voltage

Standard voltages are either 120V or 240V. Other voltages are available.

How To Order

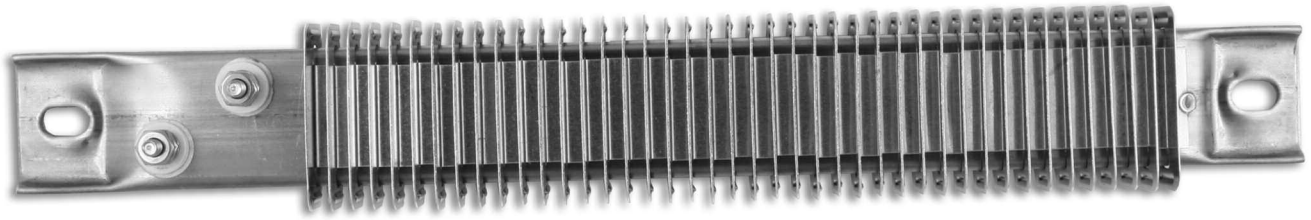
After determining the wattage required and the line voltage available, determine the physical space available for heaters and the number of heaters required.

Specify: catalog number, wattage, voltage, termination and special features if required.

Example: CS12/250W120V/OF/XS54.

Strip Heaters

Ceramic Insulated Finned



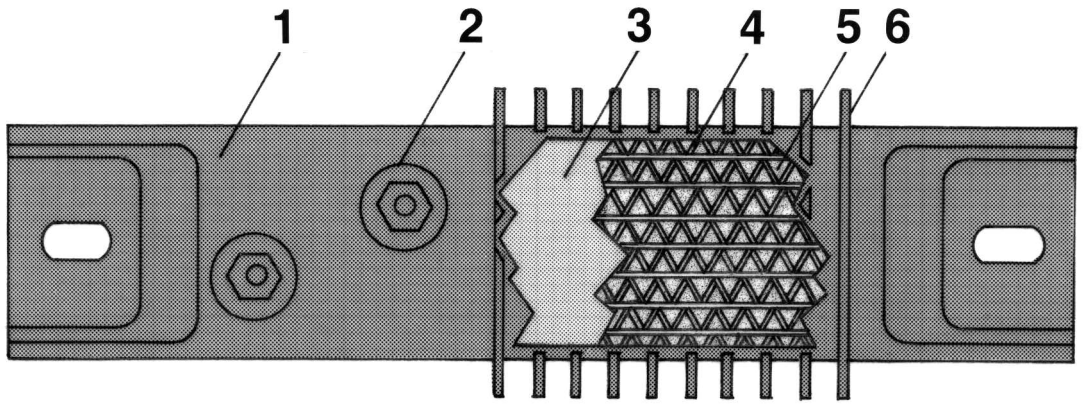
U.L. Recognized-E56973 **C.S.A. Certified** – 016386-0-000

Applications

Air Heating, Air Ovens, Load Banks.

Construction

1. Seamless stainless steel sheath.
2. Post terminals.
3. Ceramic element support.
4. Element wire situated in close proximity to outside surface for maximum heat transfer and minimum internal temperature while preserving good dielectric qualities.
5. Magnesium oxide packing.
6. Aluminum fins offering maximum radiating surface and providing for rapid heat transfer to the surrounding medium. Stainless steel fins are available for corrosive environments. Aluminum fins are standard.

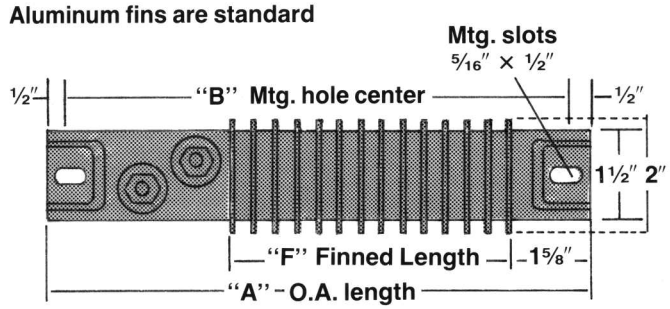


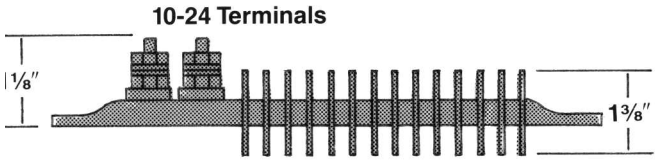
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Strip Heaters

Ceramic Insulated Finned

Aluminum fins are standard





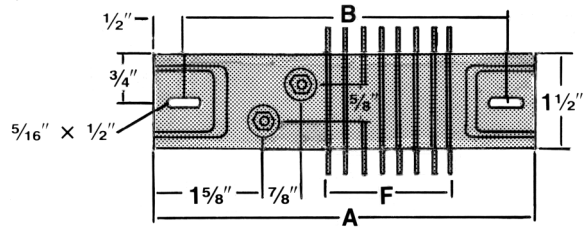
▼ Manfactured Items ▼

Cat.No.	"A"	"B"	"F"	Min. Watts	Max. Watts
FS-8	8"	7"	3¼"	50	475
FS-10.5	10½"	9½"	5¾"	50	785
FS-12	12"	11"	7¾"	50	1000
FS-14	14"	13"	9¾"	50	1300
FS-15.2	15¼"	14¼"	10½"	50	1500
FS-18	18"	17"	13¼"	50	1890
FS-19.5	19½"	18½"	14¾"	50	2135
FS-21	21"	20"	16¼"	50	2360
FS-23.7	23¾"	22¾"	19"	50	2775
FS-25.5	25½"	24½"	20¾"	50	3000
FS-26.7	26¾"	25¾"	22"	50	3225
FS-30.5	30½"	29½"	25¾"	75	3780
FS-33.5	33½"	32½"	28¾"	75	4230
FS-35.7	35¾"	34¾"	31"	75	4320
FS-38.5	38½"	37½"	33¾"	100	4320
FS-42.5	42½"	41½"	37¾"	100	4320

- Maximum wattage limited by 18 amp maximum at 240 volts for catalog numbers FS-35.7 and longer. Any wattage is available between minimum and maximum without effecting price.
- Lengths between and longer than those listed may be ordered.

Standard Termination

Type OF: Offset at one end.



Type of Air	ft./min.	°F	°C	Max. Watts/ sq. in.
Still		Up to 300°F	Up to 149°C	20
Still		300°F-600°F	149°C-316°C	16
Still		600°F-800°F	316°C-427°C	10
Moving	600	Up to 200°F	Up to 93°C	40
Moving	600	200°F-400°F	93°C-204°C	30
Moving	600	400°-600°F	204°C-316°C	20
Moving	1200	Up to 200°F	Up to 93°C	50
Moving	1200	200°-400°F	93°C-204°C	35
Moving	1200	400°-600°F	204°C-316°C	25

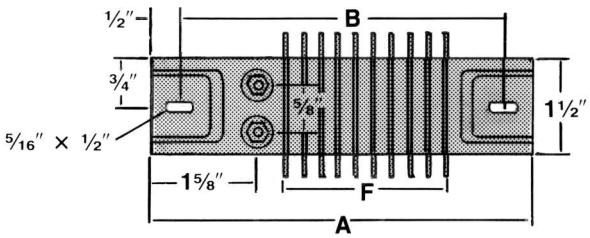
Formulas for Determination of Watt Density

Type OF:

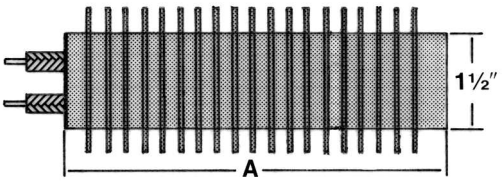
$$\text{Watts/sq.in.} = \frac{\text{Total unit wattage}}{\text{F (finned length) x 3}}$$

Optional Terminations

Type SSA: Parallel at one end. Finned length ("F") is ¾" longer.



Type SF-1: Flexible high temperature insulated leads. Specify length. Opposite end of unit may be standard closure with mounting hole or any of the optional closures. Suitable for use to 480V. Lead end may be sealed for moisture resistance.



STRIP

Strip Heaters

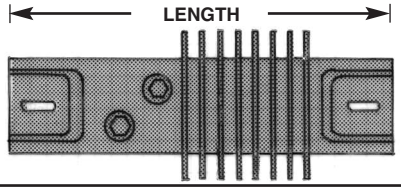
Ceramic Insulated Finned

▼ IN STOCK ITEMS ▼

Strip Heaters – Seamless stainless steel sheath

Supplied with: Type OF terminals, aluminum fins

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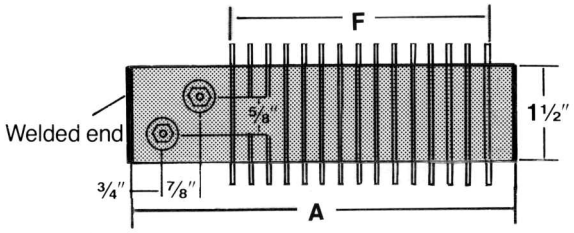
Length	Cat. No.	Wattage	Voltage	Watts/in²	Weight	Mounting Hole Center
8"	FS8	100	120	12	.62	7"
8"	FS8	400	120	48	.62	7"
8"	FS8	400	240	48	.62	7"
10½"	FS10.5	75	120	7	.85	9½"
10½"	FS10.5	300	120	19	.85	9½"
10½"	FS10.5	300	240	19	.85	9½"
12"	FS12	125	120	6	1.06	11"
12"	FS12	190	120	9	1.06	11"
12"	FS12	500	120	24	1.06	11"
12"	FS12	500	240	24	1.06	11"
12"	FS12	750	120	37	1.06	11"
12"	FS12	750	240	37	1.06	11"
15¼"	FS15.2	125	120	4	1.37	14¼"
15¼"	FS15.2	500	120	16	1.37	14¼"
15¼"	FS15.2	500	240	16	1.37	14¼"
18"	FS18	190	120	5	1.56	17"
18"	FS18	310	120	8	1.56	17"
18"	FS18	750	120	20	1.56	17"
18"	FS18	750	240	20	1.56	17"
18"	FS18	1250	120	32	1.56	17"
18"	FS18	1250	240	32	1.56	17"
23¾"	FS23.7	250	120	4	2.18	22¾"
23¾"	FS23.7	1000	120	18	2.18	22¾"
23¾"	FS23.7	1000	240	18	2.18	22¾"
35¾"	FS35.7	625	120	7	3.31	34¾"
35¾"	FS35.7	2500	240	27	3.31	34¾"

Strip Heaters

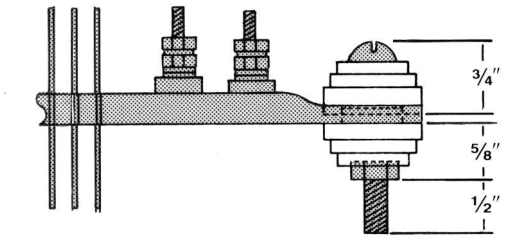
Ceramic Insulated Finned

Optional End Closures

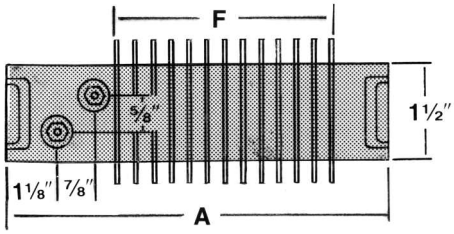
XS-54: Blunt end. Welded each end with no mounting holes. May be used with Type OF or SSA terminals. Finned length ("F") is 3" longer.



XS-84: Secondary insulating bushings. Required when units are connected in series on voltages above 300V. Sheath must be isolated. Requires enlarged (½" x ¾") mounting hole each end. May be used with Type OF or SSA terminals.



XS-83: Short crimp. At each end with no mounting holes. May be used with Type OF or SSA terminals. Finned length ("F") is 1" longer.



XS-85: Stainless steel fins. For use in corrosive environments.

Tolerances

Length: Up to 24", ±1/16"
24" and over, ±⅛"

Wattage tolerances are held to +5%, -10% at rated voltage.

How To Order

After determining the wattage required and the line voltage available, determine the physical space available for heaters and the number of heaters required. Review stock list for in-stock items. Review Special Features.

Specify: catalog number, wattage, voltage, terminal type, and special features if applicable.

STRIP

Strip Heaters: Special Features

SF-11: Lugs, rings, quick connect terminals attached to the end of lead wires. Specify terminal type and size when ordering. Special terminals are available.

• **Available on:**
Mica insulated strip and ceramic insulated strip and finned strip heaters with lead wires.

SF-11A: Ring terminals. Specify size: #6, #8, #10.



SF-11B: Straight quick connect terminals. Specify male or female and size: 3/16" or ¼".



SF-11C: Flag quick connect terminals. Specify mail or female and size: 3/16" or ¼".



SF-11D: Spade terminals. Specify size: #6, #8, #10.



SF-12: Male dead front armored plug.

• **Available on:**
Mica insulated and ceramic insulated strip and finned strip heaters with leads.

Ground wire (SF6) should be specified when using any 3 prong plug.

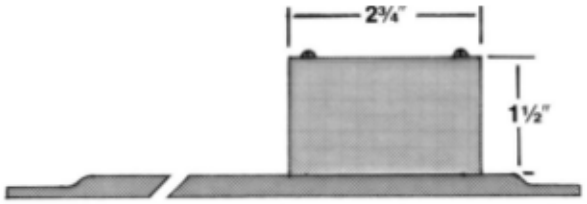
SF12-P1: 2 prong/straight blade/2 pole/2wire/ UL&CSA Listed/NEMA 1-15P/125 volts/15 amps.	
SF12-P2: 2 prong/twist lock/2 pole/2 wire/UL Listed/ NEMA L1-15P/125 volts/15 amps.	
SF12-P3: 3 prong/twist lock/2 pole/3 wire/ UL&CSA Listed/NEMA L6-15P/250 volts/15 amps.	
SF12-P4: 3 prong/twist lock/2 pole/3 wire/ UL &CSA Listed/NEMA L6-20/250 volts/20 amps.	
SF12-P5: 3 prong/straight blade/2 pole/3 wire/ UL&CSA Listed/NEMA 5-15P/125 volts/15 amps.	

Strip Heaters

Special Features (Continued)

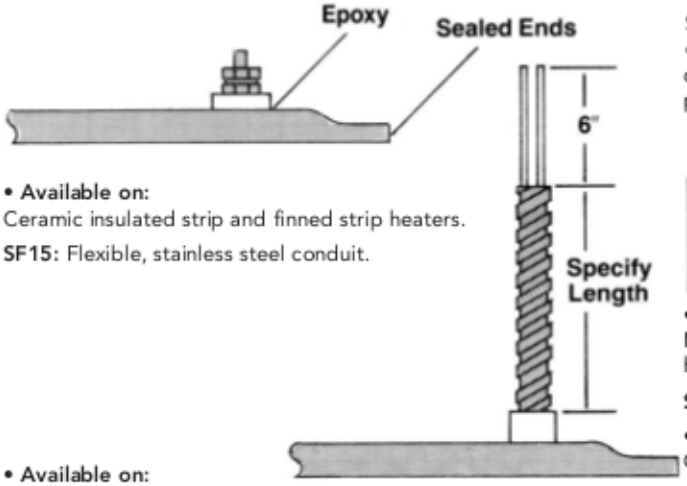
SF-13: Enclosures for protection of electrical connections.

SF-13A: General purpose box. NEMA No. 1.
2¾" x 1½" x 1½".



• **Available on:**
Mica insulated strip, ceramic insulated strip and finned strip heaters.

XS-34: Epoxy potting and welded ends for moisture proof applications to 265°F (129°C) in potting area.

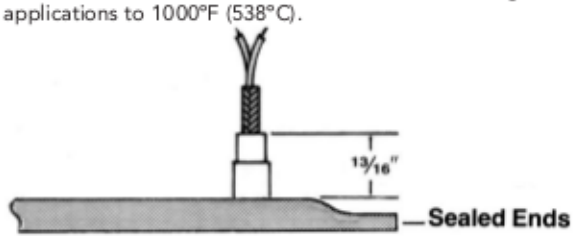


• **Available on:**
Ceramic insulated strip and finned strip heaters.

SF15: Flexible, stainless steel conduit.

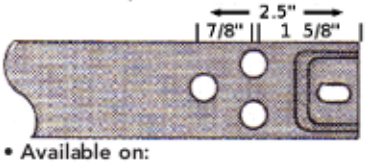
• **Available on:**
Mica insulated strip, ceramic insulated strip and finned strip heaters with leads.

SF23: Ceramic to metal seals for hermetic sealing and vacuum applications to 1000°F (538°C).



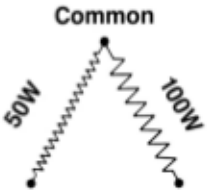
• **Available on:**
Ceramic insulated strip and finned strip heaters with leads.

SF28: Three phase heaters.



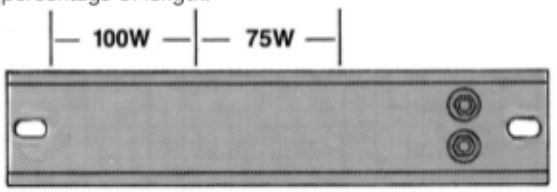
• **Available on:**
Mica insulated strip, ceramic insulated strip and finned strip heaters.

SF29: Multiple heat; when a single unit with multiple wattages is necessary. Some uses of these units include: quick heat-up with a standby circuit for maintenance of low temperature; providing different wattages when there is a wide variation in thermal loads; and replacing more expensive rheostats or powerstats for wattage control.



• **Available on:**
Mica insulated strip, ceramic insulated strip and finned strip heaters. 1½" wide and wider.

SF30: Special wattage distribution for units requiring different concentrations of wattage over their heated length. Specify distribution required in terms of percentage of wattage over a percentage of length.



• **Available on:**
Mica insulated strip, ceramic insulated strip and finned strip heaters.

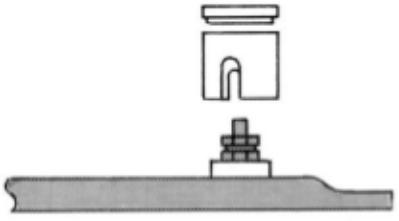
SF37: Stainless steel sheath.

• **Standard on:**
Ceramic insulated strip and finned strip heaters.

• **Available on:**
All mica insulated strip heaters.

• **Available on:**
Finned strip heaters.

XS-86: Ceramic terminal covers: with Type OF or SO terminals only.



• **Available on:**
Mica insulated strip, ceramic insulated strip and finned strip heaters. 1½" wide and wider.

XS-87: Mica heater. Mica insulation only. Unit has no metal outer sheath.

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Band Heaters



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Applications

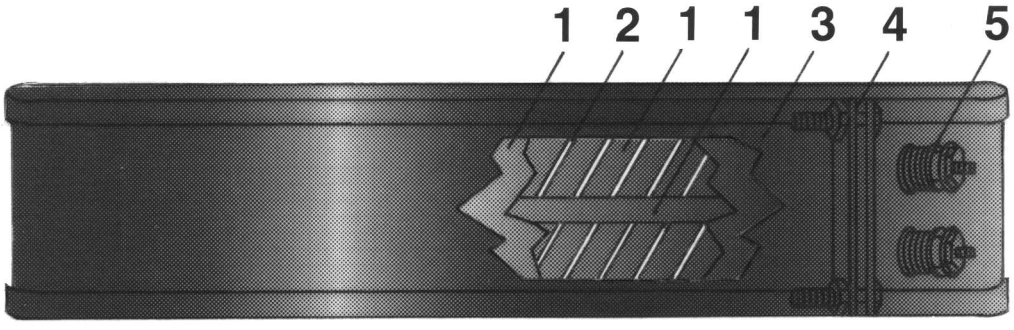
Cylinders, Dies, Drums, Holding Tanks, Injections and Blow Molding Machines, and Plastic Extruders.

Features

- The Hotwatt Standard Band Heaters are manufactured in one or two piece constructions with maximum inside diameters of 11½" and 22½" respectively. Three or more sections are employed when heaters of larger diameters are needed (as for blown film extrusion dies).
- Holes and cutouts are available. Maximum wattage may be reduced with the addition of holes and cutouts. Drawing required for specific location.
- Made in U.S.A.

Construction

1. Mica insulation.
2. Element ribbon.
3. Rust resistant steel sheath.
4. Radial lock-up tabs.
5. Post terminals.



Band Heaters

▼ Manfactured Items ▼

Standard Band Heater

Inside Dia.	Width 1"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	5½"	6"
1"	85	130	185	235							
1½"	140	210	280	350	420	490	560				
2"	175	255	350	470	565	675	765	865	950		
2½"	235	350	470	590	700	825	940	1050	1175	1300	1400
3"	275	405	550	675	800	935	1075	1270	1410	1550	1690
3½"	330	475	660	825	990	1150	1320	1485	1650	1800	1980
4"	375	545	725	910	1100	1275	1450	1640	1825	2010	2200
4½"	420	635	845	1060	1270	1485	1695	1900	2120	2330	2545
5"	450	685	925	1150	1375	1610	1850	2075	2300	2525	2750
5½"	520	775	1035	1295	1555	1815	2070	2330	2590	2850	3100
6"	550	820	1100	1325	1650	1935	2225	2495	2770	3050	3325
6½"	610	920	1225	1530	1835	2140	2450	2755	3060	3365	3675
7"	650	975	1300	1625	1950	2275	2600	2875	3250	3575	3900
7½"	705	1060	1415	1765	2120	2470	2825	3180	3530	3885	4240
8"	750	1125	1500	1860	2225	2585	2950	3325	3700	4075	4450
8½"	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800
9	850	1275	1675	2050	2525	2935	3350	3825	4200	4600	5000
9½"	895	1340	1790	2235	2685	3130	3580	4025	4475	4920	5370
10"	925	1385	1850	2325	2800	3260	3725	4185	4650	5110	5575
10½"	990	1485	1980	2475	2970	3465	3960	4455	4950	5445	5940
11"	1000	1500	2030	2535	3040	3600	4140	4650	5170	5690	6200
11½"	1060	1590	2130	2660	3200	3750	4300	4850	5400	6030	6560

Sizes

The above chart represents typical sizes available. Other inside diameters and widths, both between those and larger than those listed are available. Metric sizes are also available.

Construction of units with inside diameters over 11½" must be manufactured in accordance with the following table.

Construction	Inside Diameter Range
Two Piece	Over 11½" to 22½"
Three Piece	Over 22½" to 36"
Four Piece	Over 36" to 48"

Wattage

The above is based on a watt density of 30 watts per square inch of surface.

The watt density may be varied, depending on operating temperature in accordance with the following table.

Operating Temperature	°C	Watts Per Square Inch
300°F	149°C	40
400°F	204°C	30
500°F	260°C	21
600°F	316°C	12
700°F to 900°F Max.	371°C 482°C	10

To compute wattage: multiply inside Diameter x pi x width x watts per square inch (based on above table).

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Band Heaters

▼ IN STOCK ITEMS ▼

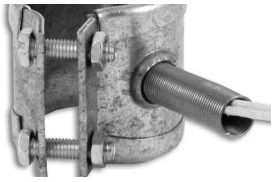
Termination Type



Termination Type SF16B



Termination Type SF3B



Termination Type SF1A

One Piece Construction

Dimensions I.D.	Dimensions Width	Cat. No.	Wattage	Voltage	Watts/in²	Weight	Termination
1"	1"	MB1-1	85	120	27	.25	SF16B-18/12
1"	1½"	MB1-1.5	130	120	27	.37	SF16B-18/12
1¼"	1"	MB1.2-1	100	120	25	.37	SF16B-18/12
1¼"	1"	MB1.2-1	150	120	38	.37	SF16B-18/12
1¼"	1½"	MB1.2-1.5	150	120	25	.43	SF16B-18/12
1¼"	1½"	MB1.2-1.5	200	120	34	.43	SF16B-18/12
1½"	1½"	MB1.5-1.5	45	120	6	.50	SF16B-18/12
1½"	1½"	MB1.5-1.5	70	120	10	.50	SF16B-18/12
1½"	1½"	MB1.5-1.5	175	120	24	.50	SF16B-18/12
1½"	1½"	MB1.5-1.5	175	240	24	.50	SF16B-18/12
1½"	1½"	MB1.5-1.5	275	120	39	.50	SF16B-18/12
1½"	1½"	MB1.5-1.5	275	240	39	.50	SF16B-18/12
1¾"	1½"	MB1.7-1.5	45	120	5	.56	SF16B-18/12
1¾"	1½"	MB1.7-1.5	75	120	9	.56	SF16B-18/12
1¾"	1½"	MB1.7-1.5	180	120	22	.56	SF16B-18/12
1¾"	1½"	MB1.7-1.5	180	240	22	.56	SF16B-18/12
1¾"	1½"	MB1.7-1.5	300	120	36	.56	SF16B-18/12
1¾"	1½"	MB1.7-1.5	300	240	36	.56	SF16B-18/12
2"	1½"	MB2-1.5	50	120	5	.68	SF16B-18/12
2"	1½"	MB2-1.5	95	120	10	.68	SF16B-18/12
2"	1½"	MB2-1.5	200	120	21	.68	SF16B-18/12
2"	1½"	MB2-1.5	200	240	21	.68	SF16B-18/12
2"	1½"	MB2-1.5	375	120	40	.68	SF16B-18/12
2"	1½"	MB2-1.5	375	240	40	.68	SF16B-18/12
2½"	1½"	MB2.5-1.5	75	120	6	.81	SF16B-18/12
2½"	1½"	MB2.5-1.5	110	120	9	.81	SF16B-18/12
2½"	1½"	MB2.5-1.5	300	120	25	.81	SF16B-18/12
2½"	1½"	MB2.5-1.5	300	240	25	.81	SF16B-18/12
2½"	1½"	MB2.5-1.5	450	120	38	.81	SF16B-18/12
2½"	1½"	MB2.5-1.5	450	240	38	.81	SF16B-18/12
2½"	2"	MB2.5-2	150	120	9	.87	SF16B-18/12
2½"	2"	MB2.5-2	600	120	38	.87	SF16B-18/12
2½"	2"	MB2.5-2	600	240	38	.87	SF16B-18/12
2½"	2½"	MB2.5-2.5	190	120	9	.93	SF16B-18/12
2½"	2½"	MB2.5-2.5	750	120	38	.93	SF16B-18/12
2½"	2½"	MB2.5-2.5	750	240	38	.93	SF16B-18/12
2½"	3"	MB2.5-3	225	120	9	1.06	SF16B-18/12
2½"	3"	MB2.5-3	900	120	38	1.06	SF16B-18/12
2½"	3"	MB2.5-3	900	240	38	1.06	SF16B-18/12
3"	1½"	MB3-1.5	100	120	7	.56	SF3B
3"	1½"	MB3-1.5	400	120	28	.56	SF3B

Band Heaters

▼ IN STOCK ITEMS CONTINUED ▼

One Piece Construction (continued)

Dimensions I.D.	Width	Cat. No.	Wattage	Voltage	Watts/in²	Weight	Termination
3"	1½"	MB3-1.5	400	240	28	.56	SF3B
3½"	1½"	MB3.5-1.5	115	120	7	.68	SF3B
3½"	1½"	MB3.5-1.5	450	120	27	.68	SF3B
3½"	1½"	MB3.5-1.5	450	240	27	.68	SF3B
3½"	2"	MB3.5-2	125	120	6	.87	SF3B
3½"	2"	MB3.5-2	500	120	23	.87	SF3B
3½"	2"	MB3.5-2	500	240	23	.87	SF3B
1"	1"	MB1-1	85	120	27	.25	SF1A-12
1"	1½"	MB1-1.5	130	120	27	.37	SF1A-12
1¼"	1"	MB1.2-1	100	120	25	.37	SF1A-12
1¼"	1"	MB1.2-1	150	120	38	.37	SF1A-12
1¼"	1½"	MB1.2-1.5	150	120	25	.43	SF1A-12
1¼"	1½"	MB1.2-1.5	200	120	34	.43	SF1A-12
1½"	1½"	MB1.5-1.5	45	120	6	.50	SF1A-12
1½"	1½"	MB1.5-1.5	70	120	10	.50	SF1A-12
1½"	1½"	MB1.5-1.5	175	120	24	.50	SF1A-12
1½"	1½"	MB1.5-1.5	175	240	24	.50	SF1A-12
1½"	1½"	MB1.5-1.5	275	120	39	.50	SF1A-12
1½"	1½"	MB1.5-1.5	275	240	39	.50	SF1A-12
1¾"	1½"	MB1.7-1.5	45	120	5	.56	SF1A-12
1¾"	1½"	MB1.7-1.5	75	120	9	.68	SF1A-12
1¾"	1½"	MB1.7-1.5	180	120	22	.56	SF1A-12
1¾"	1½"	MB1.7-1.5	180	240	22	.56	SF1A-12
1¾"	1½"	MB1.7-1.5	300	120	36	.56	SF1A-12
1¾"	1½"	MB1.7-1.5	300	240	36	.56	SF1A-12
2"	1½"	MB2-1.5	50	120	5	.68	SF1A-12
2"	1½"	MB2-1.5	95	120	10	.68	SF1A-12
2"	1½"	MB2-1.5	200	120	21	.68	SF1A-12
2"	1½"	MB2-1.5	200	240	21	.68	SF1A-12
2"	1½"	MB2-1.5	375	120	40	.68	SF1A-12
2"	1½"	MB2-1.5	375	240	40	.68	SF1A-12

▼ IN STOCK ITEMS CONTINUED ▼

Two Piece Construction

Each half is manufactured at 120 volts. Units are not designed for use in series on voltage in excess of 240 volts.

Dimensions							Termination
I.D.	Width	Cat. No.	Wattage	Voltage	Watts/in²	Weight	Stud Size
4"	1½"	MB4-1.5	550	120	30	.50	SF3B
4"	1½"	MB4-1.5	550	240	30	.50	SF3B
4"	2"	MB4-2	600	120	25	.62	SF3B
4"	2"	MB4-2	600	240	25	.62	SF3B
4½"	1½"	MB4.5-1.5	650	120	31	.56	SF3B
4½"	1½"	MB4.5-1.5	650	240	31	.56	SF3B
5"	1½"	MB5-1.5	750	120	31	.68	SF3B
5"	1½"	MB5-1.5	750	240	31	.68	SF3B
5"	2"	MB5-2	800	120	26	1.00	SF3B
5"	2"	MB5-2	800	240	26	1.00	SF3B
5½"	1½"	MB5.5-1.5	750	120	29	.95	SF3B
5½"	1½"	MB5.5-1.5	750	240	29	.95	SF3B
5½"	2"	MB5.5-2	900	120	26	1.00	SF3B
5½"	2"	MB5.5-2	900	240	26	1.00	SF3B
6"	1½"	MB6-1.5	900	120	32	.95	SF3B
6"	1½"	MB6-1.5	900	240	32	.95	SF3B
6"	2"	MB6-2	1000	120	27	1.12	SF3B
6"	2"	MB6-2	1000	240	27	1.12	SF3B
6½"	1½"	MB6.5-1.5	1100	120	36	1.12	SF3B
6½"	1½"	MB6.5-1.5	1100	240	36	1.12	SF3B
7"	1½"	MB7-1.5	1000	120	30	1.12	SF3B
7"	1½"	MB7-1.5	1000	240	30	1.12	SF3B
8"	1½"	MB8-1.5	1100	120	29	1.25	SF3B
8"	1½"	MB8-1.5	1100	240	29	1.25	SF3B
9"	1½"	MB9-1.5	1200	120	28	1.37	SF3B
9"	1½"	MB9-1.5	1200	240	28	1.37	SF3B
10"	1½"	MB10-1.5	1400	120	30	1.50	SF3B
10"	1½"	MB10-1.5	1400	240	30	1.50	SF3B
11"	2"	MB11-2	1200	120	18	2.00	SF3B
11"	2"	MB11-2	1200	240	18	2.00	SF3B
11½"	1½"	MB11.5-1.5	1650	120	31	1.68	SF3B
11½"	1½"	MB11.5-1.5	1650	240	31	1.68	SF3B

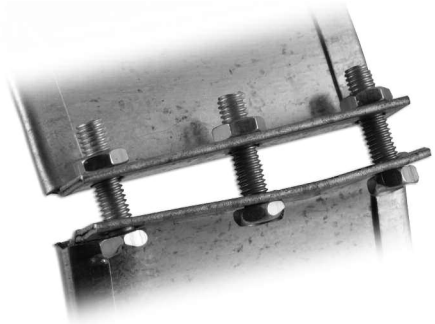
Band Heaters

Clamping Options

Standard Tightening Mechanisms

Standard:

Radial Lock-up Tabs



Optional:

Separate Stainless Steel Strap with Barrel Nut–Specify XS88.

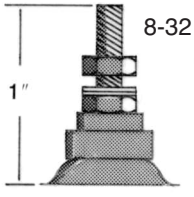


Post Type Terminal Options

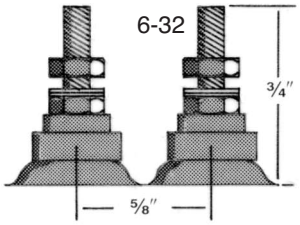
	Terminal Type	Maximum Amperage	Position On Heater	Size Limitations
	SF3A	20	One-Piece Heater 	Min. Width: 1" Min. I.D.: 2"
		40	Two-Piece Heater 	Min. Width: 1" Min. I.D.: 3"
	SF3B	20	One-Piece Heater 	Min. Width: 1½" Min. I.D.: 2"
		40	Two-Piece Heater 	Min. Width: 1½" Min. I.D.: 3"
	SF13A	20	One-Piece Heater 	Min. Width: 2½" Min. I.D.: 2½"
		40	Two-Piece Heater 	Min. Width: 2½" Min. I.D.: 4"

Dimensions

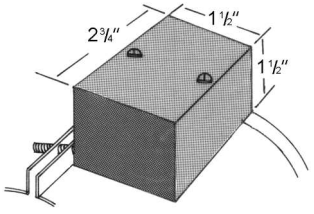
SF3A: Post Terminals



SF3B: Post Terminals



SF-13A: General purpose box. NEMA No. 1

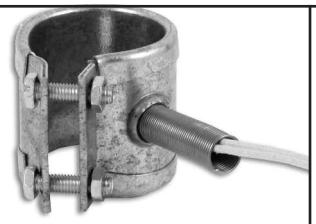
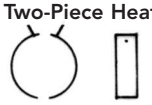
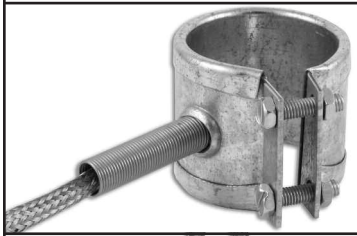
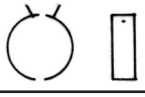


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Band Heaters

Lead Type Terminal Options

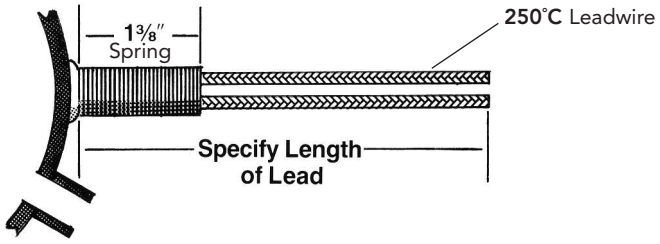
	Terminal Type	Maximum Amperage	Position On Heater	Size Limitations
	SF1A	10	One-Piece Heater 	Min. Width: 1" Min. I.D.: 1"
		20	Two-Piece Heater 	Min. Width: 1" Min. I.D.: 3"
	SF1B	12	One-Piece Heater 	Min. Width: 1" Min. I.D.: 3"
	SF14	10	One-Piece Heater 	Min. Width: 1½" Min. I.D.: 1½"
		20	Two-Piece Heater 	Min. Width: 1½" Min. I.D.: 3"
	SF15A	8	One-Piece Heater 	Min. Width: 1½" Min. I.D.: 1½"
		16	Two-Piece Heater 	Min. Width: 1½" Min. I.D.: 3"
	SF15B	8	One-Piece Heater 	Min. Width: 1½" Min. I.D.: 1½"
		16	Two-Piece Heater 	Min. Width: 1½" Min. I.D.: 3"
	SF16A	10	One-Piece Heater 	Min. Width: 1" Min. I.D.: 1"
		20	Two-Piece Heater 	Min. Width: 1" Min. I.D.: 3"
	SF16B	10	One-Piece Heater 	Min. Width: 1" Min. I.D.: 1"

BAND

Band Heaters

Special Features

SF1A: Flexible leads with spring protector. Standard lead length is 6". Longer lengths are available.



SF1B: Constructions (similar to SF-1A above) employs one leadwire on each side of gap. Same spring dimensions apply.

SF12: Male dead front armored plug. May be supplied on units with leads and conduit. Ground wire (SF-6) should be specified when using any three prong plug. Specify conduit length and plug required as follows:

SF12-P1: 2 prong/straight blade/2 pole/2wire/ UL&CSA Listed/NEMA 1-15P/125 volts/15 amps.

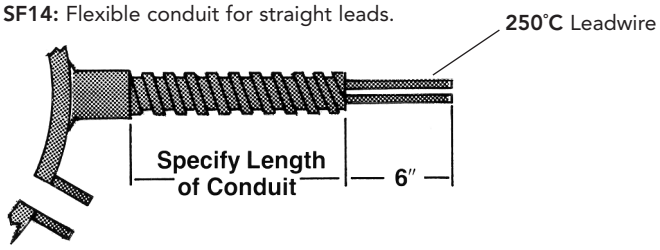
SF12-P2: 2 prong/twist lock/2 pole/2 wire/UL Listed/ NEMA L1-15P/125 volts/15 amps.

SF12-P3: 3 prong/twist lock/2 pole/3 wire/ UL&CSA Listed/NEMA L6-15P/250 volts/15 amps.

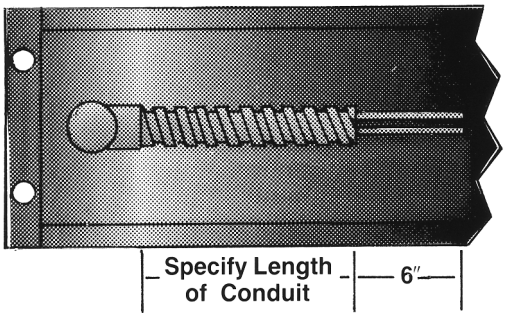
SF12-P4: 3 prong/twist lock/2 pole/3 wire/ UL &CSA Listed/NEMA L6-20/250 volts/20 amps.

SF12-P5: 3 prong/straight blade/2 pole/3 wire/ UL&CSA Listed/NEMA 5-15P/125 volts/15 amps.

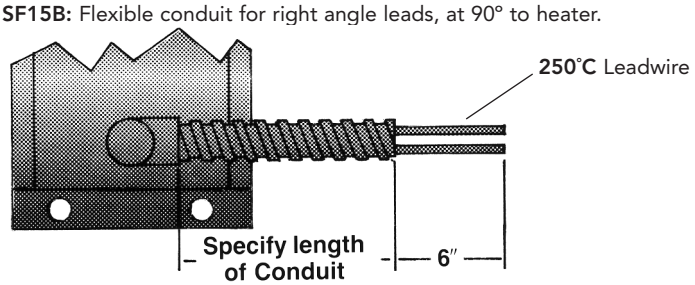
SF14: Flexible conduit for straight leads.



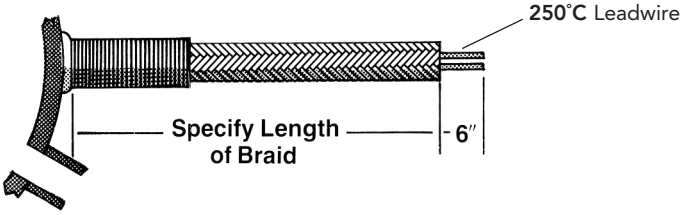
SF15A: Flexible conduit for right angle leads in line with heater.



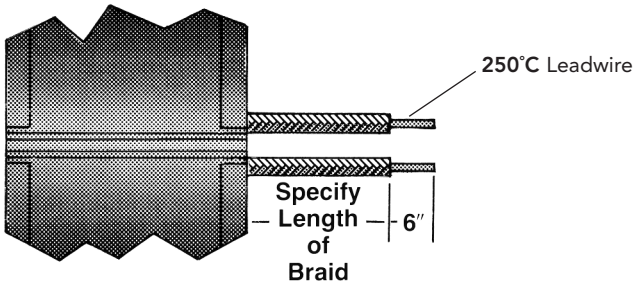
SF15B: Flexible conduit for right angle leads, at 90° to heater.



SF16A: Stainless steel, flexible braid for straight leads. Specify braid length. Lengths are supplied 6" longer than braid.



SF16B: Stainless steel, flexible braid for individual leads out from edge of heater.



SF29: Multiple heat; when a single unit with multiple wattages is necessary. Some uses of these units include: quick heat-up with a standby circuit for maintenance of low temperature; providing different wattages when there is a wide variation in thermal loads; and replacing more expensive rheostats or powerstats for wattage control.

SF37: Stainless steel sheath.

XS79: 2 piece construction through 11½" I.D.

XS79-1: Two piece construction. Over 11½" I.D. to 22½" I.D.

XS79-2: Three piece construction. Over 22½" I.D. to 36" I.D.

XS79-3: Four piece construction. Over 36" I.D. to 48" I.D.

Voltage

Standard voltages are either 120V or 240V. Other voltages are available.

Tolerances

Inside diameters are based upon outside diameter of area being heated

Width dimensions: ±1/16"

Gap dimensions: 1" to 6 dia. – 5/16" nom.
6" to 11½" dia. – ⅜" nom.
11½" to 23" dia. – ⅜" nom.

Wattage tolerances are held to +5%, -10% at voltage specified.

How To Order

Specify: catalog number prefix "MB" followed by inside diameter, width, wattage, voltage, termination type, and special feature options if required. On multiple piece construction (XS79-1, -2, -3) specify total rating as well as rating per section (i.e. 500W240V total 250W120V per section)

Example: MB1.75-4.25/300W120V/SF15A-14/36.

BAND

Phone: 978-777-0070 Fax: 978-774-2409

Drum Heaters
Metal Sheathed

DH-1/55 Gallon
High Temperature, Metal Sheathed

▼ IN STOCK ITEMS ▼

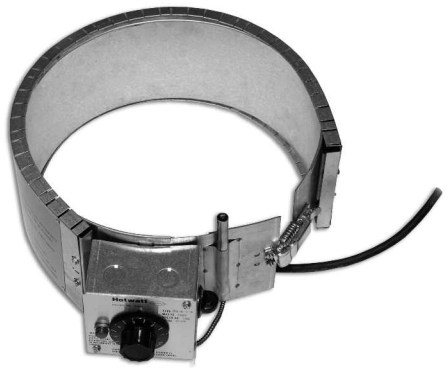


Table-55 Gallon

Cat. No.	Wattage	Voltage	I.D.	Width	Temp. Range
DH-1-1-4	2000	115	22½"	5"	200-400˚F
DH-1-2-4	3000	230	22½"	5"	200-400˚F
DH-1-1-2	2000	115	22½"	5"	60-250˚F
DH-1-2-2	3000	230	22½"	5"	60-250˚F

Features

- Fits standard 55 gallon metal drums.
- Lightweight (approx. 14 lbs.) one piece construction.
- Rust resistant steel casing.
- Heavy duty six foot cord and plug on all models with 3 wire plug for grounded operation.
- Quick release spring loaded clamp.
- Conservatively rated for long life.
- Available in 115V or 230V.
- Supplied in two temperature ranges, 200˚F-400˚F or 60˚F-250˚F.
- Supplied with three heat switch allowing for three wattage ratings.

Installation

Place the heater over the drum using the hook and chain to hang the unit from the drum rim. Mount unit at base of drum. Tighten the clamp springs after closing clamp to ensure a tight fit and maximum heat transfer to the contents of the drum. Do not allow cord to contact heater surface. Before energizing the heater, make sure drum contents are above the top edge of the heater. If the material level falls below the heater the unit may not cycle and life will be reduced.

Connection

115 Volt/2000 Watt and 230 Volt/3000 Watt Drum Heaters are equipped with a SPECIAL 3 wire plug for extra safe operation. For 115V/2000W use a Hubbell single outlet #5361 or equal. For 230V/3000W use a Hubbell single outlet #5661 or equal.

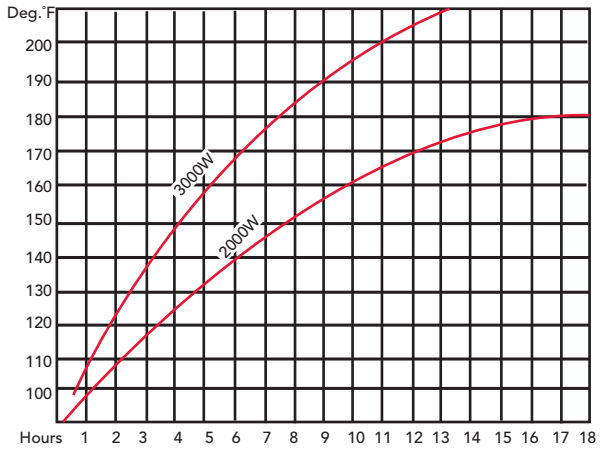
Operation

When heating a material for the first time, the material temperature should be monitored with a temperature indicating device and the final drum heater control setting recorded for future reference. The material should be mixed to get an accurate temperature since the material near the outside of the drum will heat faster than the material near the center. This initial set-up should be done with the three heat switch set on high. If the material you are heating exhibits excellent heat receptivity you may maintain your desired temperature with the three heat switch set on medium or low, thus reducing power consumption.

- Use on all metal drums only.
- For use indoors only.
- Do not use to heat flammable materials.
- Do not use in hazardous areas.
- Vent container to prevent pressure build-up.

Time vs. Temperature

Achieved at maximum setting, Covered 55 gallon drum filled with water at 70˚F.



DRUM

Tubular Heaters

Straight and Formed



U.L. AND C-UL Recognized-E177353

Features

- The Hotwatt Tubular Heater has built-in resistance to shock, vibration, corrosion, and temperature extremes.
- The heater is swaged, reducing the diameter of the metal sheath and compacting the insulation. This insures rapid heat transfer and holds the coil in position for forming.
- Many formations are available.
- Long, trouble free service.
- Made in U.S.A.

Construction

1 Steel, stainless steel, copper, or Incoloy sheathed elements.

2 Element wire situated in proximity to outside surface for maximum heat transfer and minimum internal temperature while preserving good dielectric qualities.

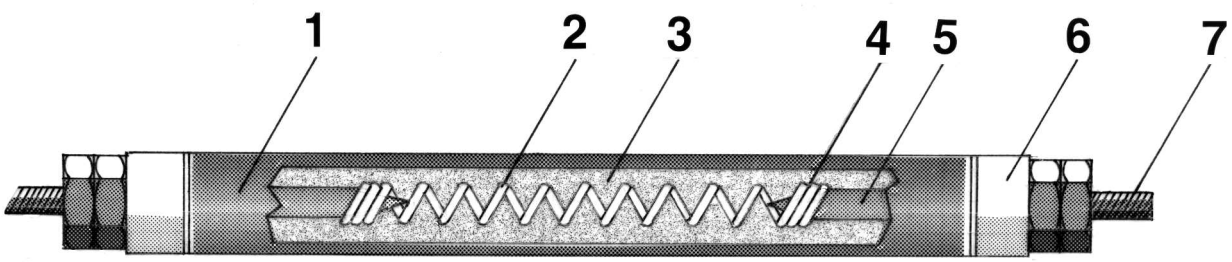
3 Pure magnesium oxide compressed to an optimum density for best heat transfer and electrical insulation at elevated temperatures.

4 Weld connection.

5 Cold pin.

6 Insulator.

7 Standard post terminal.



Phone: 978-777-0070 ■ Fax: 978-774-2409

Tubular Heaters

Straight and Formed

Standard Sizes and Materials

The sheath materials available are stainless steel, steel, copper, and incoloy. Standard diameters are: .260", .315", .375", .440"and .475". Diameter tolerance is ±.010".

Sheath Material	Max. Temp. Allowed on Sheath	Max. Length of Sheath	Max. Cold Lengths
Steel	750°F	252"	96"
Copper	350°F	252"	96"
St. Steel	1200°F	324"	96"
Incoloy	1600°F	324"	96"

Sheath Materials and Watt Densities

Application	Approx. Operating Temp.	Rec. Sheath Material	Watts/sq. in. Of Element Surface
Clamped to Surfaces	up to 300°F	Steel	30
	500°F	Steel	20
	800°F	Incoloy	15
	1000°F	Incoloy	10
	1200°F	Incoloy	7
	1400°F	Incoloy	2.5
Still Air (Sheath Temp.)	800°F	Incoloy	7
	1000°F	Incoloy	11
	1200°F	Incoloy	14
	1400°F	Incoloy	30
Clamped into Machined Grooves	500°F	Steel	25
	800°F	St. Steel	15
	900°F	Incoloy	15

Formula for Determination of Unit Wattage

Unit Wattage = Diameter x 3.142 x Heated Length x Allowable watts/sq. in.

Electrical Tolerances and Limits

Sheath Diameter	.260"	.315"	.375"	.440"	.475"
Min. OHMS/in.	.15	.05	.05	.05	.05
Max. OHMS/in.	80	50	50	50	50
Max. Voltage	250	300	480	600	600
Max. Amperes	20	30	40	40	40

Wattage tolerance is +5%, -10% at rated volts.

Standard Length Tolerances

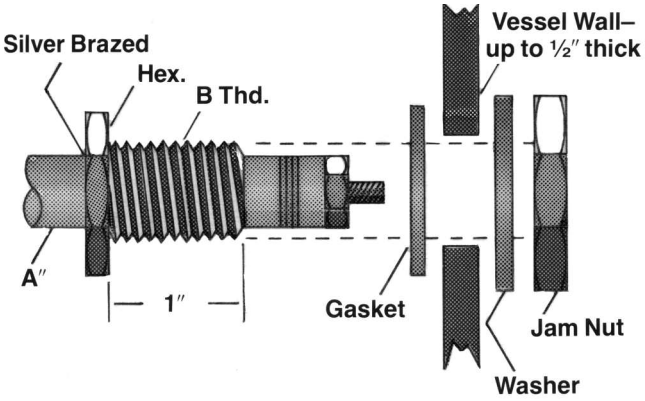
Sheath Length	Length	Heated Length
Up to 20"	±1/16"	±2%
20" to 100"	±1/8"	±2%
100" to 200"	±1/4"	±2%

Cold Ends

When not specified, cold ends will be the minimum length as shown in the table below. Longer cold lengths may be specified. Optional cold ends of unequal lengths are available.

Sheath Length	Minimum Cold Ends
Up to 20"	1"
20" to 100"	1½"
100" to 200"	4"

Mounting Fittings



Fittings are available with light jam nuts (plated steel), plain washers (plated steel), and/or copper gaskets.

Brass bushings are used with copper and steel sheaths. Silver brazed stainless steel bushings are used with stainless steel and Incoloy sheaths. Welded stainless steel bushings are available at additional cost.

Catalog Number	Sheath Diameter A"	Thread Size B"
EF-12	.260"	½"-20
EF-13	.315"	½"-20
EF-16	.375"	⅝"-18
EF-17	.440"	¾"-16
EF-17	.475"	¾"-16

Forming

If you plan to do the bending required, observe the minimum bend limits in the table, and do not plan any bend within 1" of a cold end junction.

Annealing for bending must be specified.

If Hotwatt is to do the bending, submit a sketch showing clearly the form the bent unit is to take.

Minimum Bend Radius

Diameter	.260"	.315"	.375"	.440"	.475"
Formed By Factory	¼"	5/16"	⅜"	7/16"	7/16"
Formed By Customer	¾"	1"	1¼"	1½"	1½"

TUBULAR

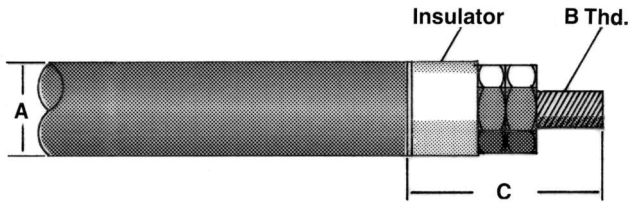
Tubular Heaters

Straight and Formed

Optional Terminations

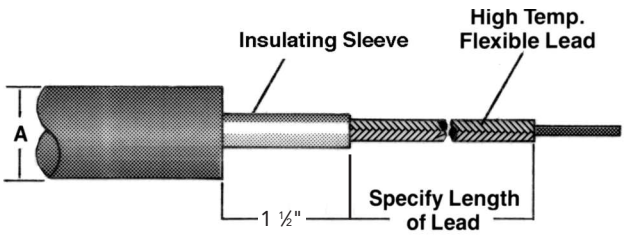
SF3S: Post

Post terminations will be supplied unless otherwise specified.



A	B	C	Max. Amps.
.260"	6-32	⅝"	20
.315"	6-32	⅝"	20
.375"	8-32	¾"	30
.375"	10-32	1"	40
.440"	8-32	¾"	30
.440"	10-32	1"	40
.475"	10-32	1"	40

SF2A: Lead Wire



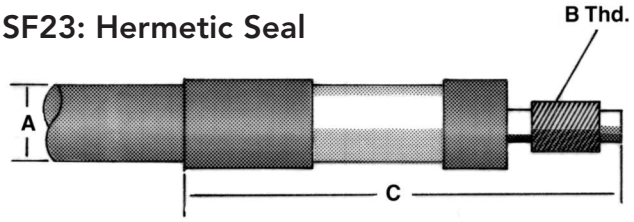
A	Max. Amps.
.260"	21
.315"	28
.375"	28
.440"	28
.475"	28

SF3P: Pin



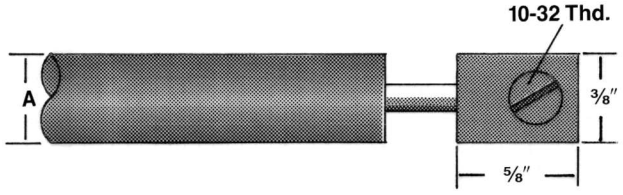
A	B	C	Max. Amps.
.260"	.091"	⅝"	20
.315"	.135"	⅝"	20
.375"	.156"	¾"	40
.440"	.156"	¾"	40
.475"	.156"	¾"	40

SF23: Hermetic Seal



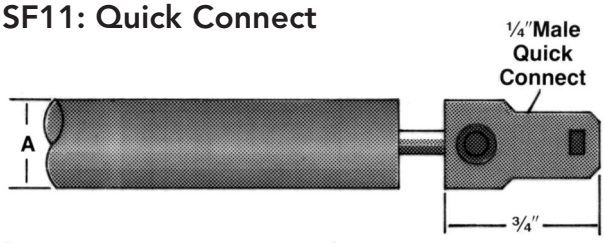
A	B	C	Max. Amps.
.260"	8-32	1 11/16"	20
.315"	10-32	1⅛"	30
.375"	10-32	1⅛"	30
.440"	¼-28	2⅛"	40
.475"	¼-28	2⅛"	40

SF3T: Tab



A	Max. Amps.
.260"	20
.315"	30
.375"	30
.440"	30
.475"	30

SF11: Quick Connect



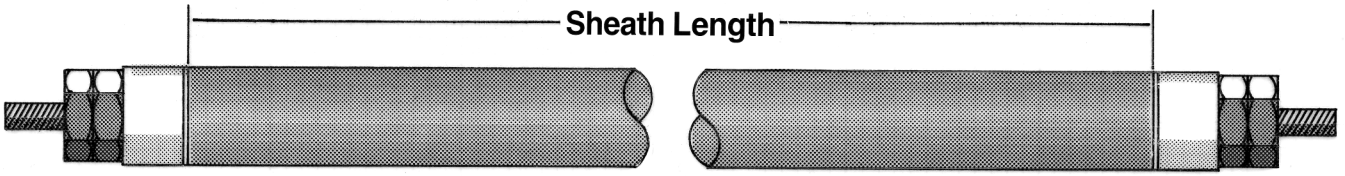
A	Max. Amps.
.260"	20
.315"	30
.375"	30
.440"	30
.475"	30

TUBULAR

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Tubular Heaters

Straight and Formed



Diameter:	.260: Incoloy		.315: Incoloy		.375: Incoloy	
Maximum Amperage:	20		30		40	
Sheath Length	Cat. No.	Max. Watts at 240V	Cat. No.	Max. Watts at 240V	Cat. No.	Max. Watts at 480V
20"	TA26-20	555	TA31-20	675	TA37-20	800
40"	TA26-40	1210	TA31-40	1465	TA37-40	1745
60"	TA26-60	1860	TA31-60	2255	TA37-60	2685
80"	TA26-80	2515	TA31-80	3050	TA37-80	3630
100"	TA26-100	3170	TA31-100	3840	TA37-100	4570
120"	TA26-120	3825	TA31-120	4630	TA37-120	5515
140"	TA26-140	4475	TA31-140	5425	TA37-140	6455
160"	TA26-160	4640	TA31-160	6215	TA37-160	7395
180"	TA26-180	4640	TA31-180	7010	TA37-180	8340
200"	TA26-200	4640	TA31-200	7005	TA37-200	9285
220"	TA26-220	4640	TA31-220	7005	TA37-220	10225
240"	TA26-240	4640	TA31-240	7005	TA37-240	11170

Diameter:	.440: Incoloy		.475: Incoloy		.260: St. Steel	
Maximum Amperage:	40		50		20	
Sheath Length	Cat. No.	Max. Watts at 480V	Cat. No.	Max. Watts at 480V	Cat. No.	Max. Watts at 240V
20"	TA44-20	960	TA47-20	1055	TT26-20	420
40"	TA44-40	2090	TA47-40	2300	TT26-40	910
60"	TA44-60	3225	TA47-60	3545	TT26-60	1395
80"	TA44-80	4355	TA47-80	4790	TT26-80	1885
100"	TA44-100	5485	TA47-100	6035	TT26-100	2375
120"	TA44-120	6615	TA47-120	7280	TT26-120	2865
140"	TA44-140	7745	TA47-140	8520	TT26-140	3355
160"	TA44-160	8880	TA47-160	9765	TT26-160	3845
180"	TA44-180	10010	TA47-180	11010	TT26-180	4340
200"	TA44-200	11140	TA47-200	12255	TT26-200	4705
220"	TA44-220	12270	TA47-220	13495	TT26-220	4705
240"	TA44-240	13400	TA47-240	14740	TT26-240	4705

Diameter:	.315: St. Steel		.375: St. Steel		.440: St. Steel	
Maximum Amperage:	30		40		40	
Sheath Length	Cat. No.	Max. Watts at 240V	Cat. No.	Max. Watts at 240V	Cat. No.	Max. Watts at 480V
20"	TT31-20	505	TT37-20	600	TT44-20	720
40"	TT31-40	1095	TT37-40	1305	TT44-40	1570
60"	TT31-60	1690	TT37-60	2015	TT44-60	2415
80"	TT31-80	2285	TT37-80	2720	TT44-80	3265
100"	TT31-100	2880	TT37-100	3425	TT44-100	4115
120"	TT31-120	3475	TT37-120	4135	TT44-120	4960
140"	TT31-140	4065	TT37-140	4840	TT44-140	5810
160"	TT31-160	4660	TT37-160	5550	TT44-160	6660
180"	TT31-180	5255	TT37-180	6255	TT44-180	7505
200"	TT31-200	5850	TT37-200	6965	TT44-200	8355
220"	TT31-220	6440	TT37-220	7670	TT44-220	9205
240"	TT31-240	7035	TT37-240	8375	TT44-240	10050

Tubular Heaters

Straight and Formed

Diameter:	.260: Steel		.315: Steel		.440: Steel	
Maximum Amperage:	20		30		40	
Sheath Length	Cat. No.	Max. Watts at 240V	Cat. No.	Max. Watts at 240V	Cat. No.	Max. Watts at 240V
20"	TS26-20	280	TS31-20	335	TS44-20	480
40"	TS26-40	605	TS31-40	730	TS44-40	1045
60"	TS26-60	930	TS31-60	1130	TS44-60	1610
80"	TS26-80	1260	TS31-80	1525	TS44-80	2175
100"	TS26-100	1585	TS31-100	1920	TS44-100	2745
120"	TS26-120	1910	TS31-120	2315	TS44-120	3310
140"	TS26-140	2240	TS31-140	2710	TS44-140	3875
160"	TS26-160	2565	TS31-160	3105	TS44-160	4440
180"	TS26-180	2890	TS31-180	3505	TS44-180	5005
200"	TS26-200	3220	TS31-200	3900	TS44-200	5570
220"	TS26-220	3545	TS31-220	4295	TS44-220	6135
240"	TS26-240	3870	TS31-240	4690	TS44-240	6700

Diameter:	.315: Copper		.440: Copper	
Maximum Amperage:	30		40	
Sheath Length	Cat. No.	Max. Watts at 240V	Cat. No.	Max. Watts at 600V
20"	TC31-20	1345	TC44-20	1925
40"	TC31-40	2930	TC44-40	4185
60"	TC31-60	4515	TC44-60	6445
80"	TC31-80	6095	TC44-80	8710
100"	TC31-100	6890	TC44-100	10970
120"	TC31-120	6890	TC44-120	13230
140"	TC31-140	6890	TC44-140	15495
160"	TC31-160	6890	TC44-160	17755
180"	TC31-180	6890	TC44-180	18885
200"	TC31-200	6890	TC44-200	18885
220"	TC31-220	6890	TC44-220	18885
240"	TC31-240	6890	TC44-240	18885

Wattage

Wattages as shown in the above tables are based on sheath material or voltage/amperage limitations. For allowable wattage for your application, refer to Sheath Material/Watt Density chart on page 77.

How To Order

Specify: catalog number, wattage, voltage, termination and other optimal features. If forming is required, include a dimensional sketch and reference formation number, if applicable, as shown on pages 83 and 84.

Example: TA31-40/1000W240V/SF3S

Tubular Heaters

Finned



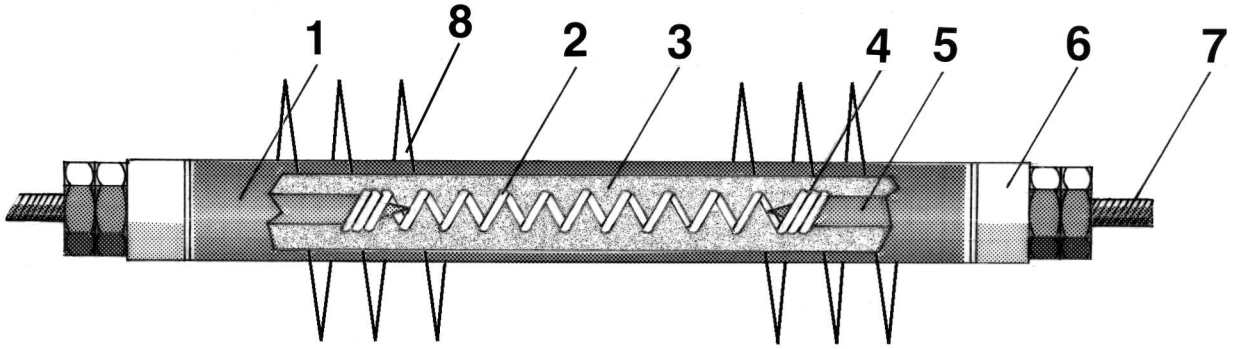
U.L. And C -UL Recognized No. E177353

Features

- Mechanically-bonded continuous fin assures excellent heat transfer and helps prevent fin vibration at high air velocities.
- Several standard formations and mounting bushings available.
- Standard fin is high temperature painted steel with steel sheath.
- Optional stainless steel fin with stainless steel or incoloy sheath for corrosion resistance.
- 120v, 208v, 240v, 480v available.
- Maximum Sheath Temperature.
  750°F (400°C) - Steel
  900°F (480°C) - ST.ST./INCOLY
- Made in U.S.A.

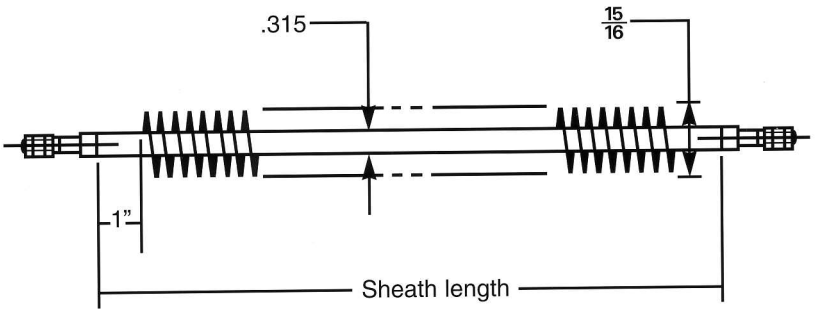
Construction

1. Steel, stainless steel or Incoloy sheathed elements.
2. Element wire situated in proximity to outside surface for maximum heat transfer and minimum internal temperature while preserving good dielectric qualities.
3. Pure magnesium oxide compressed to an optimum density for best heat transfer and electrical insulation at elevated temperatures.
4. Weld connection.
5. Cold pin.
6. Insulator.
7. Standard post terminal.
8. Painted steel or stainless steel continuous fin (approx. 5 per inch).



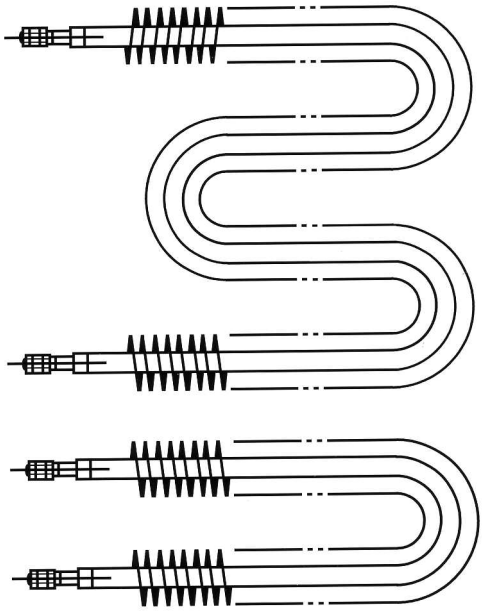
Tubular Heaters

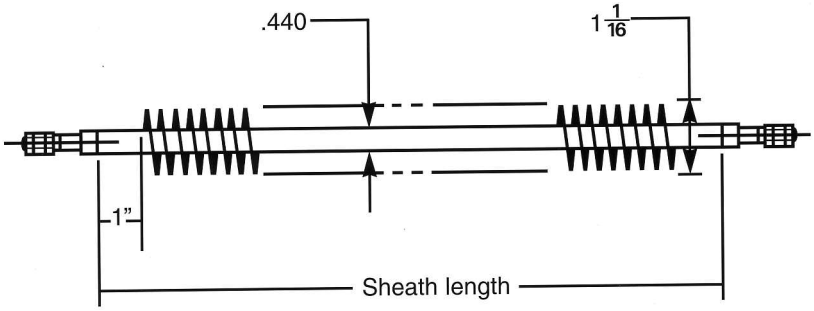
Finned



Sheath Length	Cat. No.	Wattage
.315 Sheath Dia.30 Amps. max.		
12"	FT31-12	530
15"	FT31-15	700
24"	FT31-24	1250
36"	FT31-36	1960
48"	FT31-48	2675
60"	FT31-60	3385
72"	FT31-72	4100
96"	FT31-96	5500
Available in Voltages up to 250V		

Optional Configurations





Sheath Length	Cat. No.	Wattage
.440 Sheath Dia.40 Amps. max.		
12"	FT44-12	750
15"	FT44-15	1175
24"	FT44-24	1725
36"	FT44-36	2725
48"	FT44-48	3725
60"	FT44-60	4725
72"	FT44-72	5700
96"	FT44-96	7700
Available in Voltages up to 480V		

Wattages in the above tables are based on 60w/in^2. Other wattages both higher and lower are available depending upon operating conditions. Consult factory for details. Available in lengths between those and longer than those listed in the above tables. Maximum length is 120".

Units may be formed to various shapes. Typical configurations shown above. Minimum radius as follows:

Sheath diameter	Minimum radius
.315	3/4 in.
.440	7/8 in.

Units may be supplied with mounting fittings as shown on page 77. Standard terminations is post type termination (SF3S), optional terminations as shown on page 78 are also available.

HOW TO ORDER

Specify: catalog number, wattage, termination, and other optimal features. If forming is required, include a dimensional sketch.

Example: FT31-27/1300W 120V/SF3S

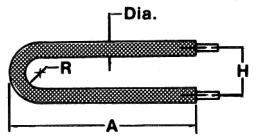
Phone: 978-777-0070 ■ Fax: 978-774-2409

Tubular Heaters

Forming Options

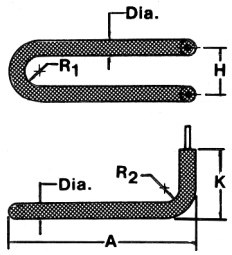
Custom Formations to your requirements are available.

1



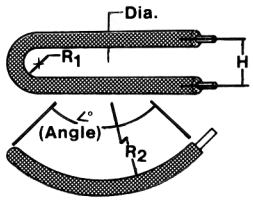
SL = 2A + 1.14R - .43 Dia.

2



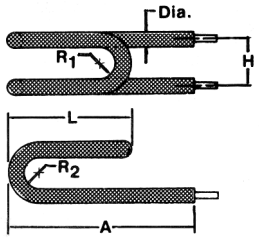
SL = 2K - .86 R_2 - 2.86 Dia. + 2A + 1.14 R_1

3



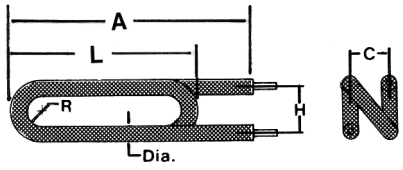
SL = .0175 <°(2 R_2 + Dia.) + 1.14 R_1 - .43 Dia.

4



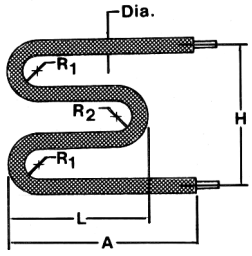
SL = 2A + 2.28 R_2 - 1.29 Dia. + 2L + 1.14 R_1

5



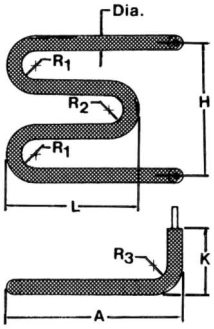
SL = 2A + 3.42R - 1.29 Dia. + 2L

6



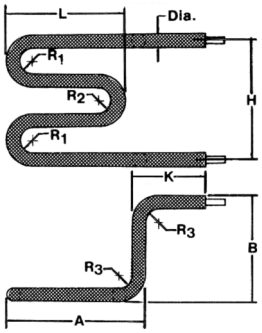
SL = 2A + 2.28 R_1 - 1.29 Dia. + 2L + 1.14 R_2

7



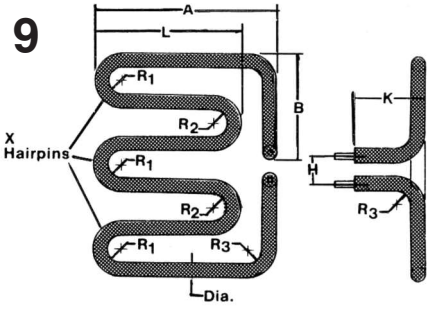
SL = 2K - .86 R_3 - 3.72 Dia. + 2A + 2L + 2.28 R_1 + 1.14 R_2

8



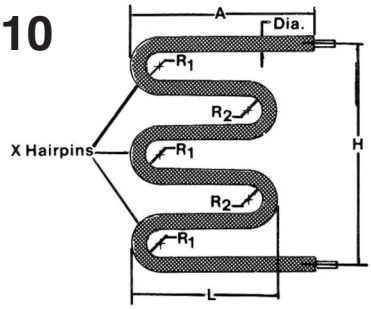
SL = 2K - 1.72 R_3 - 6.15 Dia. + 2B + 2A + 2L + 2.28 R_1 + 1.14 R_2

9



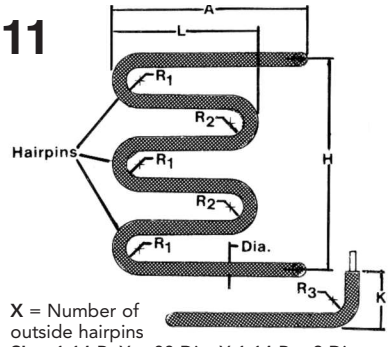
X = Number of outside hairpins
SL = 2K + 2A - 1.72 R_3 + 3.14 R_1 X + 3.14 R_2 (X-1) + 2L (X-1) - H + 1.14 X Dia. - 3.42 Dia.

10



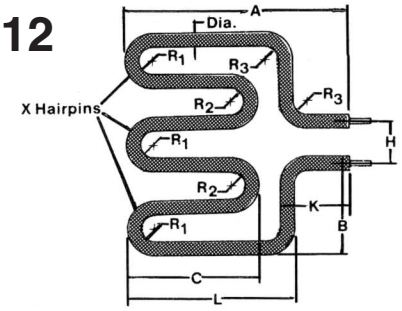
X = Number of outside hairpins
SL = 2A + .43 Dia. (1-2X) + 2L (X-1) + 1.14 X R_1 + 1.14 R_2 (X-1)

11



X = Number of outside hairpins
SL = 1.14 R_2 X - .88 Dia. X 1.14 R_2 - 2 Dia. + 1.14 R_1 X - .86 R_3 + 2L X - 2L + 2A + 2K

12



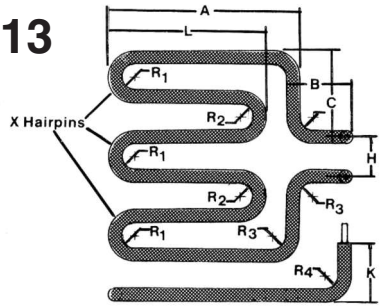
X = Number of outside hairpins
SL = 2L + 2K + 2B + 2C (X-1) - 0.86 R_3 - 0.86 R_3 - 4.86 (Dia.) + 1.14 R_1 (X) + 1.14 R_2 (X-1) - (2X-1) 0.43 Dia.

TUBULAR

Tubular Heaters

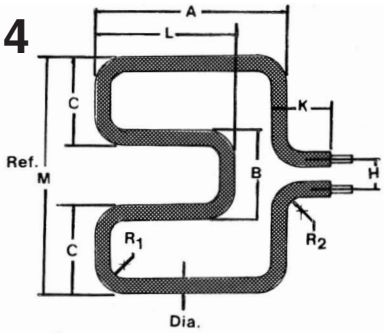
Forming Options

13



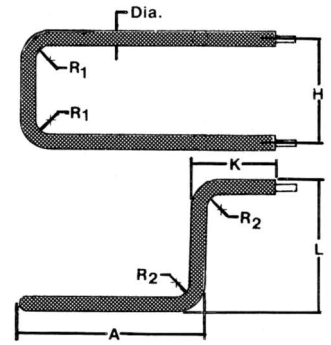
X = Number of outside hairpins
SL = 2K + 2A +2B - 2.58 R_3 + 3.14 R_1 X + 3.14 R_2 (X-1) + 2L(X-1) - H + 1.14 X Dia. - 5.85 Dia.

14



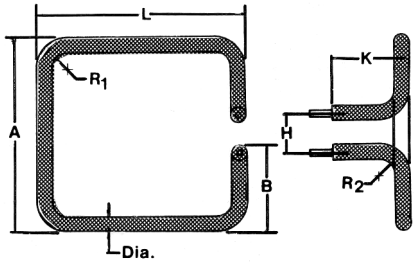
SL = 2K + 4C + 2B + 2A + 2L - H - 2.58 R_1 - .86 R_2 - 12.15 Dia.

15



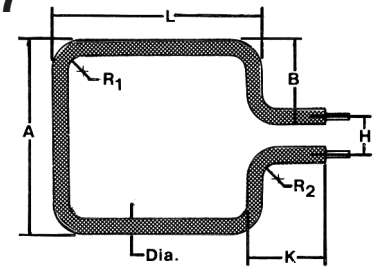
SL =2K - 1.72 R_2 - 6.29 Dia. + 2L + 2A - .86 R_1 + H

16



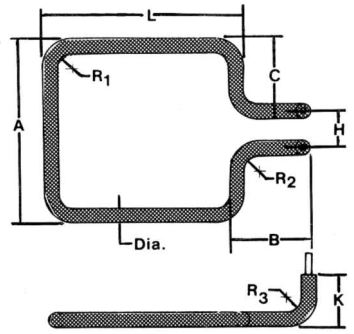
SL = 2K + 2A + 2L - H - 1.72 R_1 - .86 R_2 - 6.29 Dia.

17



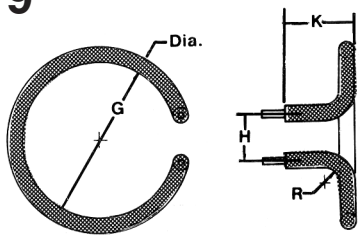
SL = 2K + 2A + 2L - H - 1.72 R_1 - .86 R_2 - 6.29 Dia.

18



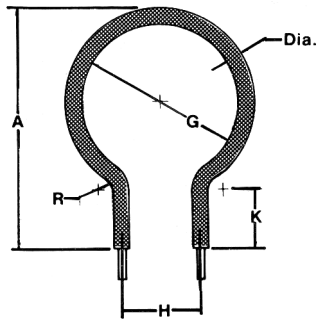
SL = 2K + 2A + 2L + 2B - H - 1.72 R_1 - 1.72 R_2 - 8.72 Dia.

19



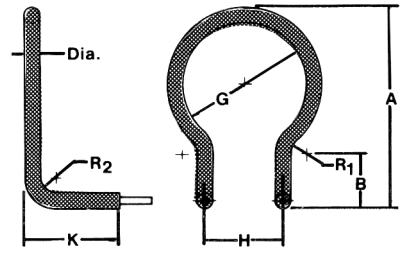
SL = (G + Dia.) (3.14) + 1.14 R + 2K + 3.28 Dia. - H

20



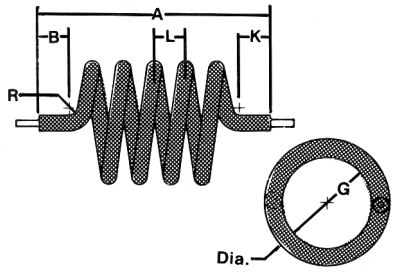
SL = (G + Dia.) (3.14) + 1.14 R + 2K + 3.71 Dia. - H

21



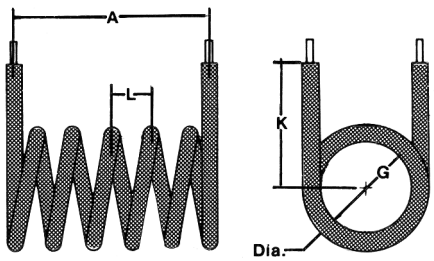
SL = (G + Dia.) (3.14) + 1.14 R_1 + 2B + 1.14 R_2 + 2K + 3.28 Dia. - H

22



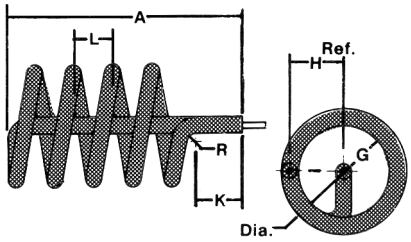
SL = [(G + Dia.) (3.14) (Number of 360°'s)] + B + K.

23



SL = [(G + Dia.) (3.14) (Number of 360°'s)] + 2K

24



SL = [(G + Dia.) (3.14) (Number of 360°'s)] + (G ÷ 2) + A + K.

TUBULAR

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Tubular Heaters

Screw Plug



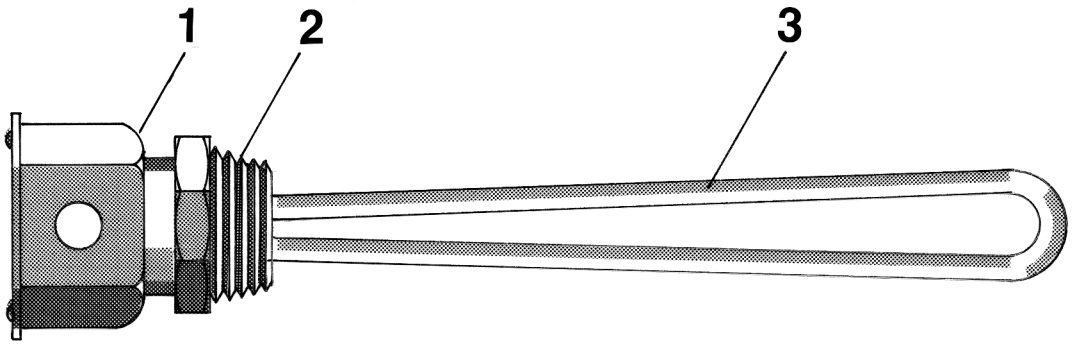
UL and C-UL Recognized-E177353

Features

- Ratings and sizes other than those listed above are available.
- Brass, steel, or stainless steel screw plugs in 1", 1¼", 2", and 2½" sizes.
- Element supports in multiple element units for proper element spacing as required.
- Steel, stainless steel, copper, or incoloy sheathed elements. One, two or three per unit depending on size.
- Optional thermostat and well for temperature control.
- General purpose terminal housing with conduit opening. Optional terminal housings for special applications.
- 120V, 208V, 240V, 480V, single or three phase which are factory wired to your requirements.
- Long, trouble free service.
- Made in U.S.A.

Construction

1. Terminal housing, NEMA 1 general purpose for electrical connections.
2. Screw plug.
3. Tubular heating element.



Tubular Heaters

Screw Plug

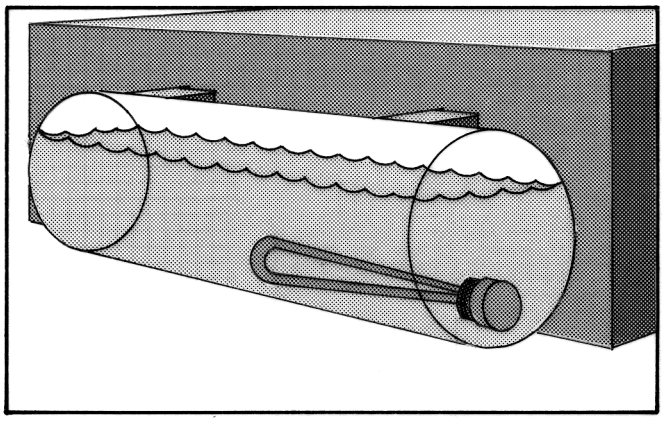
Screw Plug Heater Selection Guide

Application	Solution or Application	Alkaline or Acid Content (Est. % by Volume)	Sheath Material	Typical Watt Density (watts/sq. in.)	Screw Plug Material
Water and Very Mild Solutions	Clean Water	pH6 to pH8 Neutral	Copper	45	Brass
	Process Water or Very Mild Solutions	pH5 to pH9 2–3%	Incoloy	45	Stainless Steel
	Mild Solutions	5–6%	Incoloy	45	Stainless Steel
	Demineralized or Deionized Water	—	Incoloy	45	Stainless Steel Stainless Steel
Oil Heating*	Low Viscosity Oil	—	Steel	23	Steel
	Medium Viscosity Oil	—	Steel	15	Steel
	High Viscosity Oil	—	Steel	6	Steel
Specialty Heaters	Process Water Demineralized Water Low Viscosity Oil	pH5–pH9 — —	Incoloy Incoloy Incoloy	45 45 23	Brass Stainless Steel Steel
	Pipe Insert	—	Incoloy	12	Steel
	Hot Tubs, Spa	Treated	Incoloy	100	Brass
	Commercial Equipment	Clean Water Clean Water	Incoloy Copper	30 60	Brass Brass

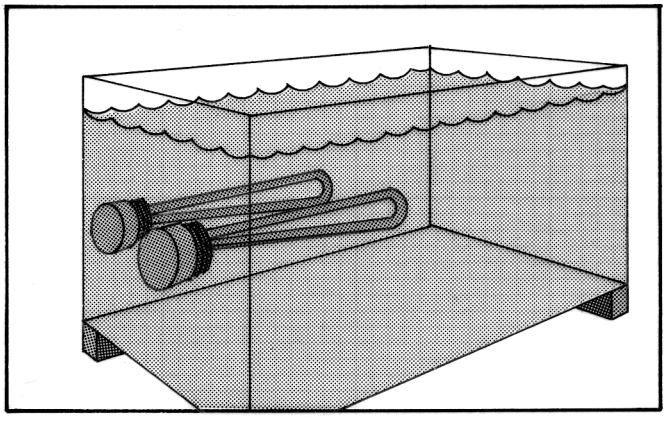
*The oil heaters on following pages are catalogued based on low viscosity oil. For medium and high viscosity oils, watt densities must be reduced in accordance with the above watt densities.

Installation

The heater is screwed into a pipe coupling or half coupling in the tank. Units must be immersed at all times for proper operation.



Oil Reservoir Heater



Tank Heater

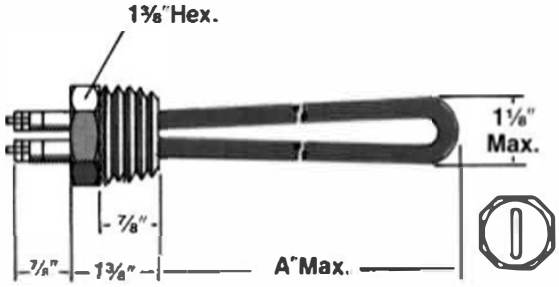
TUBULAR

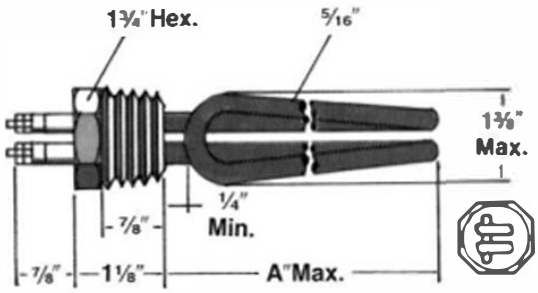
Phone: 978-777-0070 ■ Fax: 978-774-2409

Tubular Heaters

Screw Plug

Copper Sheath





1" NPT: Copper Sheath

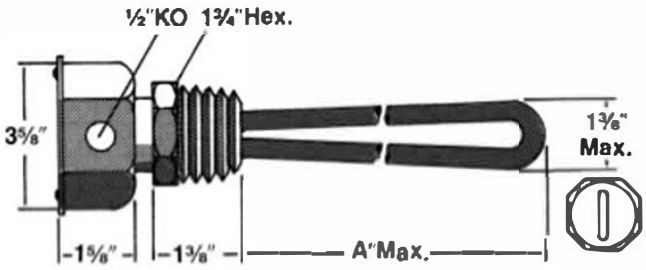
No. of Elements: 1
Plug Type: Brass Screw
Watts/sq. in.: Approx. 80
Application: Water

A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts
5¼"	LC9-5.25-X	.35	120
6⅜"	LC9-6.37-X	.50	120
6⅜"	LC9-6.37-X	.60	120
6⅜"	LC9-6.37-X	.75	120
6⅜"	LC9-6.37-X	.75	240
6⅜"	LC9-6.37-X	1.0	120
6⅜"	LC9-6.37-X	1.0	240
8⅛"	LC9-8.12-X	1.2	120
8⅛"	LC9-8.12-X	1.2	240
9¼"	LC9-9.25-X	1.5	120
9¼"	LC9-9.25-X	1.5	240
12¼"	LC9-12.25-X	2.0	120

1¼" NPT: Copper Sheath

No. of Elements: 1 (Fold Back Design)
Plug Type: Brass
Watts/sq. in.: Approx. 80
Application: Water

A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts
6⅛"	LC11-6.12-X	1.0	120
6⅛"	LC11-6.12-X	1.0	240
6⅝"	LC11-6.62-X	2.0	120
6⅝"	LC11-6.62-X	2.0	240
8½"	LC11-8.5-X	2.5	120
9¼"	LC11-9.06-X	1.5	120
9¼"	LC11-9.06-X	1.5	240
10¾"	LC11-10.18-X	3.0	240
13¾"	LC11-13.56-X	4.0	240
16¹³⁄₁₆"	LC11-16.93-X	5.0	240



1¼" NPT: Copper Sheath

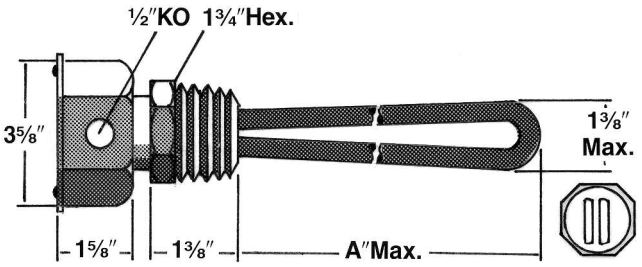
No. of Elements: 1
Plug Type: Brass
Watts/sq. in.: Approx. 45min. – 80max.
Application: Water
Terminal Enclosure: NEMA 1

A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts
6⅛"	LC11-6.12-XJ	.60	120
6⅛"	LC11-6.12-XJ	.60	240
6⅛"	LC11-6.12-XJ	.75	120
6⅛"	LC11-6.12-XJ	.75	240
6⅛"	LC11-6.12-XJ	1.0	120
6⅛"	LC11-6.12-XJ	1.0	240

TUBULAR

Tubular Heaters

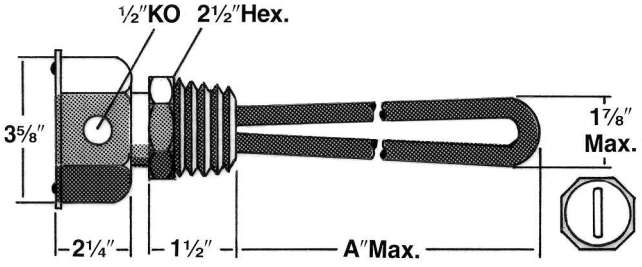
Screw Plug



1¼" NPT: Copper Sheath

No. of Elements: 2
Plug Type: Brass
Watts/sq. in.: Approx. 45min. – 80max.
Application: Water
Terminal Enclosure: NEMA 1

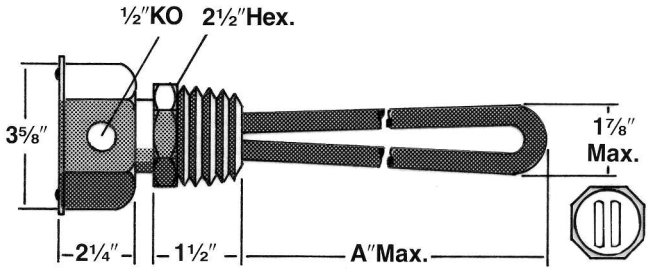
A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts
6⅛"	LC11-6.12-YJ	1.0	120
6⅛"	LC11-6.12-YJ	1.0	240
6⅛"	LC11-6.12-YJ	1.2	120
6⅛"	LC11-6.12-YJ	1.2	240
6⅛"	LC11-6.12-YJ	1.5	120
6⅛"	LC11-6.12-YJ	1.5	240
6⅛"	LC11-6.12-YJ	2.0	120
6⅛"	LC11-6.12-YJ	2.0	240



2" NPT: Copper Sheath

No. of Elements: 1
Plug Type: Brass Screw
Watts/sq. in.: Approx. 45
Application: Water
Terminal Enclosure: NEMA 1

A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts
12"	LC13-12-XJ	1.5	120
12"	LC13-12-XJ	1.5	240
12"	LC13-12-XJ	1.5	480
18"	LC13-18-XJ	2.0	120
18"	LC13-18-XJ	2.0	240
18"	LC13-18-XJ	2.0	480



2" NPT: Copper Sheath

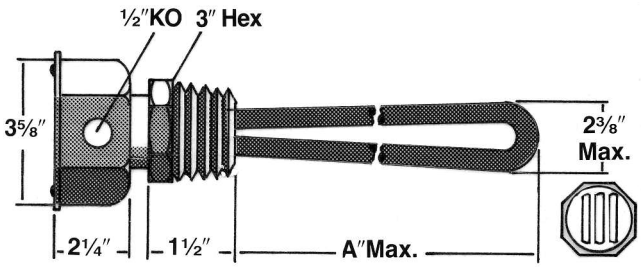
No. of Elements: 2
Plug Type: Brass Screw
Watts/sq. in.: Approx. 45
Application: Water
Terminal Enclosure: NEMA 1

A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts
7⅞"	LC13-7.87-YJ	2.0	120
7⅞"	LC13-7.87-YJ	2.0	240
7⅞"	LC13-7.87-YJ	2.0	480
9⅜"	LC13-9.37-YJ	2.5	120
9⅜"	LC13-9.37-YJ	2.5	240
9⅜"	LC13-9.37-YJ	2.5	480
12"	LC13-12-YJ	3.0	120
12"	LC13-12-YJ	3.0	240
12"	LC13-12-YJ	3.0	480
18"	LC13-18-YJ	4.0	240
18"	LC13-18-YJ	4.0	480
19⅞"	LC13-19.87-YJ	5.0	240
19⅞"	LC13-19.87-YJ	5.0	480
25"	LC13-25-YJ	6.0	240
25"	LC13-25-YJ	6.0	480
28"	LC13-28-YJ	7.0	240
28"	LC13-28-YJ	7.0	480
40⅜"	LC13-40.37-YJ	10.0	240
40⅜"	LC13-40.37-YJ	10.0	480

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Tubular Heaters

Screw Plug

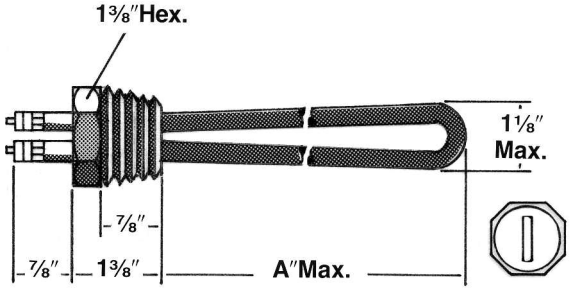


2½" NPT: Copper Sheath

No. of Elements: 3
Plug Type: Brass Screw
Watts/sq. in.: Approx. 45
Application: Water
Terminal Enclosure: NEMA 1

A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts	Phase
7⅜"	LC15-7.37-ZJ	3.0	240	1
7⅜"	LC15-7.37-ZJ	3.0	240	3
7⅜"	LC15-7.37-ZJ	3.0	480	3
8⅞"	LC15-8.87-ZJ	3.75	240	1
8⅞"	LC15-8.87-ZJ	3.75	240	3
8⅞"	LC15-8.87-ZJ	3.75	480	3
11⅜"	LC15-11.37-ZJ	4.5	240	1
11⅜"	LC15-11.37-ZJ	4.5	240	3
11⅜"	LC15-11.37-ZJ	4.5	480	1
11⅜"	LC15-11.37-ZJ	4.5	480	3
17⅜"	LC15-17.37-ZJ	6.0	240	1
17⅜"	LC15-17.37-ZJ	6.0	240	3
17⅜"	LC15-17.37-ZJ	6.0	480	1
17⅜"	LC15-17.37-ZJ	6.0	480	3
19⅛"	LC15-19.12-ZJ	7.5	240	1
19⅛"	LC15-19.12-ZJ	7.5	240	3
19⅛"	LC15-19.12-ZJ	7.5	480	1
19⅛"	LC15-19.12-ZJ	7.5	480	3
24½"	LC15-24.5-ZJ	9.0	240	1
24½"	LC15-24.5-ZJ	9.0	240	3
24½"	LC15-24.5-ZJ	9.0	480	1
24½"	LC15-24.5-ZJ	9.0	480	3

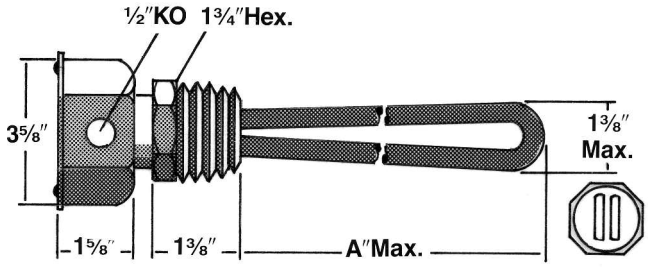
Steel Sheath



1" NPT: Steel Sheath

No. of Elements: 1
Plug Type: Steel Screw
Watts/sq. in.: Approx. 20
Application: Low Viscosity Oil

A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts
9½"	LS9-9.5-X	.37	120
9½"	LS9-9.5-X	.37	240
12½"	LS9-12.5-X	.50	120
12½"	LS9-12.5-X	.50	240
18⅞"	LS9-18.87-X	.80	120
18⅞"	LS9-18.87-X	.80	240



1¼" NPT: Steel Sheath

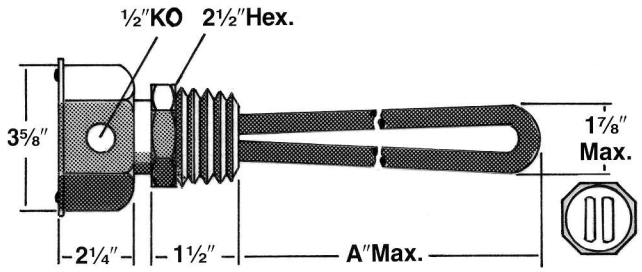
No. of Elements: 2
Plug Type: Steel
Watts/sq. in.: Approx. 20
Application: Low Viscosity Oil
Terminal Enclosure: NEMA 1

A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts
12½"	LS11-12.5-YJ	1.0	120
12½"	LS11-12.5-YJ	1.0	240

TUBULAR

Tubular Heaters

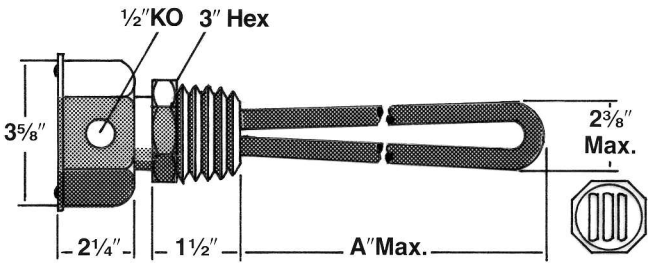
Screw Plug



2" NPT: Steel Sheath

No. of Elements: 2
Plug Type: Steel Screw
Watts/sq. in.: Approx. 20
Application: Low Viscosity Oil
Terminal Enclosure: NEMA 1

A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts
11¾"	LS13-11.75-YJ	1.5	120
11¾"	LS13-11.75-YJ	1.5	240
11¾"	LS13-11.75-YJ	1.5	480
17¾"	LS13-17.75-YJ	2.0	120
17¾"	LS13-17.75-YJ	2.0	240
17¾"	LS13-17.75-YJ	2.0	480
19¾"	LS13-19.75-YJ	2.5	120
19¾"	LS13-19.75-YJ	2.5	240
19¾"	LS13-19.75-YJ	2.5	480
24⅞"	LS13-24.87-YJ	3.0	120
24⅞"	LS13-24.87-YJ	3.0	240
24⅞"	LS13-24.87-YJ	3.0	480
32¾"	LS13-32.75-YJ	4.0	120
32¾"	LS13-32.75-YJ	4.0	240
32¾"	LS13-32.75-YJ	4.0	480
40¼"	LS13-40.25-YJ	5.0	120
40¼"	LS13-40.25-YJ	5.0	240
40¼"	LS13-40.25-YJ	5.0	480
47¾"	LS13-47.75-YJ	6.0	240
47¾"	LS13-47.75-YJ	6.0	480



2½" NPT: Steel Sheath

No. of Elements: 3
Plug Type: Steel Screw
Watts/sq. in.: Approx. 20
Application: Low Viscosity Oil
Terminal Enclosure: NEMA 1

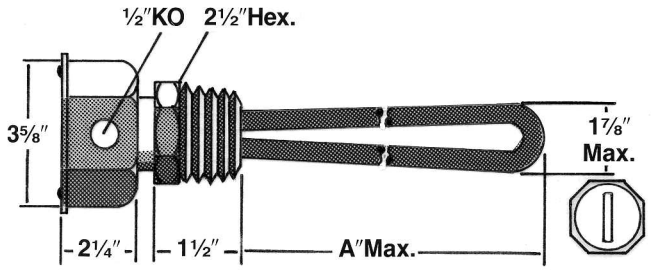
A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts	Phase
17⅜"	LS15-17.37-ZJ	3.0	240	1
17⅜"	LS15-17.37-ZJ	3.0	240	3
17⅜"	LS15-17.37-ZJ	3.0	480	1
17⅜"	LS15-17.37-ZJ	3.0	480	3
19"	LS15-19-ZJ	3.75	240	1
19"	LS15-19-ZJ	3.75	240	3
19"	LS15-19-ZJ	3.75	480	1
19"	LS15-19-ZJ	3.75	480	3
24½"	LS15-24.50-ZJ	4.5	240	1
24½"	LS15-24.50-ZJ	4.5	240	3
24½"	LS15-24.50-ZJ	4.5	480	1
24½"	LS15-24.50-ZJ	4.5	480	3
32⅜"	LS15-32.37-ZJ	6.0	240	1
32⅜"	LS15-32.37-ZJ	6.0	240	3
32⅜"	LS15-32.37-ZJ	6.0	480	1
32⅜"	LS15-32.37-ZJ	6.0	480	3
40"	LS15-40-ZJ	7.5	240	1
40"	LS15-40-ZJ	7.5	240	3
40"	LS15-40-ZJ	7.5	480	1
40"	LS15-40-ZJ	7.5	480	3
47⅜"	LS15-47.37-ZJ	9.0	240	1
47⅜"	LS15-47.37-ZJ	9.0	240	3
47⅜"	LS15-47.37-ZJ	9.0	480	1
47⅜"	LS15-47.37-ZJ	9.0	480	3

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Tubular Heaters

Screw Plug

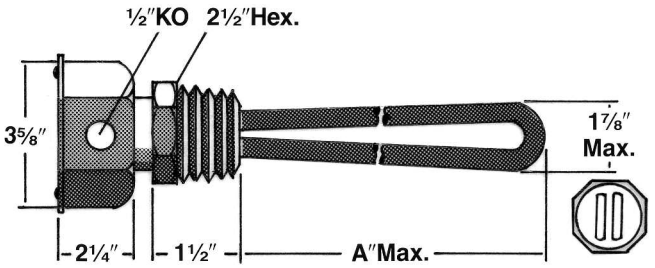
Incoloy Sheath



2" NPT: Incoloy Sheath

No. of Elements: 1
Plug Type: Stainless Steel Screw
Watts/sq. in.: Approx. 45
Application: Process Water and Very Mild Solution
Terminal Enclosure: NEMA 1

A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts
11½"	LA13-11.5-XJ	1.5	120
11½"	LA13-11.5-XJ	1.5	240
17½"	LA13-17.5-XJ	2.0	120
17½"	LA13-17.5-XJ	2.0	240



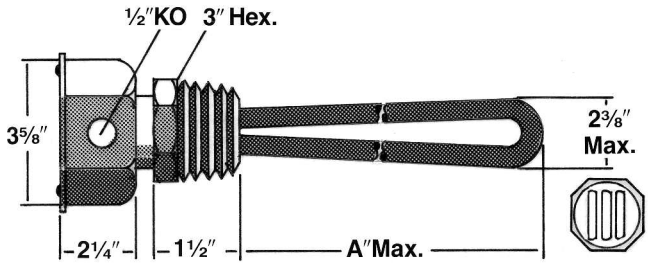
2" NPT: Incoloy Sheath

No. of Elements: 2
Plug Type: Stainless Steel Screw
Watts/sq. in.: Approx. 45
Application: Process Water and Very Mild Solution
Terminal Enclosure: NEMA 1

A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts
8"	LA13-8-YJ	2.0	240
8"	LA13-8-YJ	2.0	480
9½"	LA13-9.5-YJ	2.5	240
9½"	LA13-9.5-YJ	2.5	480
12"	LA13-12-YJ	3.0	240
12"	LA13-12-YJ	3.0	480
18"	LA13-18-YJ	4.0	240
18"	LA13-18-YJ	4.0	480
19⅛"	LA13-19.12-YJ	5.0	240
19⅛"	LA13-19.12-YJ	5.0	480
25¼"	LA13-25.25-YJ	6.0	240
25¼"	LA13-25.25-YJ	6.0	480
28⅛"	LA13-28.12-YJ	7.0	240
28⅛"	LA13-28.12-YJ	7.0	480
40½"	LA13-40.5-YJ	10.0	240
40½"	LA13-40.5-YJ	10.0	480
48"	LA13-48-YJ	12.0	240
48"	LA13-48-YJ	12.0	480
54"	LA13-54-YJ	15.0	240
54"	LA13-54-YJ	15.0	480

Tubular Heaters

Screw Plug



2½" NPT: Incoloy Sheath

No. of Elements: 3
Plug Type: Stainless Steel Screw
Watts/sq. in.: Approx. 45
Application: Process Water and Very Mild Solution
Terminal Enclosure: NEMA 1

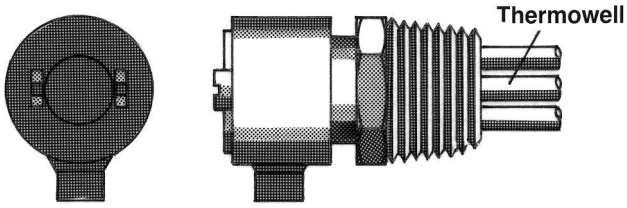
A Dim. Imm. Lgth	Cat. No.	Kilo-watts	Volts	Phase
7⅛"	LA15-7.12-ZJ	3.0	240	1
7⅛"	LA15-7.12-ZJ	3.0	240	3
7⅛"	LA15-7.12-ZJ	3.0	480	3
11¼"	LA15-11.25-ZJ	4.5	240	1
11¼"	LA15-11.25-ZJ	4.5	240	3
11¼"	LA15-11.25-ZJ	4.5	480	1
11¼"	LA15-11.25-ZJ	4.5	480	3
17"	LA15-17-ZJ	6.0	240	1
17"	LA15-17-ZJ	6.0	240	3
17"	LA15-17-ZJ	6.0	480	1
17"	LA15-17-ZJ	6.0	480	3
19"	LA15-19-ZJ	7.5	240	1
19"	LA15-19-ZJ	7.5	240	3
19"	LA15-19-ZJ	7.5	480	1
19"	LA15-19-ZJ	7.5	480	3
24⅛"	LA15-24.12-ZJ	9.0	240	1
24⅛"	LA15-24.12-ZJ	9.0	240	3
24⅛"	LA15-24.12-ZJ	9.0	480	1
24⅛"	LA15-24.12-ZJ	9.0	480	3
32⅛"	LA15-32.12-ZJ	12.0	240	1
32⅛"	LA15-32.12-ZJ	12.0	240	3
32⅛"	LA15-32.12-ZJ	12.0	480	1
32⅛"	LA15-32.12-ZJ	12.0	480	3
39½"	LA15-39.5-ZJ	15.0	240	1
39½"	LA15-39.5-ZJ	15.0	240	3
39½"	LA15-39.5-ZJ	15.0	480	1
39½"	LA15-39.5-ZJ	15.0	480	3
47⅛"	LA15-47.12-ZJ	18.0	240	1
47⅛"	LA15-47.12-ZJ	18.0	240	3
47⅛"	LA15-47.12-ZJ	18.0	480	1
47⅛"	LA15-47.12-ZJ	18.0	480	3

Dimensions

Screw plug and enclosure dimensions shown in preceding tables may vary.

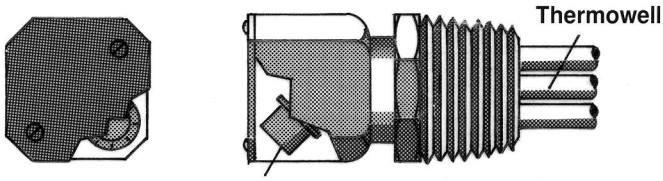
Special Features

SF-13B: Moisture tight/Explosion resistant terminal enclosure.



Available on:
1", 1¼", 2", 2½", NPT screw plugs. Enclosure sizes vary with element size.

XS-55: Thermostat control. Integral bulb and capillary control with thermowell. Two temperature ranges available. Specify XS-55 (0°–100°F) or XS-55 (60°–250°F).



Enclosed Thermostat Control

Available on:
1¼", 2", 2½", NPT screw plugs. Enclosure sizes vary with element size.

How To Order

Specify: catalog number, wattage, voltage, and special features, if any. Other sizes are available. Consult factory.

Example: LS13-12.5-YJ/1000W120V/SF13B/XS55 (0˚-100˚F)

TUBULAR

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Tubular Heaters

Flanged



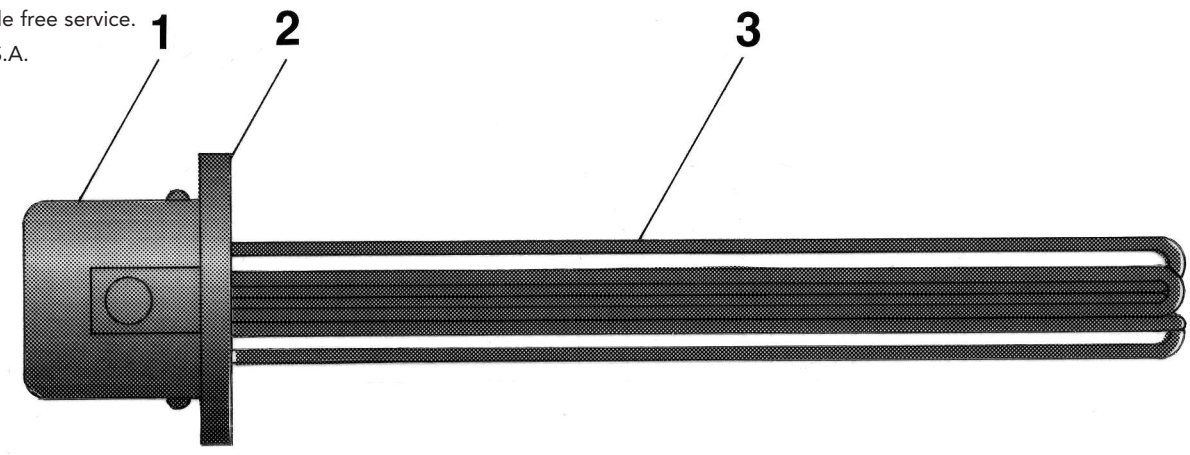
UL and C-UL Recognized-E177353

Features

- Ratings and sizes other than those listed are available.
- 150# rating ANSI carbon steel flange.
- Steel, stainless steel, copper, or incoloy sheathed elements.
- Optional thermostat and well for temperature control.
- Element supports in multiple element units for proper element spacing as required.
- General purpose terminal housing with conduit openings. Optional terminal housings for special applications.
- 240V and 480V, single or three phase which are factory wired to your requirements.
- Long, trouble free service.
- Made in U.S.A.

Construction

1. Terminal housing, NEMA 1 general purpose for electrical connections.
2. Standard pipe flange.
3. Tubular heating element.



Tubular Heaters

Flanged

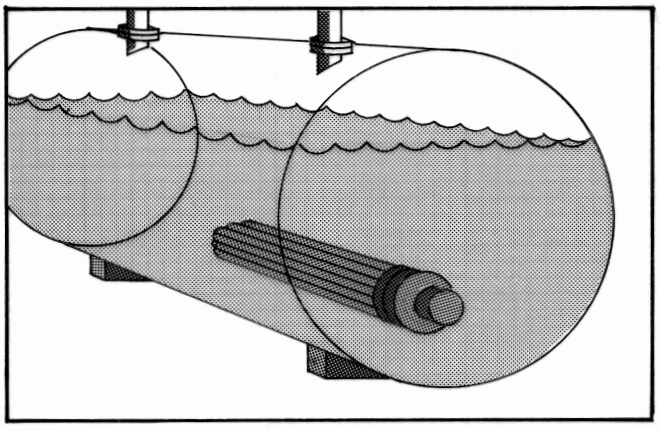
Flanged Heater Selection Guide

Application	Solution or Application	Alkaline or Acid Content (Est. % by Volume)	Sheath Material	Typical Watt Density (watts/sq. in.)
Water and Very Mild Solutions	Clean Water	pH6 to pH8 Neutral	Copper	45
	Process Water or Very Mild Solutions	pH5 to pH9 2–3%	Incoloy	45
	Mild Solutions	5–6%	Incoloy	45
	Demineralized or Deionized Water	—	Incoloy	45
Oil Heating*	Low Viscosity Oil	—	Steel	23
	Medium Viscosity Oil	—	Steel	15
	High Viscosity Oil	—	Steel	6
Specialty Heaters	Small Tanks	—		
	Process Water Demineralized Water Low Viscosity Oil	pH5–pH9 — —	Incoloy Incoloy Incoloy	45 45 23
	Pipe Insert	—	Incoloy	12
	Hot Tubs, Spa	Treated	Incoloy	100
	Commercial Equipment	Clean Water Clean Water	Incoloy Copper	30 60
Air, Gases, and Steam Heating	Low Temperature	—	Stainless Steel	23
	High Temperature	—	Incoloy	23

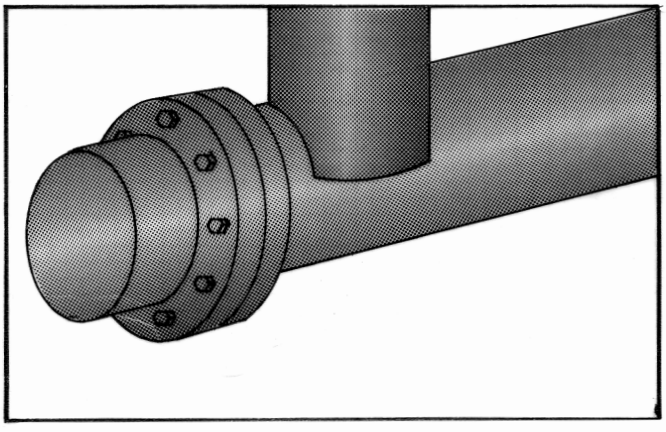
*The oil heaters on following pages are catalogued based on low viscosity oil. For medium and high viscosity oils, watt densities must be reduced in accordance with the above watt densities.

Installation

The heater is bolted onto a mating flange which is welded to a tank wall or a pipe. Terminal housings to enclose electrical connections are included.



Oil Tank Heater



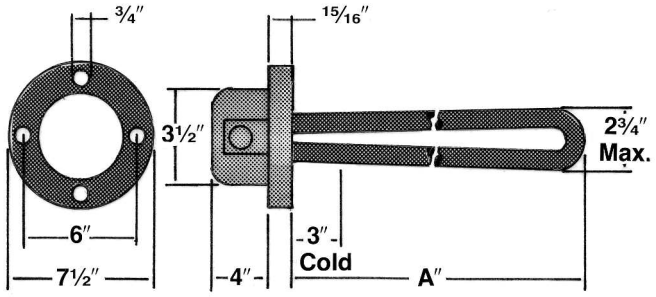
In-Line Fluid or Gas Heater

Phone: 978-777-0070 ■ Fax: 978-774-2409

Tubular Heaters

Flanged

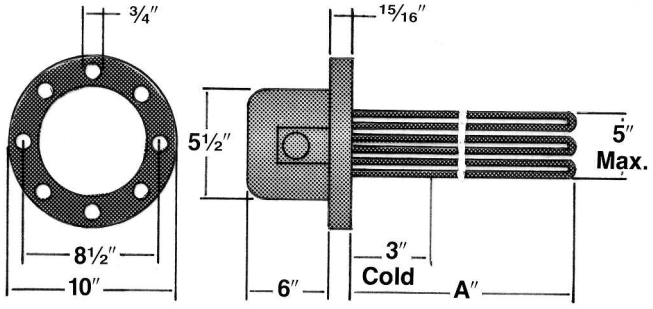
Steel Sheath: 150 lb Steel Flange



3" Flange: Steel Sheath

No. of Elements: 3
Watts/sq. in.: 23
Application: Low Viscosity Oil

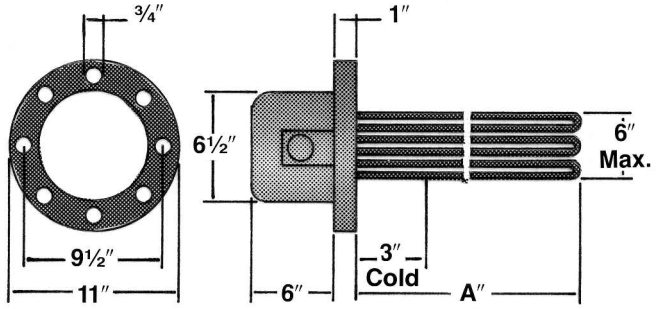
Lgth. Inside Tank A	Cat. No.	Kilowatts	Volts	Phase
18⅛"	BS3-18.06-J	3.0	240	1
18⅛"	BS3-18.06-J	3.0	240	3
25⅜"	BS3-25.18-J	4.5	240	1
25⅜"	BS3-25.18-J	4.5	240	3
33⅛"	BS3-33.06-J	6.0	240	1
33⅛"	BS3-33.06-J	6.0	240	3
40⅝"	BS3-40.56-J	7.5	240	3
48⅛"	BS3-48.06-J	9.0	240	1
48⅛"	BS3-48.06-J	9.0	240	3



5" Flange: Steel Sheath

No. of Elements: 6
Watts/sq. in.: 23
Application: Low Viscosity Oil

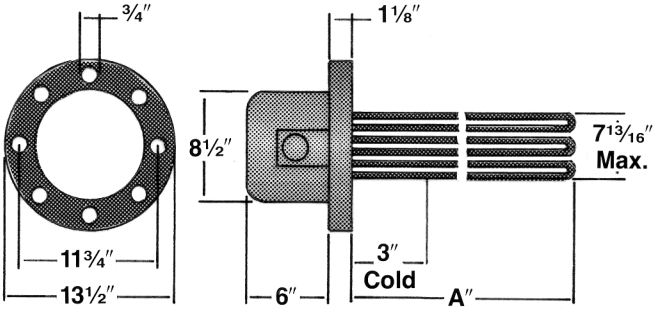
Lgth. Inside Tank A	Cat. No.	Kilowatts	Volts	Phase
25⅜"	BS5-25.18-J	9.0	240	3
33⅛"	BS5-33.06-J	12.0	240	3
40⅝"	BS5-40.56-J	15.0	240	3
52⅛"	BS5-52.06-J	20.0	240	3
65⅛"	BS5-65.06-J	25.0	240	3
78⅛"	BS5-78.06-J	30.0	240	3



6" Flange: Steel Sheath

No. of Elements: 12
Watts/sq. in.: 23
Application: Low Viscosity Oil

Lgth. Inside Tank A	Cat. No.	Kilowatts	Volts	Phase
25⅛"	BS6-25.12-J	18.0	240	3
33"	BS6-33-J	24.0	240	3
40½"	BS6-40.5-J	30.0	240	3
48"	BS6-48-J	36.0	240	3



8" Flange: Steel Sheath

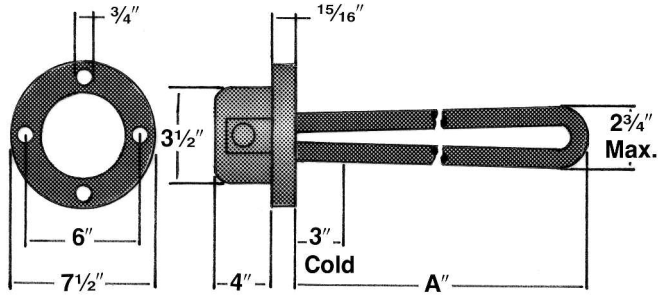
No. of Elements: 18
Watts/sq. in.: 23
Application: Low Viscosity Oil

Lgth. Inside Tank A	Cat. No.	Kilowatts	Volts	Phase
32⅞"	BS8-32.87-J	30.0	240	3
43 11⁄16"	BS8-43.68-J	40.0	240	3
51⅞"	BS8-51.87-J	50.0	240	3
61⅜"	BS8-61.37-J	60.0	240	3
61⅜"	BS8-61.37-J	60.0	480	3
69⅞"	BS8-69.87-J	70.0	240	3
69⅞"	BS8-69.87-J	70.0	480	3
78⅞"	BS8-78.87-J	80.0	240	3
78⅞"	BS8-78.87-J	80.0	480	3

Tubular Heaters

Flanged

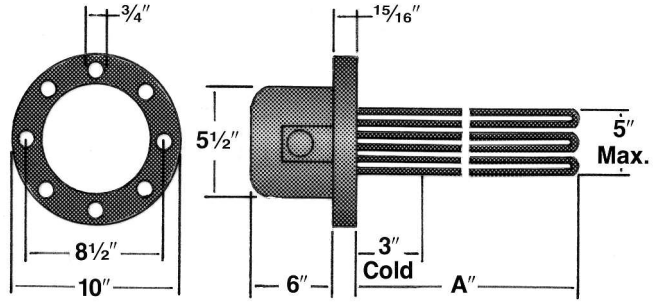
Stainless Steel Sheath: 150 lb Steel Flange



3" Flange: Stainless Steel Sheath

No. of Elements: 3
Watts/sq. in.: 45
Application: Process Water and Very Mild Solution

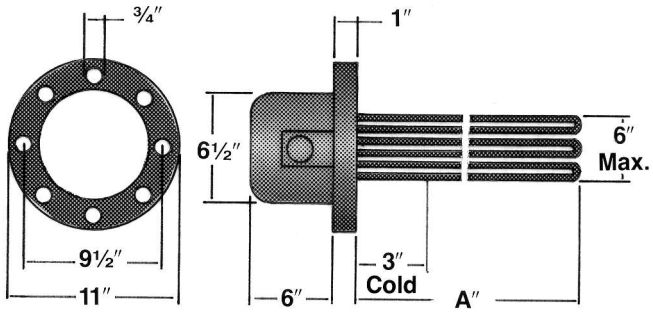
Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
18⅛"	BT3-18.06-J	6.0	240	1
18⅛"	BT3-18.06-J	6.0	240	3
25⅜"	BT3-25.18-J	9.0	240	1
25⅜"	BT3-25.18-J	9.0	240	3
33⅛"	BT3-33.06-J	12.0	240	1
33⅛"	BT3-33.06-J	12.0	240	3
40⅝"	BT3-40.56-J	15.0	240	1
40⅝"	BT3-40.56-J	15.0	240	3
48⅛"	BT3-48.06-J	18.0	240	1
48⅛"	BT3-48.06-J	18.0	240	3



5" Flange: Stainless Steel Sheath

No. of Elements: 6
Watts/sq. in.: 45
Application: Process Water and Very Mild Solution

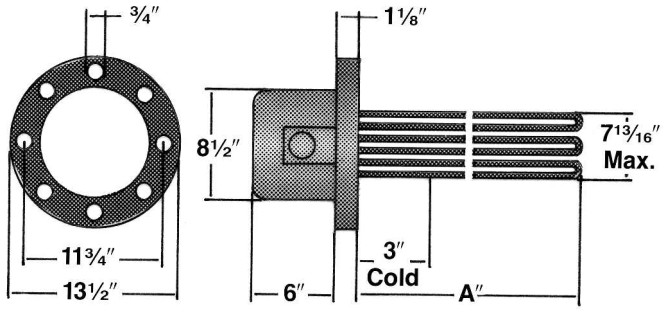
Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
18⅛"	BT5-18.06-J	12.0	240	3
19 13⁄16"	BT5-19.81-J	15.0	240	3
25⅜"	BT5-25.18-J	18.0	240	3
33⅛"	BT5-33.06-J	24.0	240	3
40⅝"	BT5-40.56-J	30.0	240	3
52⅛"	BT5-52.06-J	40.0	240	3
65⅛"	BT5-65.06-J	50.0	240	3
78⅛"	BT5-78.06-J	60.0	240	3



6" Flange: Stainless Steel Sheath

No. of Elements: 12
Watts/sq. in.: 45
Application: Process Water and Very Mild Solution

Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
25⅛"	BT6-25.12-J	36.0	240	3
33"	BT6-33-J	48.0	240	3
40½"	BT6-40.5-J	60.0	240	3
48"	BT6-48-J	72.0	240	3



8" Flange: Stainless Steel Sheath

No. of Elements: 18
Watts/sq. in.: 45
Application: Process Water or Very Mild Solution

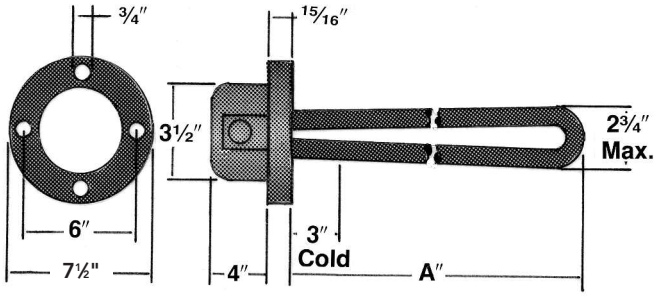
Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
27⅛"	BT8-27.87-J	50.0	240	3
36⅞"	BT8-36.87-J	75.0	240	3
43 11⁄16"	BT8-43.68-J	100.0	240	3
51⅞"	BT8-51.87-J	120.0	240	3
61⅜"	BT8-61.37-J	150.0	240	3
69⅞"	BT8-69.87-J	175.0	240	3
78⅛"	BT8-78.87-J	200.0	240	3

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Tubular Heaters

Flanged

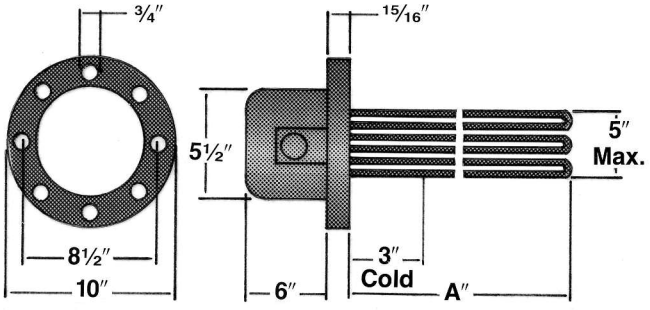
Copper Sheath: 150 lb Steel Flange



3" Flange: Copper Sheath

No. of Elements: 3
Watts/sq. in.: 45
Application: Water

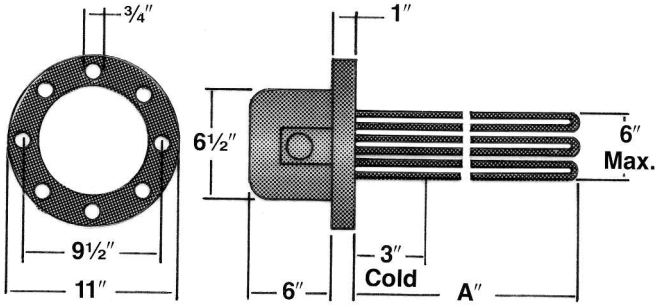
Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
18⅛"	BC3-18.06-J	6.0	240	1
18⅛"	BC3-18.06-J	6.0	240	3
25⅜"	BC3-25.18-J	9.0	240	1
25⅜"	BC3-25.18-J	9.0	240	3
33⅛"	BC3-33.06-J	12.0	240	1
33⅛"	BC3-33.06-J	12.0	240	3
40⅝"	BC3-40.56-J	15.0	240	1
40⅝"	BC3-40.56-J	15.0	240	3
48⅛"	BC3-48.06-J	18.0	240	1
48⅛"	BC3-48.06-J	18.0	240	3



5" Flange: Copper Sheath

No. of Elements: 6
Watts/sq. in.: 45
Application: Water

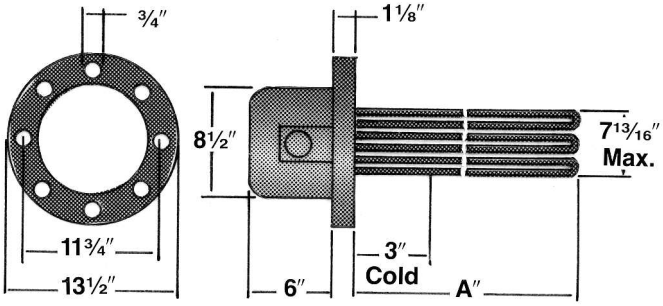
Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
18⅛"	BC5-18.06-J	12.0	240	3
19 13/16"	BC5-19.81-J	15.0	240	3
25⅜"	BC5-25.18-J	18.0	240	3
33⅛"	BC5-33.06-J	24.0	240	3
40⅝"	BC5-40.56-J	30.0	240	3
52⅛"	BC5-52.06-J	40.0	240	3
65⅛"	BC5-65.06-J	50.0	480	3
78⅛"	BC5-78.06-J	60.0	480	3



6" Flange: Copper Sheath

No. of Elements: 12
Watts/sq. in.: 45
Application: Water

Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
25⅛"	BC6-25.12-J	36.0	240	3
33"	BC6-33-J	48.0	240	3
40½"	BC6-40.5-J	60.0	240	3
48"	BC6-48-J	72.0	240	3



8" Flange: Copper Sheath

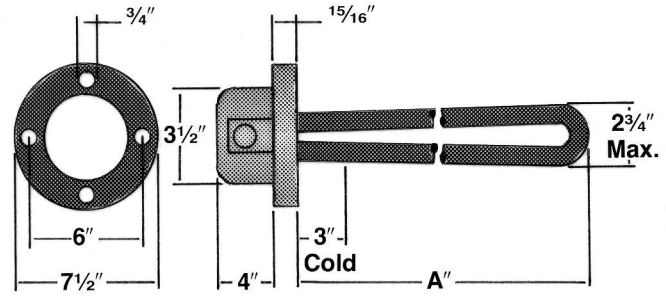
No. of Elements: 18
Watts/sq. in.: 45
Application: Water

Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
27⅞"	BC8-27.87-J	50.0	240	3
36⅞"	BC8-36.87-J	75.0	240	3
43 11/16"	BC8-43.68-J	100.0	240	3
51⅞"	BC8-51.87-J	120.0	240	3
61⅜"	BC8-61.37-J	150.0	240	3
69⅞"	BC8-69.87-J	175.0	240	3
78⅞"	BC8-78.87-J	200.0	240	3

Tubular Heaters

Flanged

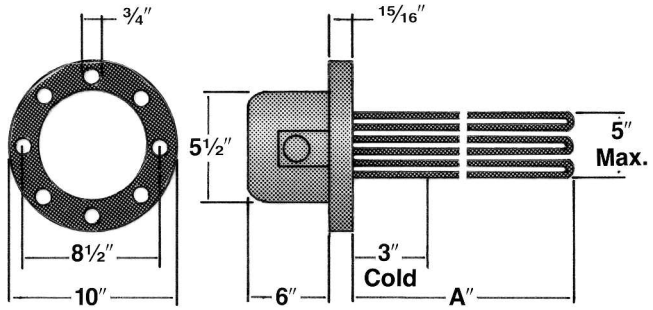
Incoloy Sheath: 150 lb Steel Flange



3" Flange: Incoloy Sheath

No. of Elements: 3
Watts/sq. in.: 45
Application: Mild Solution

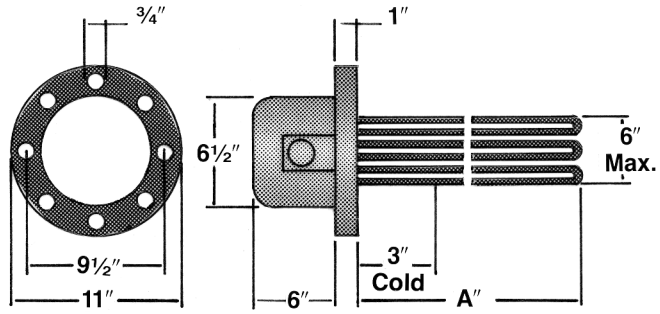
Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
18⅛"	BA3-18.06-J	6.0	240	1
18⅛"	BA3-18.06-J	6.0	240	3
25⅜"	BA3-25.18-J	9.0	240	1
25⅜"	BA3-25.18-J	9.0	240	3
33⅛"	BA3-33.06-J	12.0	240	1
33⅛"	BA3-33.06-J	12.0	240	3
40⅝"	BA3-40.56-J	15.0	240	1
40⅝"	BA3-40.56-J	15.0	240	3
48⅛"	BA3-48.06-J	18.0	240	1
48⅛"	BA3-48.06-J	18.0	240	3



5" Flange: Incoloy Sheath

No. of Elements: 6
Watts/sq. in.: 45
Application: Mild Solution

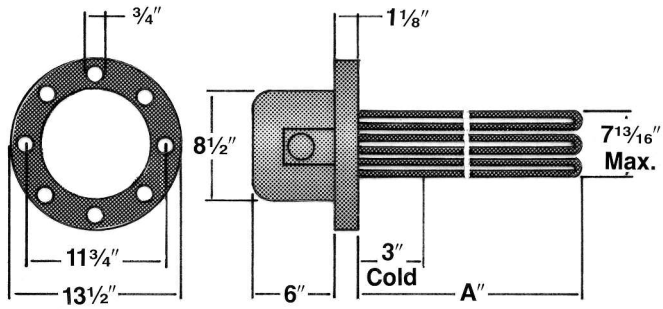
Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
18⅛"	BA5-18.06-J	12.0	240	3
19 13⁄16"	BA5-19.81-J	15.0	240	3
25⅜"	BA5-25.18-J	18.0	240	3
33⅛"	BA5-33.06-J	24.0	240	3
40⅝"	BA5-40.56-J	30.0	240	3
52⅛"	BA5-52.06-J	40.0	240	3
65⅛"	BA5-65.06-J	50.0	240	3
78⅛"	BA5-78.06-J	60.0	240	3



6" Flange: Incoloy Sheath

No. of Elements: 12
Watts/sq. in.: 45
Application: Mild Solution

Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
25⅛"	BA6-25.12-J	36.0	240	3
33"	BA6-33-J	48.0	240	3
40½"	BA6-40.5-J	60.0	240	3
48"	BA6-48-J	72.0	240	3



8" Flange: Incoloy Sheath

No. of Elements: 18
Watts/sq. in.: 45
Application: Mild Solution

Lgth. Inside Tank A	Cat. No.	Kilo-watts	Volts	Phase
27⅞"	BA8-27.87-J	50.0	240	3
36⅞"	BA8-36.87-J	75.0	240	3
43 11⁄16"	BA8-43.68-J	100.0	240	3
51⅞"	BA8-51.87-J	120.0	240	3
61⅜"	BA8-61.37-J	150.0	240	3
69⅞"	BA8-69.87-J	175.0	240	3
78⅞"	BA8-78.87-J	200.0	240	3

Dimensions

Flanged and enclosed dimensions shown in proceeding tables may vary.

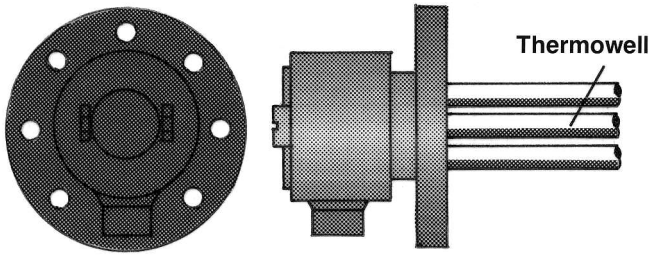
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Tubular Heaters

Flanged

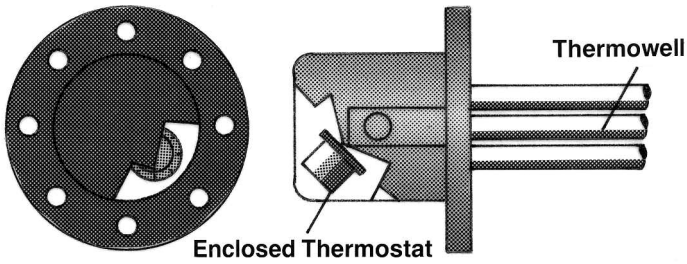
Special Features

SF-13B: Moisture tight/Explosion resistant terminal enclosure.



Available on:
3", 5", 6", 8"flanged. Enclosure sizes vary with element sizes.

XS-55: Thermostat control. Integral bulb and capillary control with thermowell. Two temperature ranges available. Specify XS-55 (0°–100°F) or XS-55 (60°–250°F).



Available on:
3", 5", 6", 8"flanged. Enclosure sizes vary with element size.

How To Order

Specify: catalog number, wattage, voltage, and special features, if any. Other sizes are available. Consult factory.

Example: BS3-18.06-J/1000W120V

Glasrope® Heaters

Single and Double

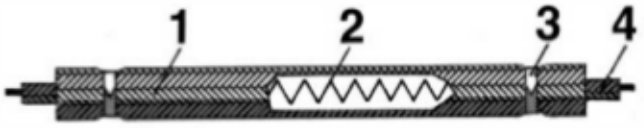


Applications

Pipes, Tubes, and other similar apparatus where spot or particular locations need to be warmed, Odd Shapes such as: Laboratory Beakers. Valves, Piping, Appliances, Drier Units for Blueprint Machines, Incubators, and Tracers for Pipe Lines.

Features (Single Glasrope®)

- c UL us Recognized-No. E56973 C.S.A. Certified• 016386-0-000
- The Hotwatt Single Glasrope® Heater has a termination on each end.
- The nominal diameter is .165" x .032" wall for 120 volts, and .180" x .040" wall for 240 volts.
- Lengths to 300".
- Maximum temperature is 900°F (482°C).
- Made in U.S.A.

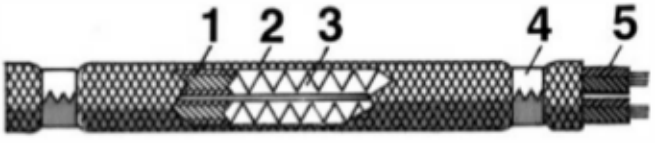


Construction

1. Flexible woven fiberglass braid.
2. Premium grade resistance wire element.
3. Braid retainer.
4. Fiberglass insulated leads.

Features (Double Glasrope®)

- The Hotwatt Double Glasrope® Heater has two terminations on the same end.
- The nominal diameter is .300".
- Lengths to 150".
- Maximum temperature is 900°F (482°C).
- Made in U.S.A.



Construction

1. Single Glasrope®.
2. Additional fiberglass sleeve.
3. Premium grade resistance wire element.
4. Braid retainer.
5. Fiberglass insulated leads.

Glasrope® Heaters

Single and Double

Single Glasrope®

▼ Manfactured Items ▼

Length	Catalog Number	Maximum Wattage
6"	GR16-6	30
8"	GR16-8	40
10"	GR16-10	50
12"	GR16-12	60
14"	GR16-14	70
16"	GR16-16	80
18"	GR16-18	90
24"	GR16-24	120
30"	GR16-30	150
36"	GR16-36	180
42"	GR16-42	210
48"	GR16-48	240
60"	GR16-60	300
72"	GR16-72	360
84"	GR16-84	420
96"	GR16-96	480
108"	GR16-108	540
120"	GR16-120	600

Unit lengths between and longer than those listed may be ordered.

Wattage

Maximum wattage is based on 5 watts per linear inch of heater. Higher or lower wattages are available depending on the application.

Voltage

Voltage is normally 120 or 240 volts. Lower voltages are available.

How To Order

Specify: GR16 followed by length, wattage, voltage, lead length, and special features if required.

Example: GR16-34/150W120V/SF1-18.

Double Glasrope®

Length	Catalog Number	Maximum Wattage
24"	GR30-24	190
30"	GR30-30	240
36"	GR30-36	290
42"	GR30-42	330
48"	GR30-48	390
60"	GR30-60	480
72"	GR30-72	575
84"	GR30-84	660
96"	GR30-96	760
108"	GR30-108	860
120"	GR30-120	960

Unit lengths between and longer than those listed may be ordered.

Wattage

Maximum wattage is based on 8 watts per linear inch of heater. Higher or lower wattages are available depending on the application.

Voltage

Voltage is normally 120 or 240 volts. Lower voltages are available.

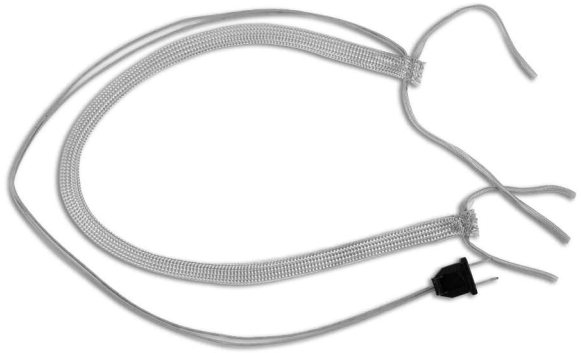
How To Order

Specify: GR30 followed by length, wattage, voltage, lead length, and special features if required.
Example: GR30-65/500W120V/SF1-6.

▼ IN STOCK ITEMS ▼

Length	Cat No.	Diameter	Watts	Volts	Lead	Weight (lbs)
36"	GR16-36	.165"	125	120	12"	.07
60"	GR16-60	.165"	250	120	12"	.12
96"	GR16-96	.165"	400	120	12"	.18
120"	GR16-120	.165"	500	120	12"	.25

Insulated Tape Heaters



Description

Insulated tape heaters, are high temperature, flexible electric heating elements in tape form. Through a new design, they offer the convenience of leads on the same end.

Specifications

- High temperature capability: 1400˚F yarn insulation
- Low watt density design: 13 watts/inch^2
- Dual, knitted, serpentine construction: Minimized expansion, vibration and thermal stress, longer life, flexible
- Multi-stranded wire element: High temperature and flexable
- Heavy braided outer cover: Heavy yarn
- 2 ft. high temperature leads with plug

Features

Heating tape basic construction: Heating tape construction begins by first: Double braiding high temperature yarn over multiple strands of fine resistance wire, then second: knitting the assembly into a tight serpentine configuration, forming a flat tape. Insulated tapes feature the basic element construction with the exception that two elements are knitted side by side as shown. This arrangement allows the two elements to be connected in series on one end and leads to exit from the other. The assembly is protected by a heavy braided cover.

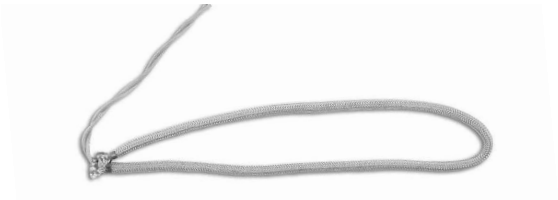


Catalog No.	Metric (cm)	U.S.	Watts	Volts
AWH-051-020D	1.3 X 60	½" X 2'	156	120
AWH-051-040D	1.3 X 120	½" X 4'	312	120
AWH-051-060D	1.3 X 180	½" X 6'	468	120
AWH-051-080D	1.3 X 240	½" X 8'	624	120

Glasrope® Heaters

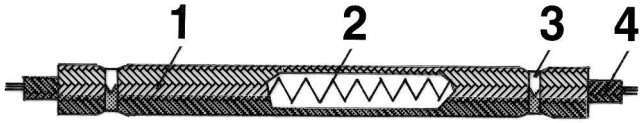
Special Glasrope®

High Temperature Glasrope®: GH16



Features

- The Hotwatt High Temperature Glasrope® Heater is similar to the Standard Single Glasrope® Heater in construction except the woven fiberglass braid is of special design to withstand higher temperatures.
- The nominal diameter is .165".
- Lengths to 300".
- Maximum temperature is 1200°F (649°C).
- Made in U.S.A.



Construction

1 Flexible woven high temperature fiberglass braid.

2 Premium grade resistance wire element.

3 Braid retainer.

4 Fiberglass insulated leads.

Wattage

Maximum wattage is computed at 7 watts per linear inch.

How To Order

Specify: GH16 followed by length, wattage, voltage, lead length, and special features if required.

Example: GH16-80/400W120V/SF1-10.

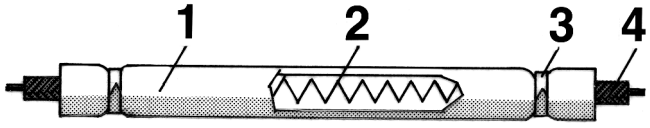
Silicone Rubber Glasrope®: GS16

U.I. Recognized-No. E48358 C.S.A. Certified• 016386-0-000



Features

- The Hotwatt Silicone Rubber Glasrope® Heater is sheathed in silicone rubber for use in wet or moist applications.
- The heater is supplied with neoprene insulated flexible leads.
- The nominal diameter is .165".
- Lengths to 300".
- Maximum temperature is 325°F (163°C).
- Made in U.S.A.



Construction

1 Silicone rubber sleeve.

2 Premium grade resistance wire element.

3 Sleeve retainer.

4 Insulated leads.

Wattage

Maximum wattage is computed at 3 watts per linear inch.

How To Order

Specify: GS16 followed by length, wattage, voltage, lead length, and special features if required.

Example: GS16-30/50W120V/SF1-12.

Glasrope® Heaters

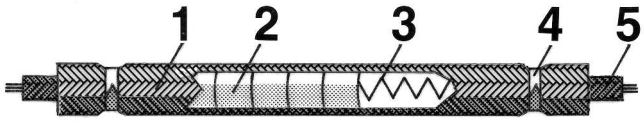
Special Glasrope® (Cont.)

Flexible Metal Glasrope®: FM25



Features

- The Hotwatt Flexible Metal Glasrope® is for high temperature, corrosive applications.
- The nominal diameter is .250".
- Lengths to 120".
- Maximum temperature is 1300°F (704°C).
- Made in U.S.A.



Construction

1. Stainless steel braid.
2. Ceramic Bead Insulation.
3. Premium grade resistance wire element.
4. Braid retainer.
5. Fiberglass insulated leads.

Wattage

Maximum wattage is computed at 5 watts per linear inch.

How To Order

Specify: FM25 followed by length, wattage, voltage, lead length, and special features if required.

Example: FM25-72/250W120V/SF1-6.

Standard Termination

SF1: Flexible leads. Standard length is 6". Longer lengths are available. Leads are non-repairable.



Special Features

SF11A: Ring terminals. Specify #6, #8, or #10.



SF11B: Female straight quick connect terminals. Specify 3⁄16" or 1⁄4".



SF11C: Female flag quick connect terminals. Specify 3⁄16" or 1⁄4".



SF11D: Spade terminals. Specify #6, #8, or #10.



SF11E: Weld terminals. For spot weld connections.



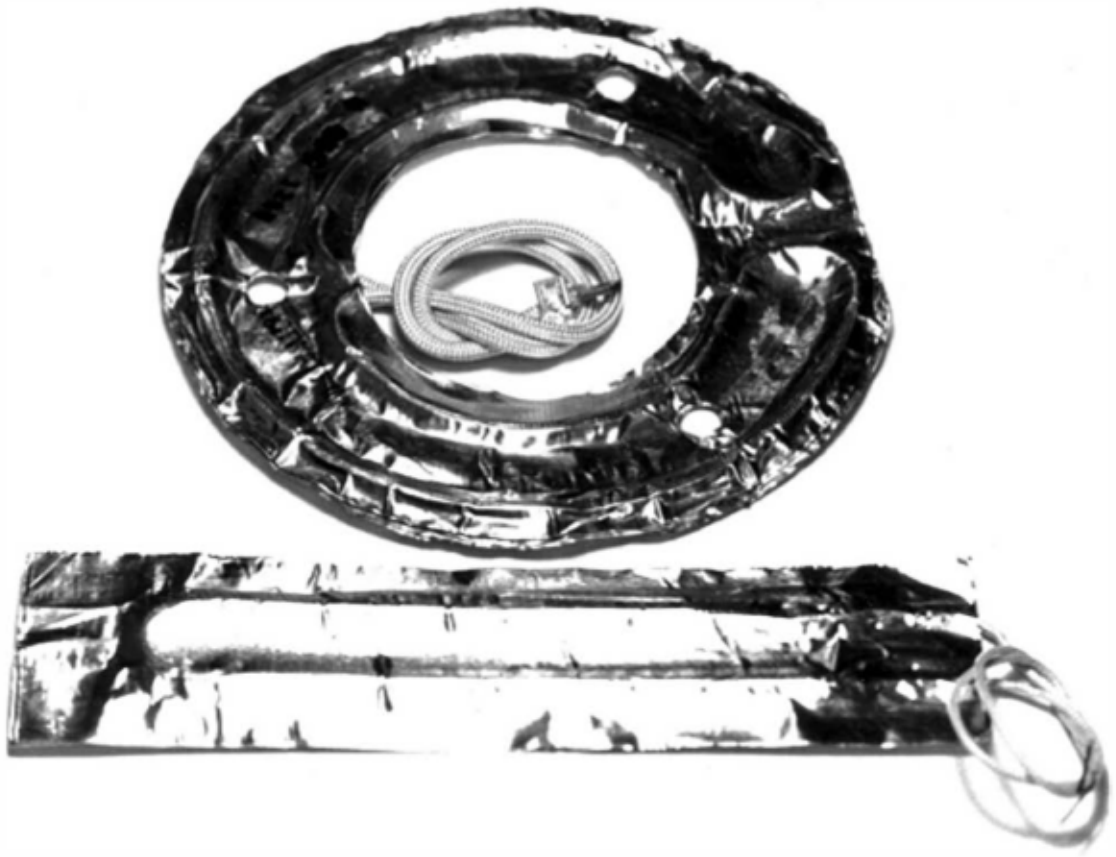
Terminals may be supplied attached to the end of the lead or directly on the glasrope.

Tolerance

Wattage tolerances are held to +5%, -10% at the voltage specified.

GLASROPE

Foil Heaters



Recognized-No. E56973
for USA and Canada c UL us

Applications

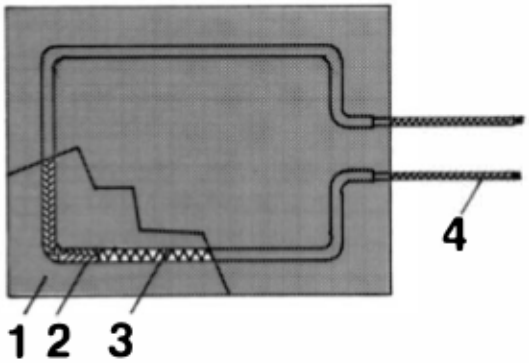
Battery Warmers, Cabinets, Defrost Applications, Heated Food Tables, Incubators, Laboratory Equipment, Ceiling Panels, and Wall Panels.

Features

- The Hotwatt Foil Heater is a self-contained one-piece assembly.
- A resistant element is laminated between two layers of aluminum foil.
- The heater is ideally suited for area and surface heating applications.
- Sheath temperatures to 300°F (149°C).
- Widths range from 1¼" minimum -36".
- Lengths range from 4"-60".
- Heaters are available with a thermostat.
- Many configurations with or without holes and cutouts are available.
- Made in U.S.A.

Construction

1. Aluminum foil.
2. Insulating sleeve.
3. Premium grade resistance wire element.
4. Insulated leads.



Wattage

The maximum wattage is based on 3 watts per square inch of surface.

Voltage

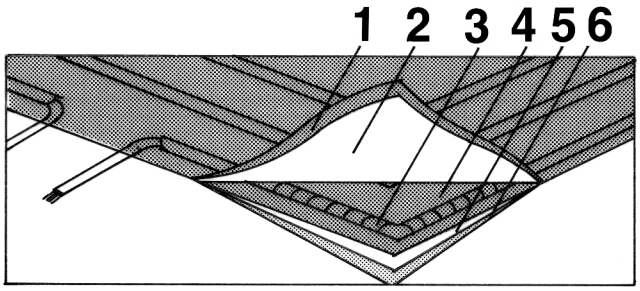
Voltage is normally 120 or 240 volts. Lower voltages are available.

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Foil Heaters

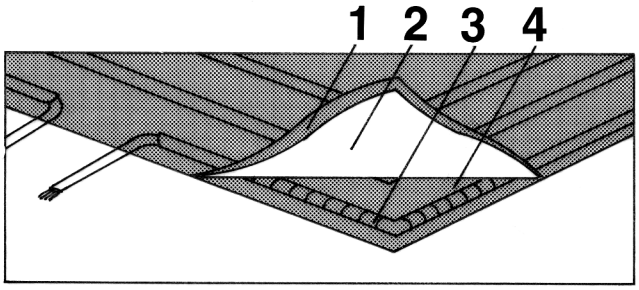
Foil Heater Construction

Type A: Self-Adhering: Flexible



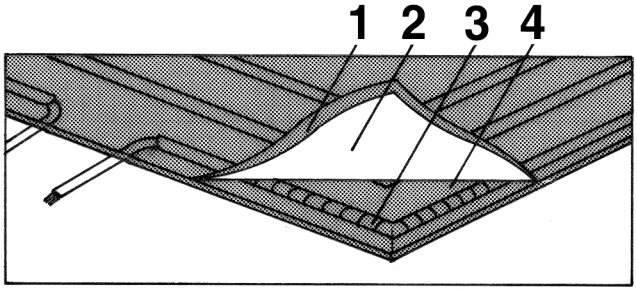
1 Aluminum foil.
2 Adhesive.
3 Element.
4 Aluminum foil.
5 Adhesive.
6 Release paper.

Type B: Mechanically Fastened: Flexible



1 Aluminum foil.
2 Adhesive.
3 Element.
4 Aluminum foil.

Type C: Mechanically Fastened: Semi-Rigid



1 Aluminum foil.
2 Adhesive.
3 Element.
4 Aluminum Sheet: .025" think.

Standard Termination

SF1: Flexible leads for applications where leads can be bent close to the end of the unit. Leads are non-repairable.



Special Features

SF11A: Ring terminals. Specify #6, #8, or #10.



SF11B: Straight quick connect terminals. Specify male or female and size: 3⁄16" or 1⁄4".



SF11C: Flag quick connect terminals. Specify male or female and size: 3⁄16" or 1⁄4".



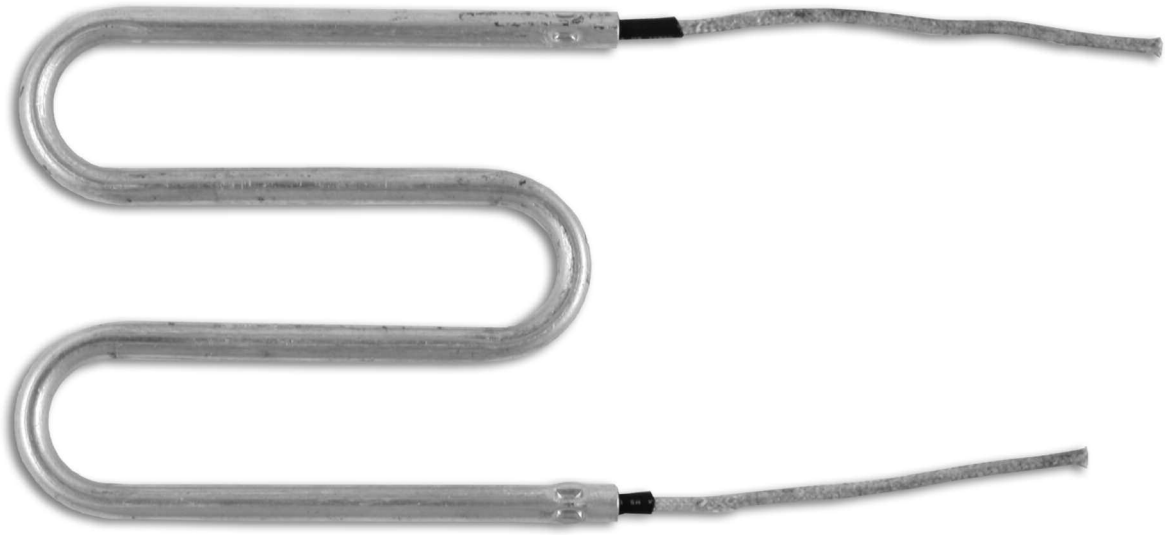
SF11D: Spade terminals. Specify #6, #8, or #10.



How to Order

Determine catalog number as shown below. For complex configurations, attach drawings.
Example: FH3-6/50W120V/SF1-12/SF11A-#8/A4-20
FH: Prefix for foil heater.
3: Width of heater from which side the lead comes out.
6: Length of heater.
50W: Voltage.
120V: Voltage.
SF1-12: Lead type and length.
SF11A: Terminal if required.
A: Construction of heater (specify A, B or C).
4: The number of passes of element inside the foil (generally determined by the factory).
20: Element length (generally determined by the factory).

Tubular Sheathed Glasrope® Heaters



U.L. Recognized-E56973

Applications

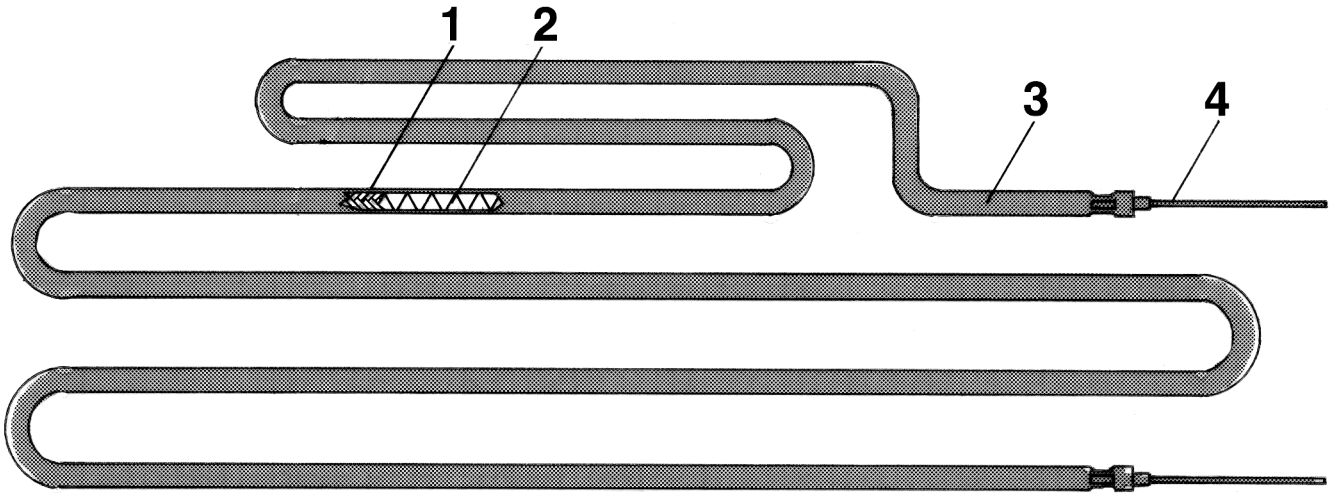
Blueprint Machinery, Cabinets, Compressor Crankcase Heating, Copiers, and Defrost Heaters.

Features

- The Hotwatt Tubular Sheathered Glasrope® Heater is a fiberglass insulated element encased in aluminum or stainless steel tubing.
- The stainless steel heater is for higher temperatures of corrosive applications.
- Extra long leads and special terminations are available. (6" long leads are standard.)
- A seal is used for wet or moist applications.
- Made in U.S.A
- The heater may be formed to special configurations.
- Special wattage distribution for specific heat location.

Construction

1. Fiberglass insulation.
2. Premium grade resistance wire element.
3. Aluminum or stainless steel tubing.
4. Fiberglass insulated leads.



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Tubular Sheathed Glasrope® Heaters

Diameter: ¼"

Standard with One Lead Each End

Length	Catalog Number Aluminum Sheath	Maximum Wattage
24"	AT25-24	120
30"	AT25-30	150
36"	AT25-36	180
42"	AT25-42	210
48"	AT25-48	240
54"	AT25-54	270
60"	AT25-60	300

Diameter: ⅜"

Standard with Both Leads Same End

Length	Catalog Number Aluminum Sheath	Maximum Wattage
24"	AT37-24	200
30"	AT37-30	250
36"	AT37-36	300
42"	AT37-42	350
48"	AT37-48	400
54"	AT37-54	450
60"	AT37-60	500

Specifications	¼" Dia.	⅜" Dia.
Minimum Inside Radius For Forming	½"	1"
Minimum Helical Diameter For Forming	1"	2"
Normal Cold Ends	1"	1"
Standard Lead Length	6"	6"
Maximum Temperature	550°F (288°C)	550°F (288°C)

Watts Per Linear Inch vs. Temperature In Air

Temperature °F	°C	Watts/Linear Inch
220°	104°	1
340°	171°	2
390°	199°	3
490°	254°	4
550°	288°	5.5

Standard Termination

SF1: Flexible leads for applications where leads can be bent close to the end of the unit. Leads are non-repairable.



Special Features

SF11A: Ring terminals. Specify #6, #8, or #10.



SF11B: Straight quick connect terminals. Specify male or female and size: 3/16" or ¼".



SF11C: Flag quick connect terminals. Specify male or female and size: 3/16" or ¼".



SF11D: Space terminals. Specify #6, #8, or #10.



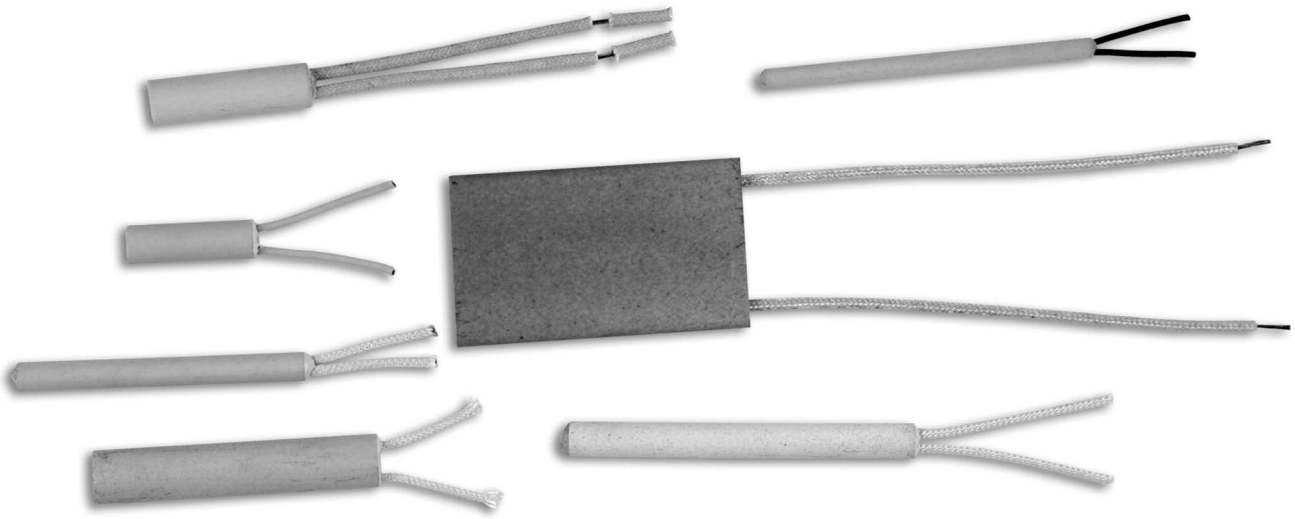
SF37: Stainless steel sheath.

How to Order

Specify: diameter, length, wattage, voltage, lead length, special features (if any), any configurations (attach drawing).
Example: AT25-33/100W120V/SF1-10/SF37



Ceramic Heaters



U.L. Recognized-No. E56973
C.S.A. Certified-No. 016386-0-000

Applications

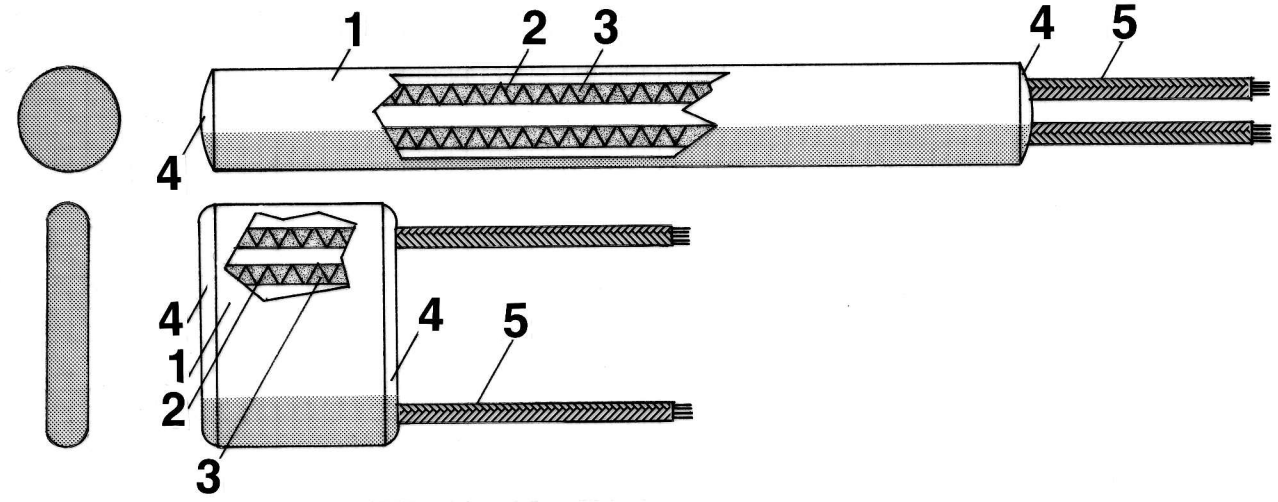
Copiers, Dehumidifiers, Glue Guns, Heat Sealing Tools, Instrumentation, Resisters, Soldering and Desoldering Equipment, Valve Heaters.

Features

- The Hotwatt Ceramic Heater is a ceramic body encasing a resistance element and packed within magnesium oxide.
- The heaters are terminated with flexible insulated lead wires.
- Temperatures to 1300˚F (705˚C).

Construction

1. Ceramic body.
2. Premium grade resistance wire element.
3. Magnesium oxide packaging.
4. Ceramic end seal.
5. Flexible insulated lead wires.



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Ceramic Heaters

Round Ceramic Sizes

Length	Catalog Number	Maximum Wattage	Diameter
1 ½"	CB216 - 1.50	40	.216
1 ½"	CB255 - 1.50	50	.255
1"	CB307 - 1.00	40	.307
1 ½"	CB307 - 1.50	60	.307
1 ¾"	CB307 - 1.75	70	.307
1 9⁄16"	CB374 - 1.56	75	.374
1 ¾"	CB374 - 1.75	85	.374
1 ⅜"	CB435 - 1.37	85	.435
1 9⁄16"	CB435 - 1.56	90	.435
2 ¼"	CB435 - 2.25	125	.435
2 ¼"	CB580 - 2.25	160	.580
1"	CB625 - 1.00	80	.625
2"	CB625 - 2.00	160	.625
1 7⁄16"	CB690 - 1.43	120	.690
2"	CB875 - 2.00	220	.875
2"	CB940 - 2.00	240	.940

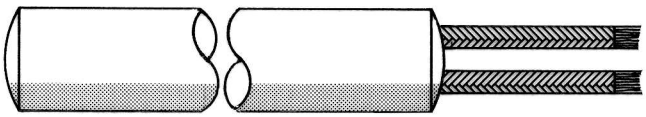
Rectangular Ceramic Sizes

Length	Catalog Number	Maximum Wattage	Thickness	Width
2"	CB18 - .93 -2.00	150	.180	.930
2"	CB18 - .56 -2.00	90	.187	.560
2"	CB19 - .60 -2.00	80	.190	.605
2 ½"	CB19 - .60 -2.50	120	.190	.605
1 1⁄6	CB25 - 1.37-1.06	150	.250	1 ⅜"
1 ¾"	CB25 - 1.37-1.75	190	.250	1 ⅜"
2 ⅜"	CB25 - 1.37-2.37	260	.250	1 ⅜"
2"	CB25 - 1.62 -2.00	250	.250	1 ⅝"

The above listings are a sampling of sizes that are available. Other sizes and lengths as well as custom sizes are available. Consult factory for details and availability.

Standard Termination

SF1: Flexible leads for applications where leads can be bent close to the end of the unit. Leads are non-repairable.



Special Features

SF11A: Ring terminals. Specify #6, #8, or #10.



SF11B: Straight quick connect terminals. Specify male or female and size: 3⁄16" or ¼".



SF11C: Flag quick connect terminals. Specify male or female and size: 3⁄16" or ¼".



SF11D: Space terminals. Specify #6, #8, or #10.



Wattage

Normal wattage is based on 40 Watts per square inch of heated length. When installed in a proper heat sink. Lower or higher wattages are available depending on the application.

Voltage

Voltage is normally 120 or 240 volts. Lower voltages are available.

How to Order

Specify: Catalog number, wattage, voltage and lead length.
Example: CB255-1.50/50W120V/SF1-3.

Crankcase Heaters



The following pages list Hotwatt Crankcase Heaters by the OEM manufacturer, showing both the OEM part number and Hotwatt part number. In addition, custom designed crankcase heaters and variations to the units shown are also available.

Applications

Crankcase heaters are used to overcome the problem of migration and condensation of refrigerant in the crankcases of compressors used in air conditioning and heat pump systems. They are designed to keep the crankcase oil at a temperature higher than the coldest part of the system to prevent migration.

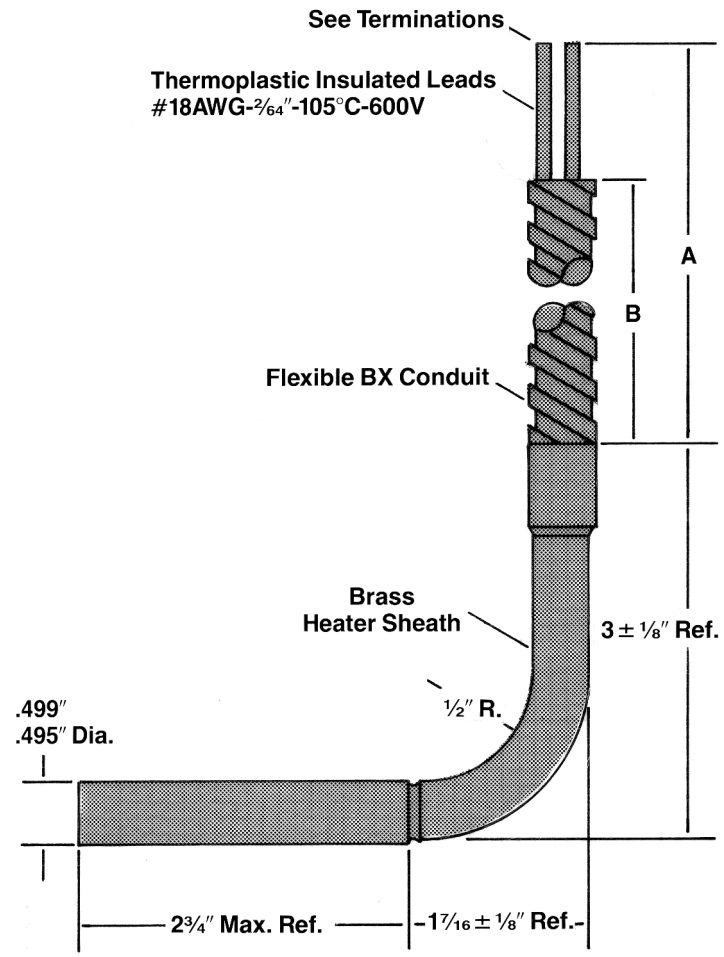
U. L. Recognized - Guide SEOT2, file SA4093 for use in the conditioning equipment.
C.S.A. Certified - Guide 165-E-90, file 016386-0-000 for use in air conditioning equipment.

Features

• Hotwatt Crankcase Heaters are constructed of the highest quality corrosion resistance materials and sealed against moisture.

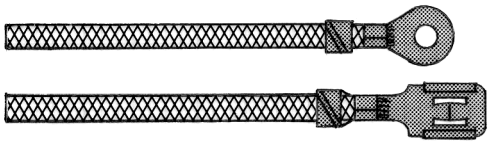
Crankcase Heaters

Carrier Compressions

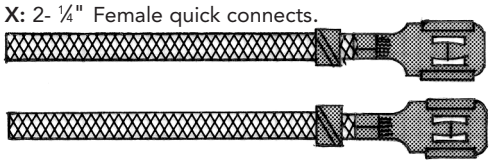


Terminations

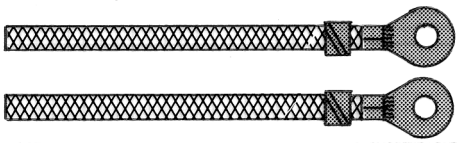
W: 1-#8 Ring terminal, 1- ¼" Female quick connect.



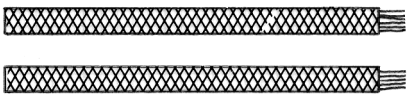
X: 2- ¼" Female quick connects.



Y: 2-#8 Ring terminals.



Z: Leads stripped ¼".



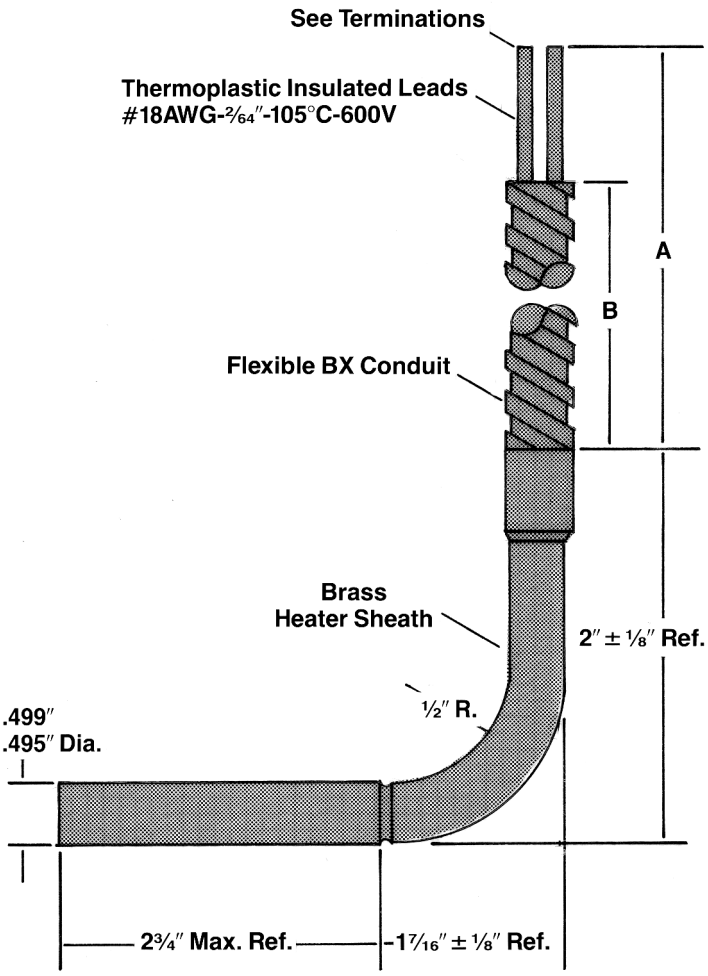
CRANKCASE

Hotwatt Part No.	Carrier Part No.	Wattage	Voltage	Terminal Type	Lead Length A"	Conduit Length B"
13A9881-21	HT36DK132	75	120	Z	24	19
13A9881-20	HT36DL472	125	240	Z	24	19
13A9881-19	HT36DL172	125	120	Z	24	19
13A9881-14	HT36FL479	125	240	Y	73	52
13A9881-13	HT36FL478	125	240	Z	15	10
13A9881-12	HT36FL477	125	240	Z	13	9
13A9881-11	HT36FL476	125	240	Y	67	52
13A9881-10	HT36FL475	125	240	W	63	28
13A9881- 9	HT36FL474	125	240	Y	51	36
13A9881-8	HT36FL463	125	240	X	48	28
13A9881-7	HT36FL379	125	120	Y	73	52
13A9881-6	HT36FL378	125	120	Z	15	10
13A9881-5	HT36FL377	125	120	Z	13	9
13A9881-4	HT36FL376	125	120	Y	67	52
13A9881-3	HT36FL375	125	120	W	63	28
13A9881-2	HT36FL374	125	120	Y	51	26
13A9881-1	HT36FL363	125	120	X	48	28

• Denotes Stock Item

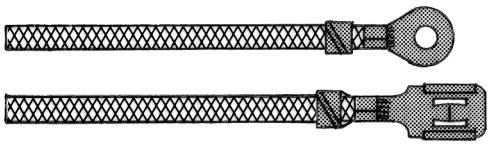
Crankcase Heaters

Carrier Compressors

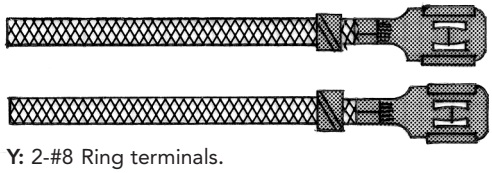


Terminations

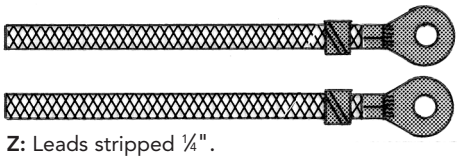
W: 1-#8 Ring terminal, 1- ¼" Female quick connect.



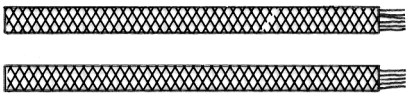
X: 2- ¼" Female quick connects.



Y: 2-#8 Ring terminals.



Z: Leads stripped ¼".



CRANKCASE

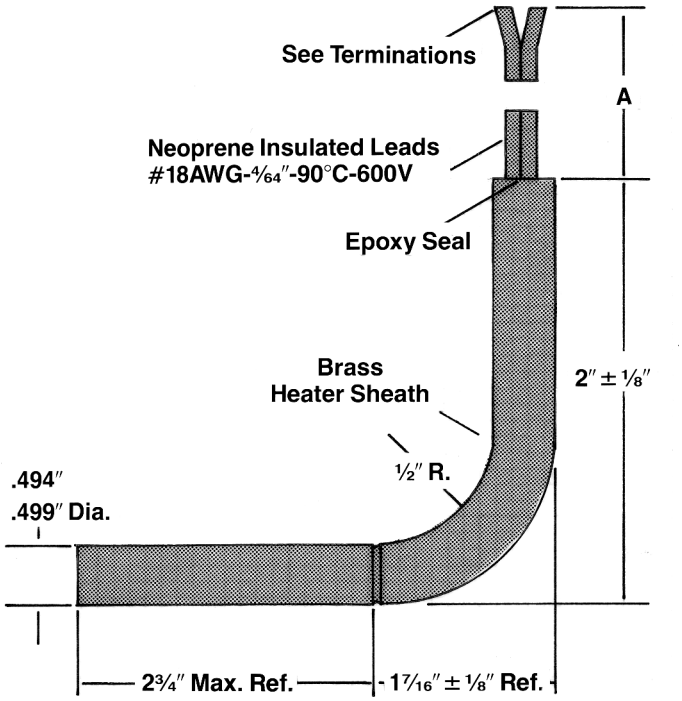
Hotwatt Part No.	Carrier Part No.	Wattage	Voltage	Terminal Type	Lead Length A"	Conduit Length B"
13A9882-18	HT36NS477	75	240	Y	87	72
13A9882-17	HT36NS377	75	120	Y	87	72
13A9882-16	HT36NS467	75	240	X	87	72
13A9882-15	HT36NS367	75	120	X	87	72
13A9882-14	HT36LS477	75	240	Y	80	60
13A9882-13	HT36LS377	75	120	Y	80	60
13A9882-12	HT36JS466	75	240	X	67	52
13A9882-11	HT36JS476	75	240	Y	67	52
13A9882-10	HT36JS376	75	120	Y	67	52
13A9882-9	HT36JS366	75	120	X	67	52
13A9882-8	HT36FS464	75	240	X	51	36
13A9882-7	HT36FS474	75	240	Y	51	36
13A9882-6	HT36FS374	75	120	Y	51	36
13A9882-5	HT36FS364	75	120	X	51	36
13A9882-4	HT36ES474	75	240	X	44	24
13A9882-3	HT36ES374	75	120	X	44	24
13A9882-2	HT36ES463	75	240	X	36	24
13A9882-1	HT36ES363	75	120	X	36	24

• Denotes Stock Item

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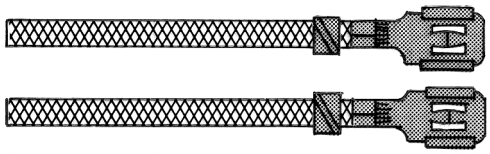
Crankcase Heaters

Carrier Compressors

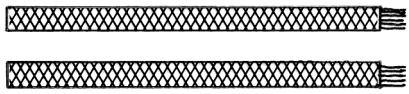


Terminations

X: 2-¼" Female quick connects.



Z: Leads stripped ¼".

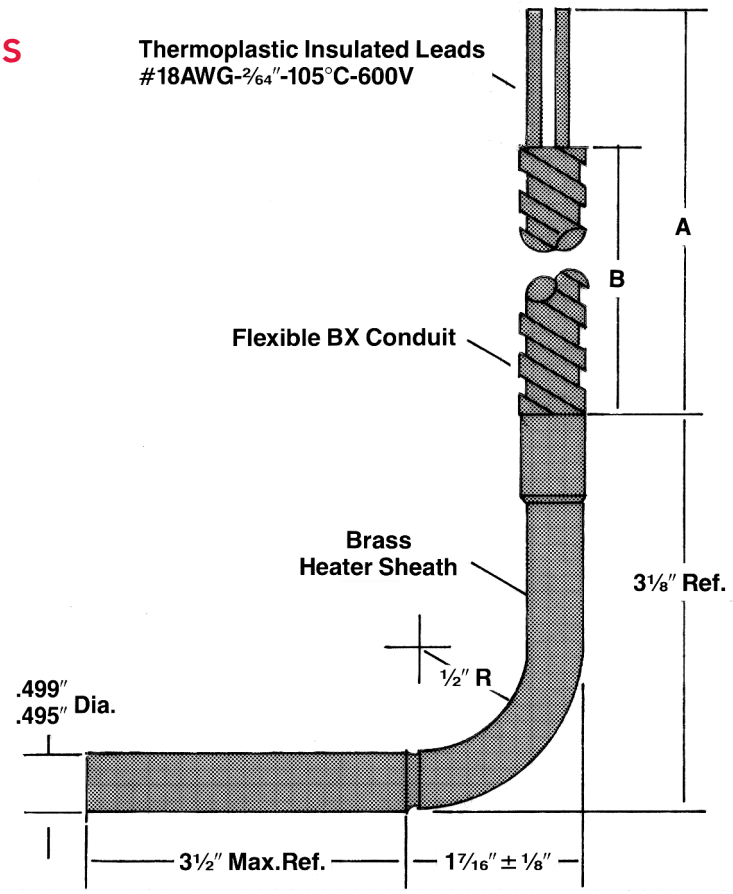


Hotwatt Part No.	Carrier Part No.	Wattage	Voltage	Lead Length A	Terminal Type
13A9883-11	HT36DL481	125	460	58"	X
13A9883-10	HT36YS241	125	240	58"	X
13A9883-9	HT36XS764	75	460	58"	X
13A9883-8	HT36XS574	75	240	58"	X
13A9883-7	HT36DL480	125	480	24"	Z
13A9883-6	HT36DK460	75	480	24"	Z
13A9883-5	HT36YS240	125	240	38"	X
13A9883-4	HT36YS120	125	120	37"	Z
13A9883-3	HT36XS120	75	120	37"	Z
13A9883-2	HT36XS573	75	240	38"	X
13A9883-1	HT36XS575	75	240	(1)38"+(1) 48"	X

• Denotes Stock Item

Crankcase Heaters

Copeland Compressors



Hotwatt Part No.	Copland Part No.	Wattage	Voltage	A"	B"
13A9881-17	018-0021-00	200	120	25	19
13A9881-18	018-0021-01	200	240	25	19
13A9881-25	018-0021-02	200	120	32	26 ½
13A9881-26	018-0021-03	200	240	32	26 ½
13A9881-27	018-0021-04	200	120	39 ½	32
13A9881-28	018-0021-05	200	240	39 ½	32

• Denotes Stock Item

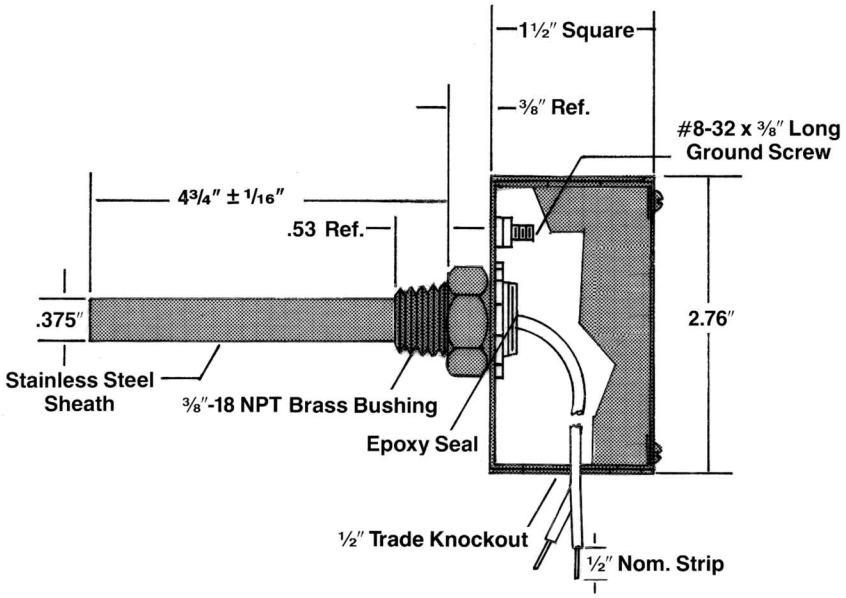
518-0028 Series

Hotwatt Part No.	Copland Part No.	Wattage	Voltage
13J0606 -01	518-0028-00	100	120
13J0606 -02	518-0028-01	100	240

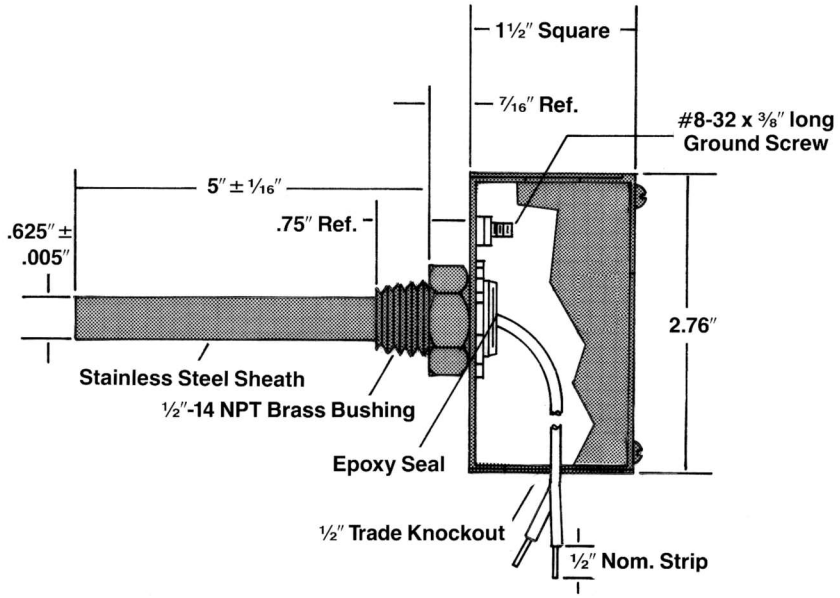
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Crankcase Heaters

Copeland Compressors



Hotwatt Part No.	Copeland Part No.	Wattage	Voltage	Lead Length"
13A0054-1	518-0001-00 or -08	65	600	8 ± ¼
13A0054-2	518-0001-01 or -09	65	480	8 ± ¼
13A0054-3	518-0001-02	65	240	8 ± ¼
13A0054-4	518-0001-03	65	120	8 ± ¼



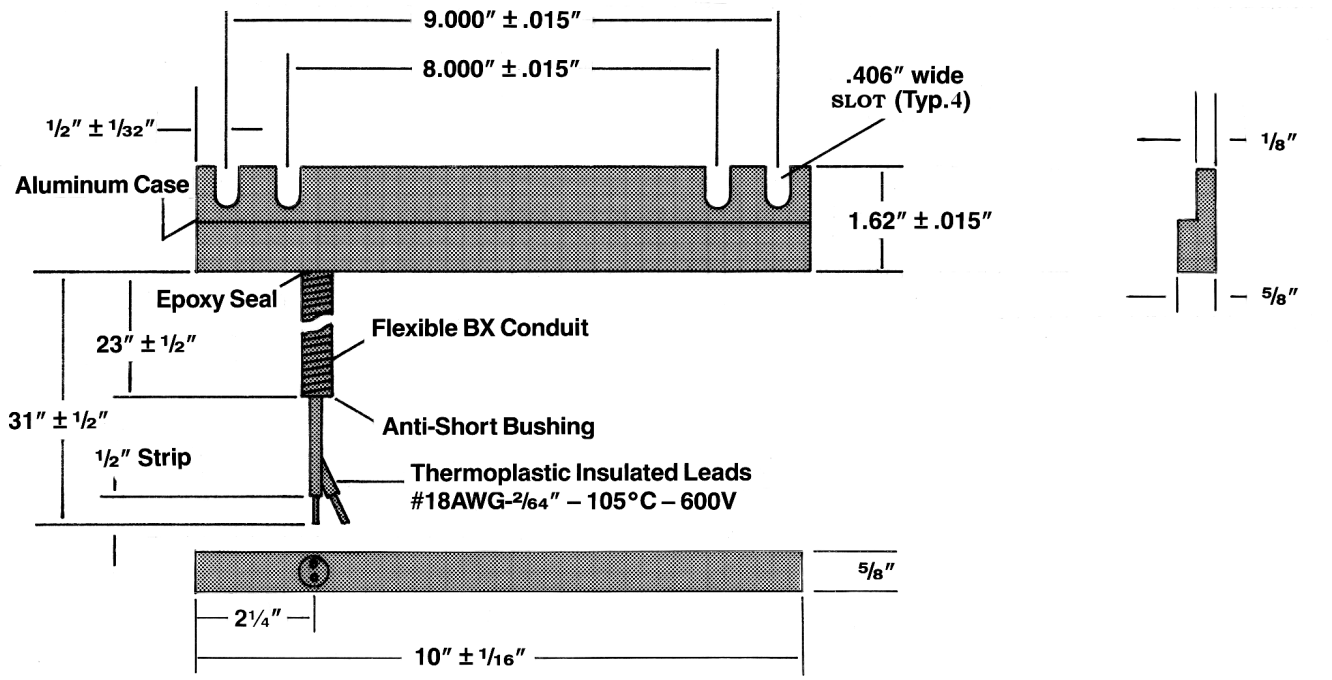
Hotwatt Part No.	Copeland Part No.	Wattage	Voltage	Lead Length"
13A9996-1	518-0002-00 or -09	100	600	8 ± ¼
13A9996-2	518-0002-01 or -10	100	480	8 ± ¼
13A9996-3	518-0002-02	100	240	8 ± ¼
13A9996-4	518-0002-03	100	120	8 ± ¼
13A9996-5	518-0002-04	100	420	8 ± ¼

• Denotes Stock Item

CRANKCASE

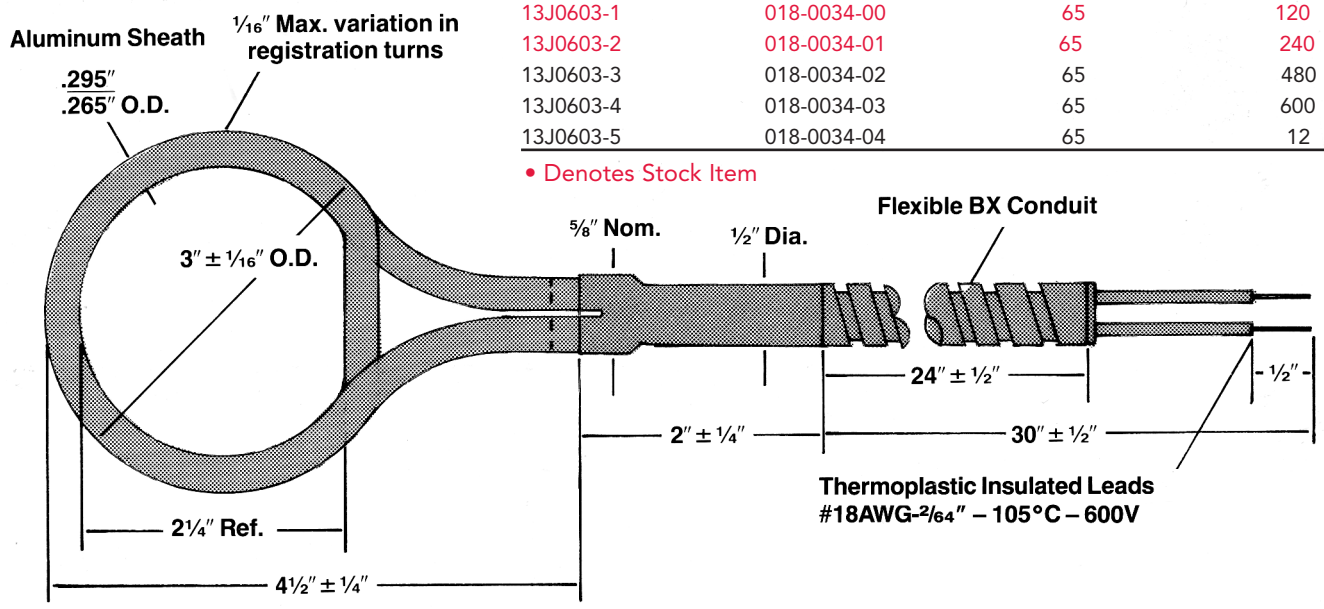
Crankcase Heaters

Copeland Compressors



Hotwatt Part No.	Copeland Part No.	Wattage	Voltage
13J0603-1	018-0034-00	65	120
13J0603-2	018-0034-01	65	240
13J0603-3	018-0034-02	65	480
13J0603-4	018-0034-03	65	600
13J0603-5	018-0034-04	65	12

• Denotes Stock Item

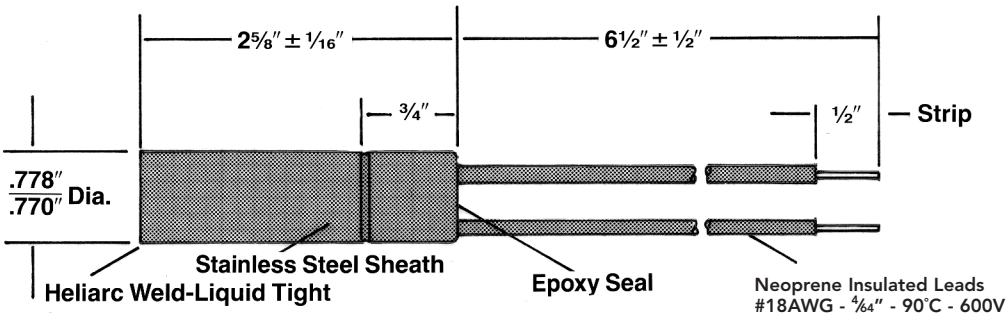


Hotwatt Part No.	Copeland Part No.	Wattage	Voltage
13R0115-02	018-0028-01 or -05	50	120
13R0115-03	018-0028-02 or -06	50	240

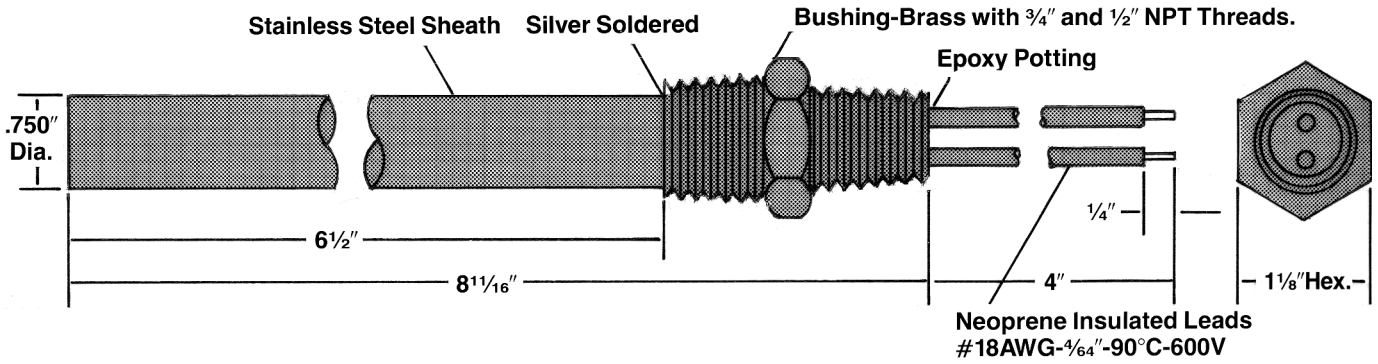
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Crankcase Heaters

Trane Compressors



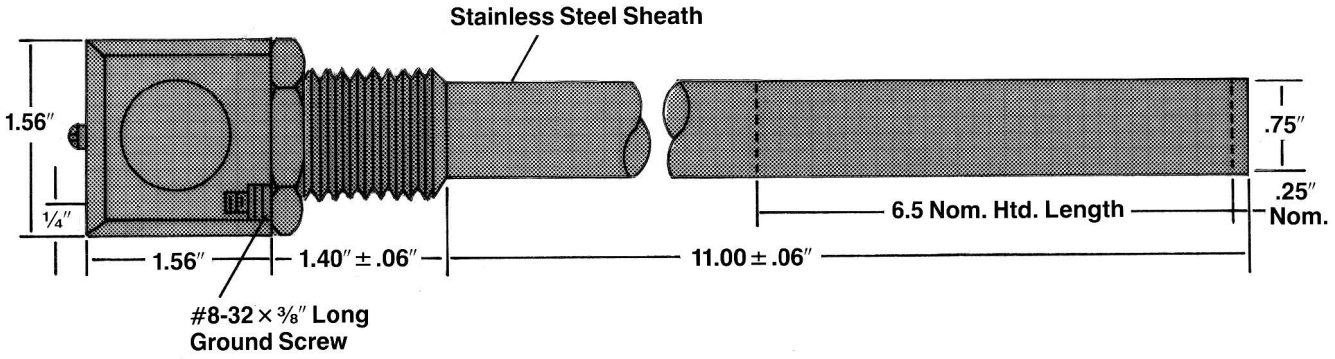
Hotwatt Part No.	Trane Part No.	Wattage	Voltage
13J2500-4	13140419-04	60	380
13J2500-3	13140419-03	60	575
13J2500-2	13140419-02	60	460
13J2500-1	13140419-01	60	230

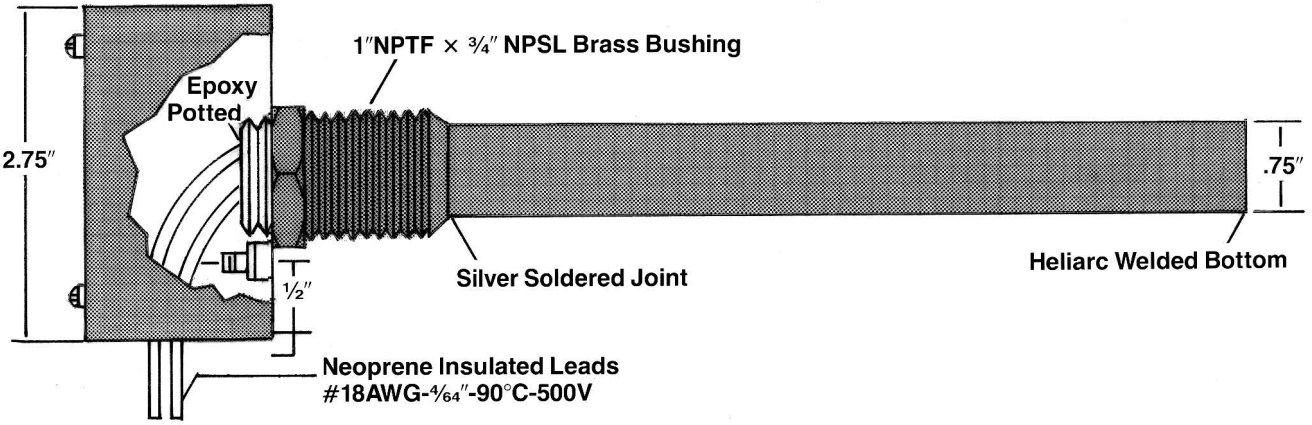


Hotwatt Part No.	Trane Part No.	Wattage	Voltage
13E6016-1	X13140587-01	75W	220V
13E6016-2	X13140587-02	75W	37V
13E6016-3	X13140587-03	75W	115V

Crankcase Heaters

Trane Compressors

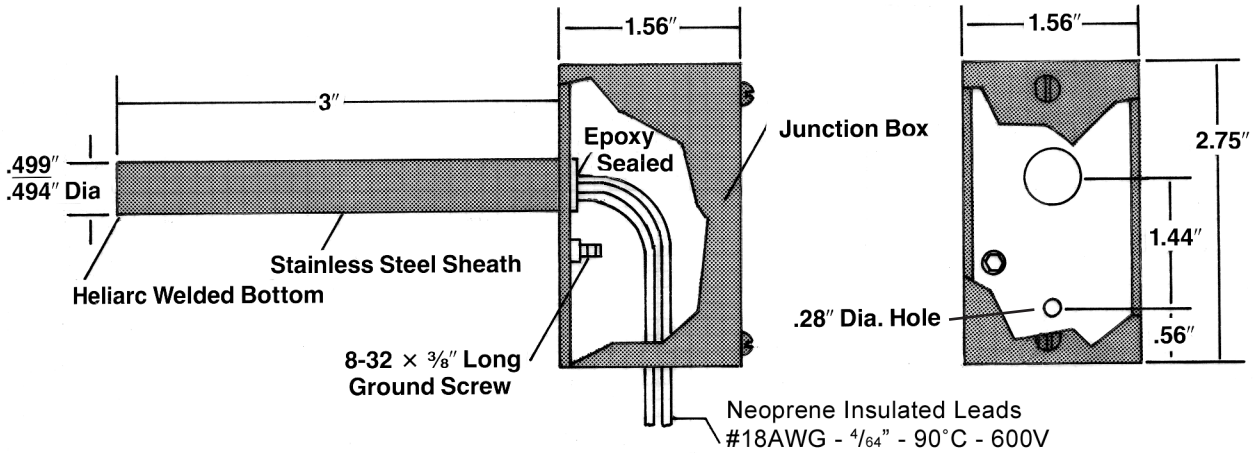




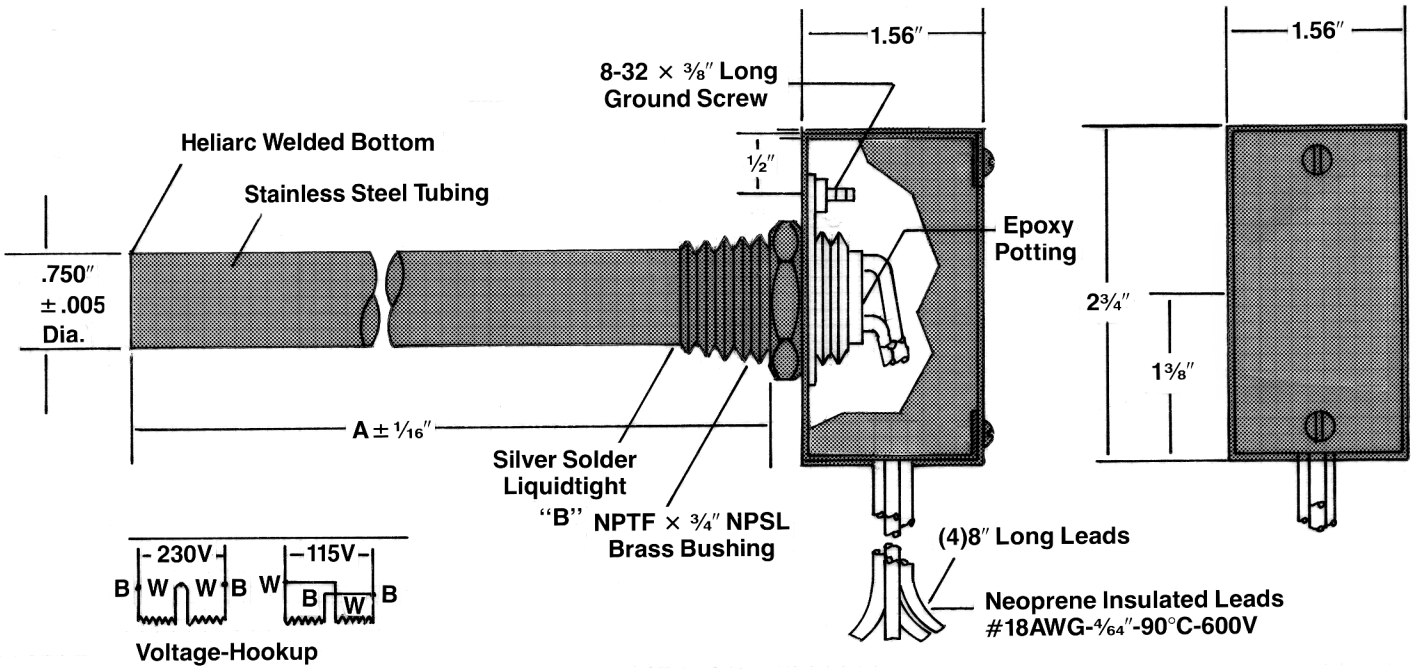
Hotwatt Part No.	Trane Part No.	Wattage	Voltage
13A0260-2	X13140396-02	140	240
13A0260-1	X13140396-01	140	120

Crankcase Heaters

Trane Compressors



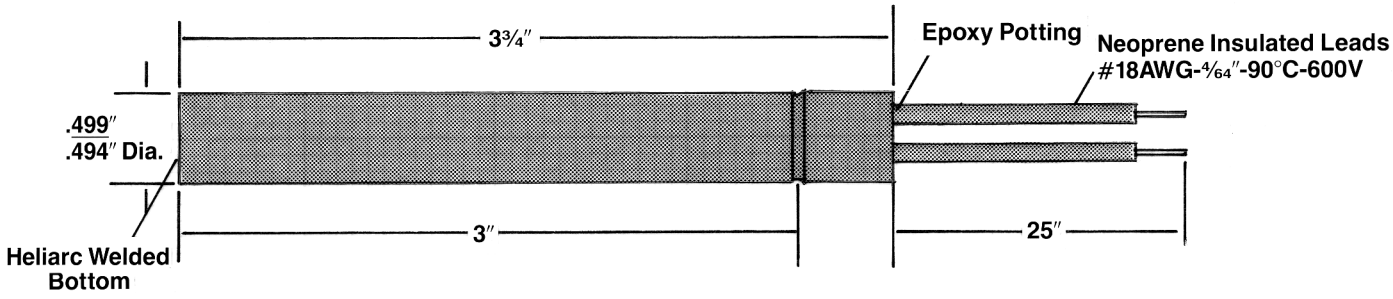
Hotwatt Part No.	Trane Part No.	Wattage	Voltage	Color Code Leads
13A7251-4	13140113	100	240	RED
13A7251-3	13140114	100	120	BLACK
13A7251-2	13120181	75	240	RED
13A7251-1	13120180	75	120	BLACK



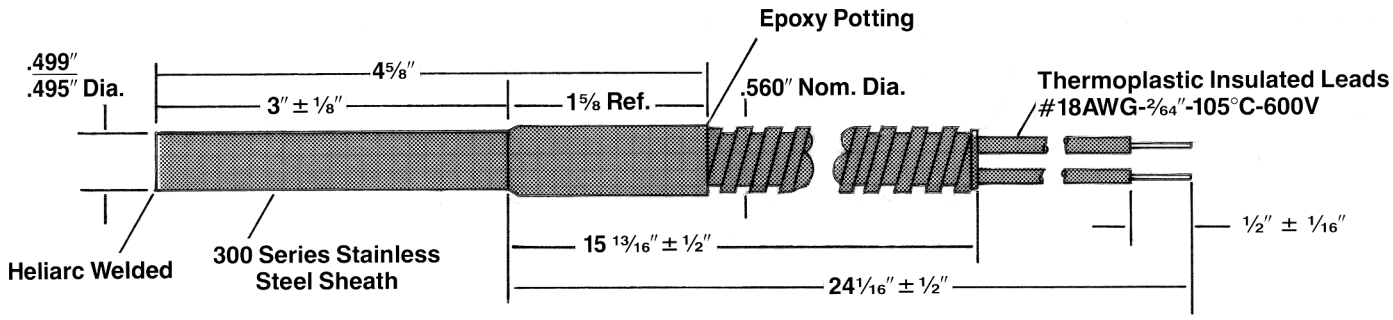
Hotwatt Part No.	Trane Part No.	Wattage	Voltage	A	B
13J1501-1	13140159-01	100	115/230	7 ¼"	¾" NPTF
13J1501-2	13140159-02	100	115/230	11"	1" NPTF

Crankcase Heaters

Borg Warner Compressors



Hotwatt Part No.	Borg Warner Part No.	Wattage	Voltage	Lead Color Code
13A0159	025-19205A	200	120	BLACK

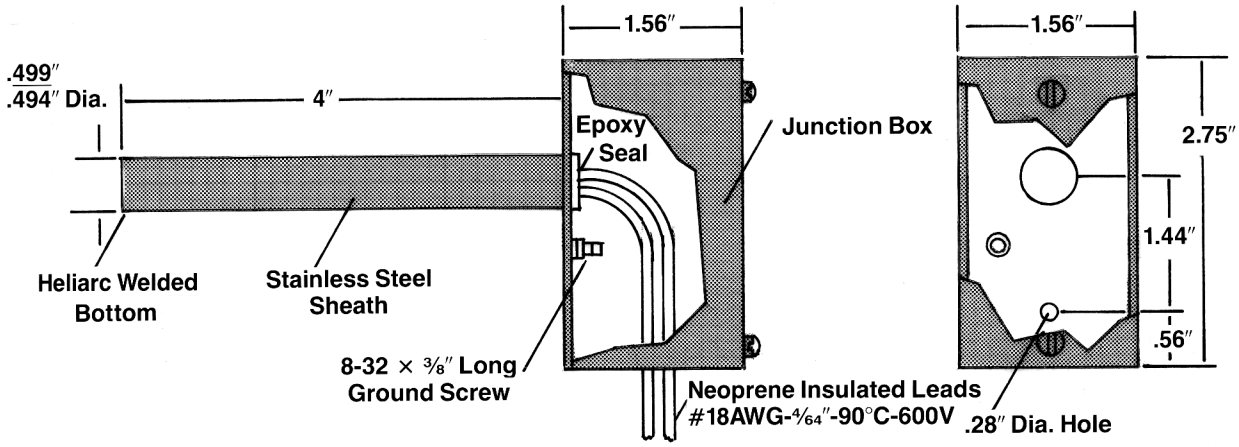


Hotwatt Part No.	Borg Warner Part No.	Wattage	Voltage
13A0331-1	25-21963-000	60	480
13A0331-2	25-21964-000	60	600

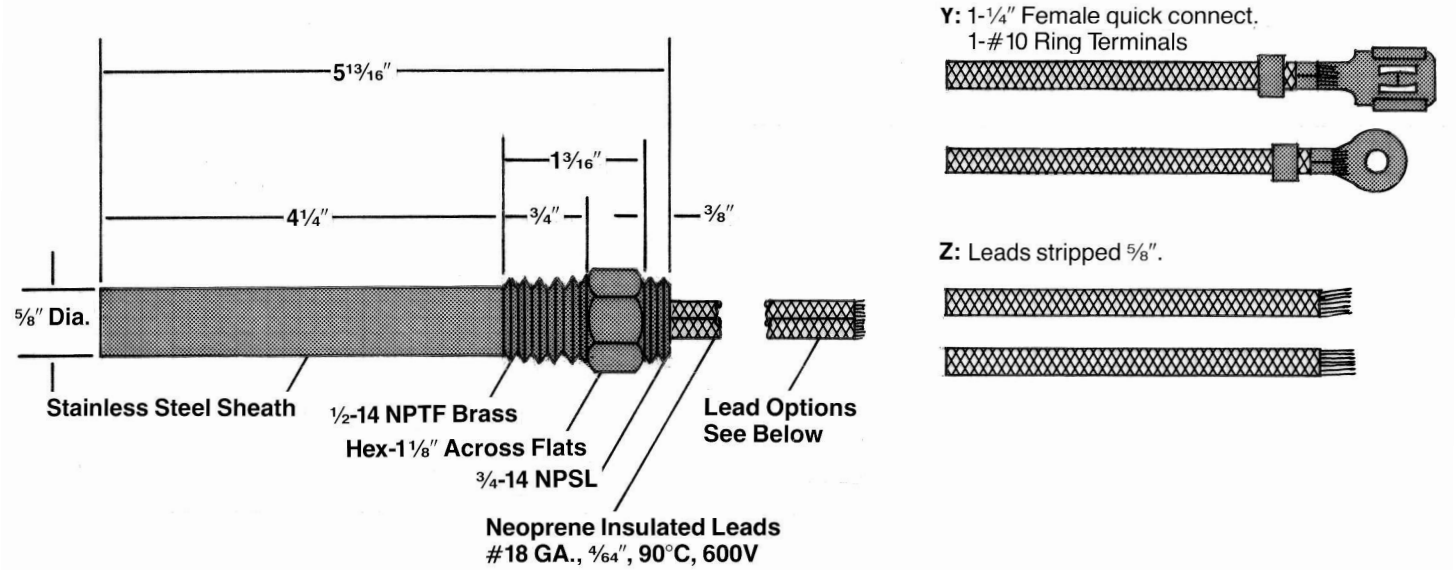
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Crankcase Heaters

Borg Warner Compressors



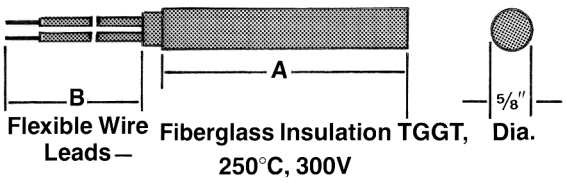
Hotwatt Part No.	Borg Warner Part No.	Wattage	Voltage	Lead Color Code
13A7251-6	025-1934-7C-002	200	240	RED
13A7251-5	025-1934-7C-001	200	120	BLACK



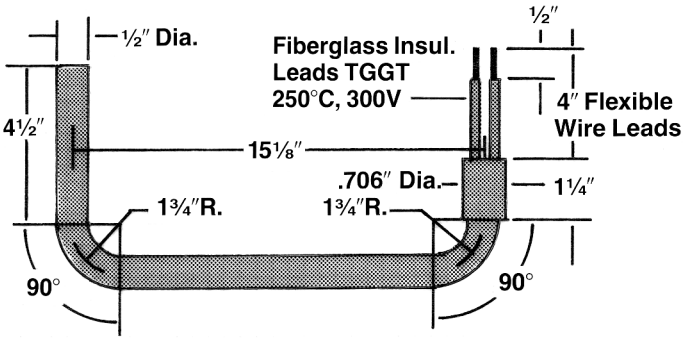
Hotwatt Part No.	Borg Warner Part No.	Wattage	Voltage	Lead Options	Lead Length
13J2401-1	025-14220	100	240	Y	53″ & 48″
13J2401-2	025-12335	100	240	Z	16″
13J2401-3	025-16313	100	240	Z	60″
13J2401-4	025-18611	100	120	Z	34″

Crankcase Heaters

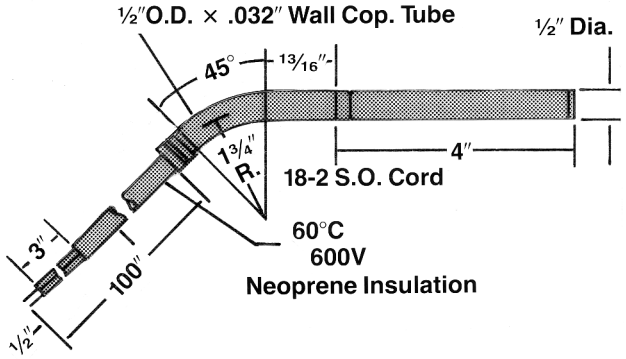
Westinghouse/McQuay Compressors



Hotwatt Part No.	West/McQ Part No.	Wattage	Voltage	A″	B″
13J1405-1	350A412-1	250	115	9	36
13J1405-2	350A412-2	250	208	9	27
13J1405-3	350A412-3	250	230	8 7/8	27
13J1405-4	350A412-4	250	440	9	27
13J1405-5	350A412-5	250	550	9	27
13J1405-6	350A412-6	65	115	3 7/8	3
13J1405-7	350A412-7	65	230	3 7/8	3
13J1405-8	350A412-8	65	440	3 7/8	3
13J1405-9	350A412-9	65	550	3 7/8	3
13J1405-10	350A412-10	65	230	3 7/8	3
13J1405-11	350A412-11	65	440	3 7/8	3
13J1405-12	350A412-12	65	550	3 7/8	3
13J1405-13	350A412-13	250	400	9	27
13J1405-14	350A412-17	550	240	13 3/16	10
13J1405-15	350A412-29	350	115	6.5	36
13J1405-16	350A412-30	300	115	7.0	60
13J1405-17	350A412-32	300	115	7	72
13J1405-18	350A412-43	150	115	5 7/8	36
13J1405-19	350A412-46	200	230	2 1/2	60
13J1405-20	350A412-47	300	230	7	60
13J1405-21	350A412-48	300	115	7	60
13J1405-22	350A412-51	250	115	8 7/8	60
13J1405-23	350A412-52	200	115	2 1/2	60



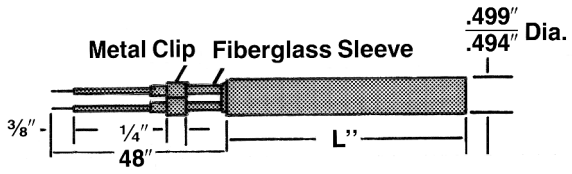
Hotwatt Part No.	West/McQ Part No.	Wattage	Voltage
13J2305-1	350A412-14	100	230
13J2305-2	350A412-15	100	440
13J2305-3	350A412-16	100	550
13J2305-4	350A412-34	100	120



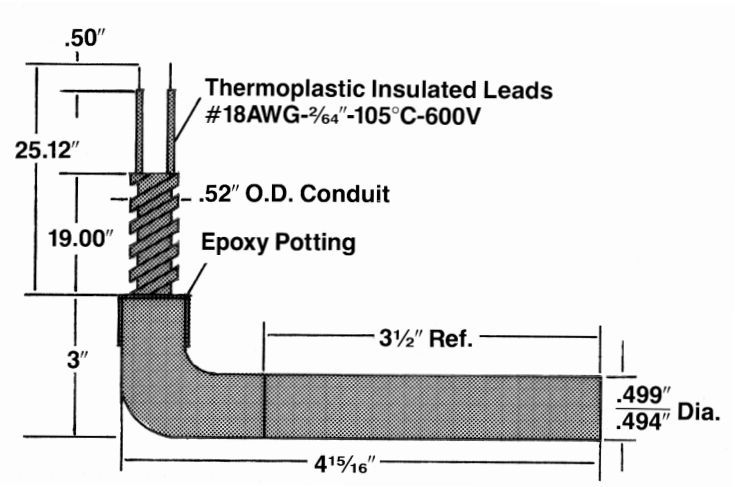
Hotwatt Part No.	West/McQ Part No.	Wattage	Voltage
13J2306-1	350A412-18	65	230
13J2306-2	350A412-19	65	440
13J2306-3	350A412-20	65	550

Crankcase Heaters

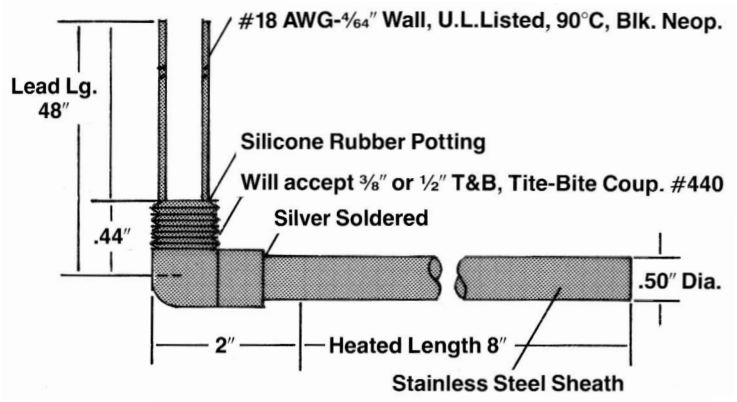
Westinghouse/McQuay Compressors



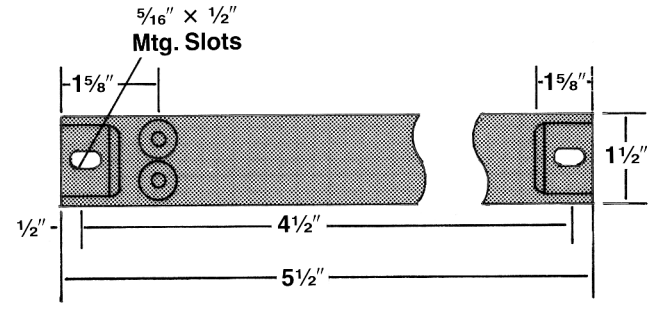
Hotwatt Part No.	West/McQuay Part No.	Wattage	Voltage	L″
13J1305-1	350A412-21	200	220	6
13J1305-2	350A412-22	200	440	6
13J1305-3	350A412-23	200	550	6
13J1305-4	350A412-24	350	220	10
13J1305-5	350A412-25	350	440	10
13J1305-6	350A412-26	350	550	10
13J1305-7	350A412-27	200	115	6
13J1305-8	350A412-28	350	115	10

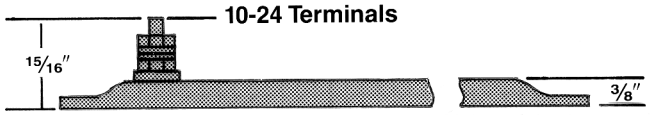


Hotwatt Part No.	West/McQuay Part No.	Wattage	Voltage
13A9881-17	350A412-44	200	120



Hotwatt Part No.	West/McQuay Part No.	Wattage	Voltage
13J2307-1	350A412-31	100	115
13J2307-2	350A412-35	100	230
13J2307-3	350A412-36	100	460
13J2307-4	350A412-37	100	575



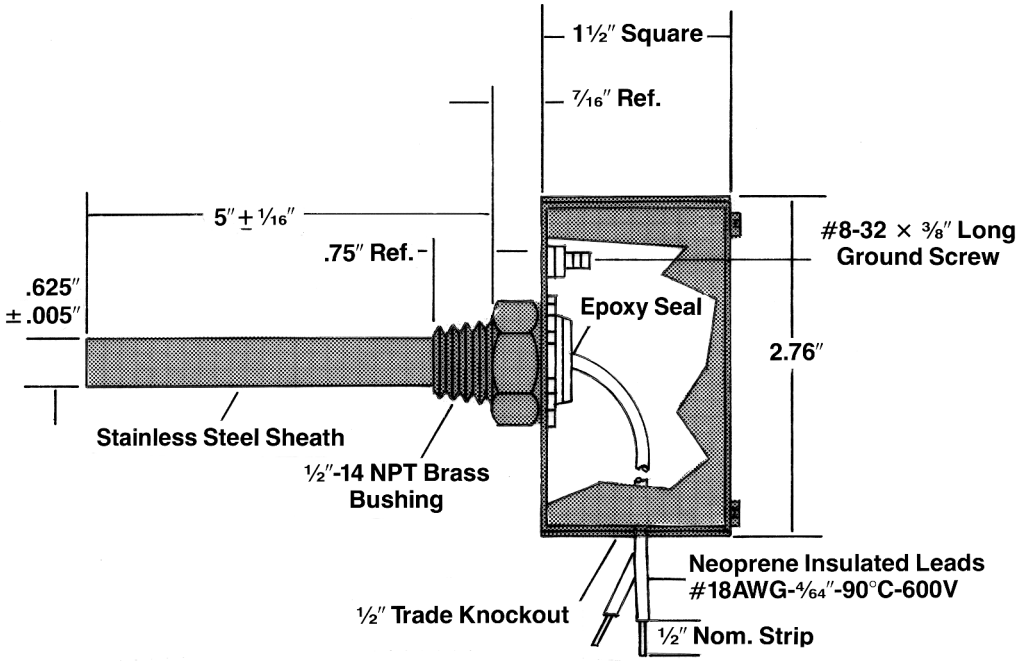


Hotwatt Part No.	West/McQuay Part No.	Wattage	Voltage
13J4602	350A412-33	125	240

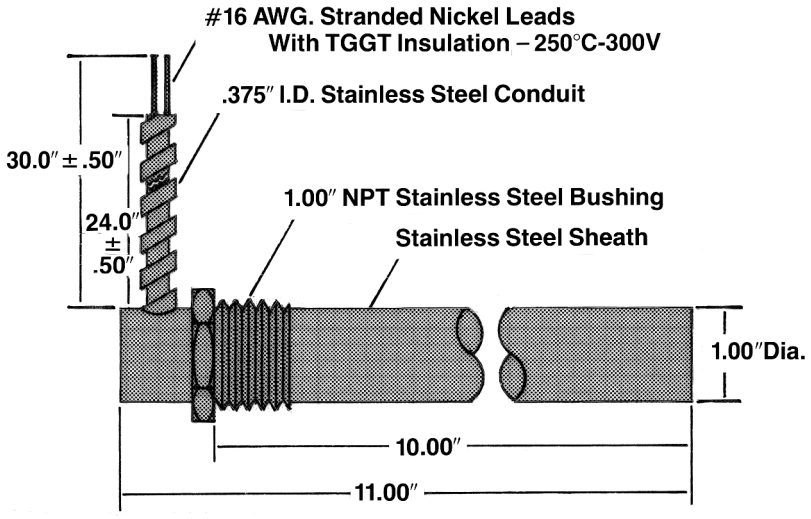
CRANKCASE

Crankcase Heaters

Westinghouse/McQuay Compressors



Hotwatt Part No.	West/McQ Part No.	Wattage	Voltage
13A9996-4	350A412-45	100	120

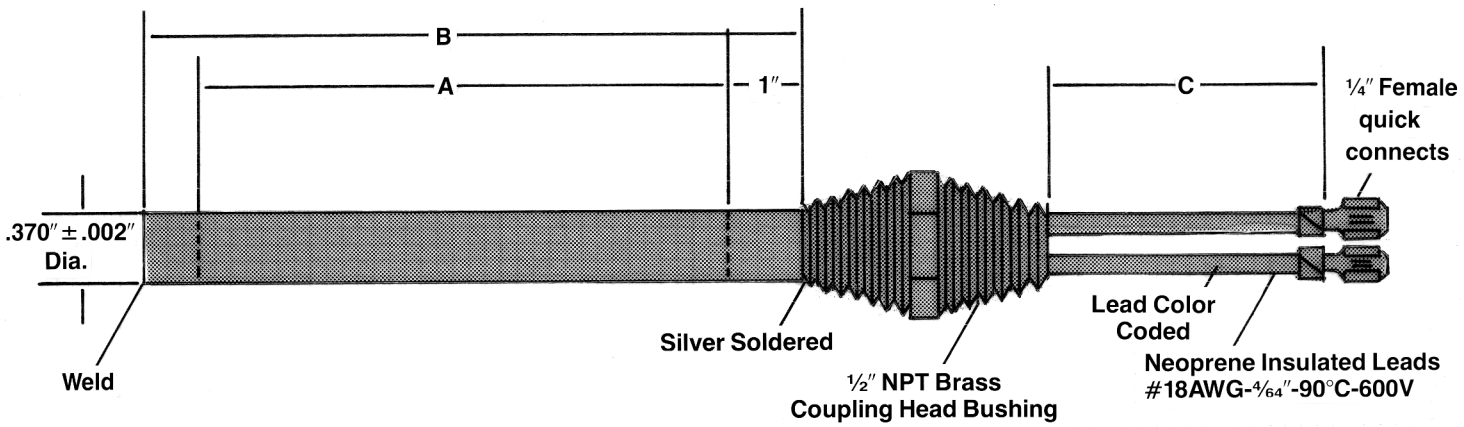


Hotwatt Part No.	West/McQ Part No.	Wattage	Voltage
13E0109-1	350A412-53	250	120
13E0109-2	350A412-54	400	120

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Crankcase Heaters

Fedders Compressors

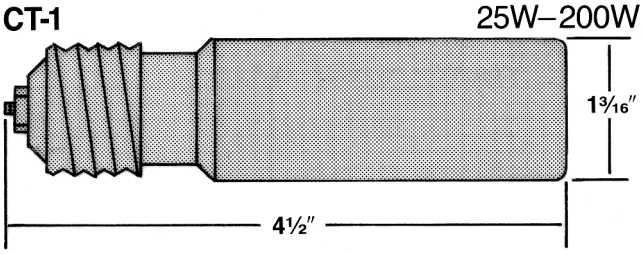


Hotwatt Part No.	Fedders Part No.	Wattage	Voltage	Lead Color Code	A″	B″	C″
13A6580-10	16-06-0217B-006	200	480	RED	2⅛	3⅜	54
13A6580-9	16-06-0217B-005	200	240	BLACK	2⅛	3⅜	54
13A6580-8	16-06-0217B-004	200	120	ORANGE	2⅛	3⅜	54
13A6580-7	16-06-0217B-002	275	240	BLACK	5⅛	6⅜	48
13A6580-6	16-06-0217B-001	275	120	ORANGE	5⅛	6⅜	48
13A6580-5	16-06-0217B-003	275	480	RED	5⅛	6⅜	48

Miscellaneous Heaters

Cabinet Heater Features

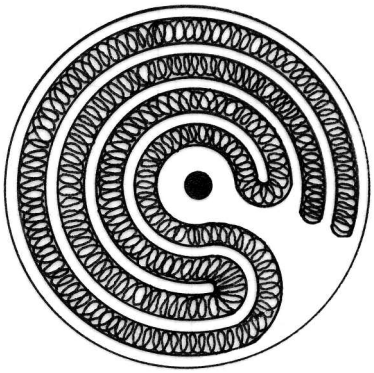
- The Hotwatt Cabinet Heater is used primarily as a dehumidifier.
- These heaters are often used to keep stored tools, dies, and gauges free from rust as well as to keep many hygroscopic materials from absorbing harmful moisture.
- The Heater is available in different wattages and voltages.
- Most Cabinet Heaters are supplied with a standard screw base, but may be supplied with a three-prong grounded plug or twist lock connection.



Ceramic Plate Heater Features

- The Ceramic Plate Heater is made of the highest quality refractory ceramic with heating coils of nickel chrome resistance wire.
- These heaters are supplied with leads.
- Available in various wattages and voltages.
- Heaters may be supplied with exposed resistance element or refractory cement filled.

PH3: 3-⅛ O.D. 100W-300W

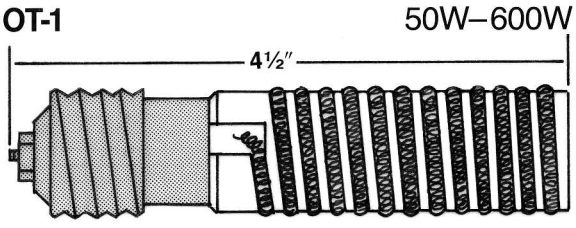






Open Coil Features

- These heaters are used as resistors, radiant heaters or air heaters.
- The heater is available in different wattages and voltages.
- The heater is supplied with a standard screw base.





MISCELLANEOUS

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Controls

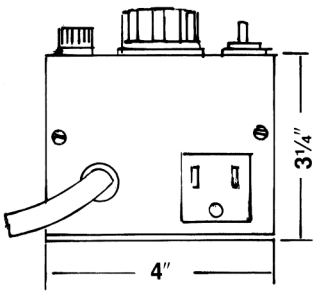
Voltage Controlling Devices

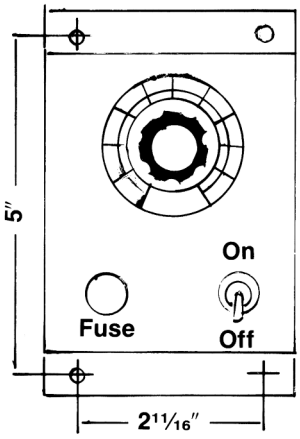
▼ IN STOCK ITEMS ▼

Model ACVC100-1 or -2

Surface Mount Power Control







The SR100 is a compact low cost power control designed for applications requiring a variable source of AC or DC voltage. In many applications it is an economical replacement for variable auto transformers and rheostats. The SR100 is supplied complete with three wire line cord, fuse, outlet and switch mounted in a rugged steel enclosure. Output voltage is fully adjustable from zero to full line voltage with current ratings to 15 Amps. An internal voltage trim allows the SR100 to be used with a large variety of loads - resistive or inductive. The low current control option is offered for applications involving frequent On-Off operation. This feature greatly increases relay contact life even when switching heavy inductive loads.

Features

- Rugged steel enclosure.
- Lightweight - portable.
- 50/60 HZ operation.
- Oversized semiconductors.
- Low current switching.
- Internal trim adjustment to suit application.
- 120 V unit complete with input cord set and output plug.
- 240 V unit complete with input cord and three foot output cord.

How To Order

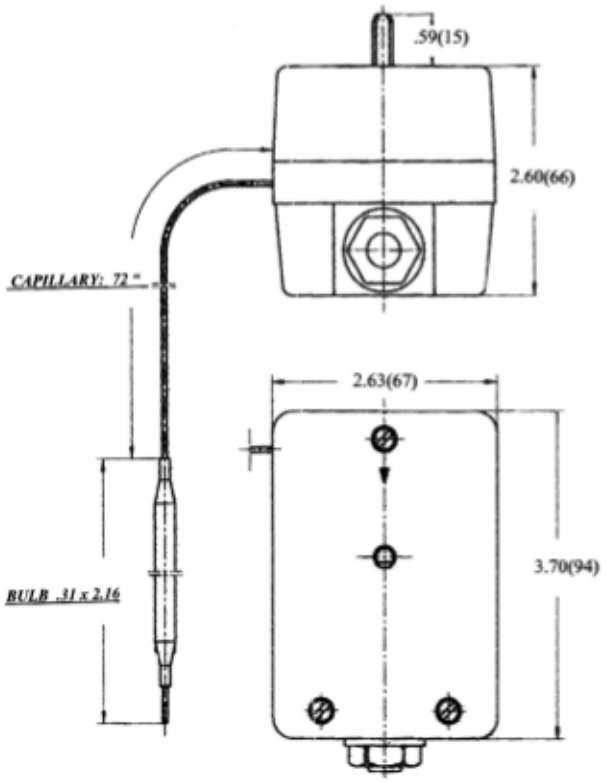
Specify: Catalog number as follows:
120V-ACVC100-1
240V-ACVC100-2

Controls

Temperature Controlling Devices

Snap-Action Thermostat

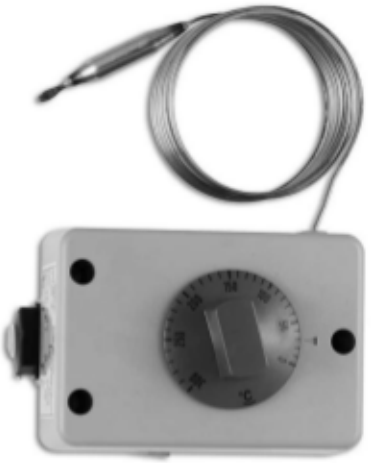
Bulb and Capillary



Features

- Liquid filled bulb and capillary, non-indicating, adjustable range thermostat.
- 72" capillary length.
- Panel Mount.
- Rating – 20 AMP at 120V or 240V.
- Temperature Range: 32°F(0°C) - 572°F (300°C)
- 2½ % Differential

Catalog Number: AC602021HOT1

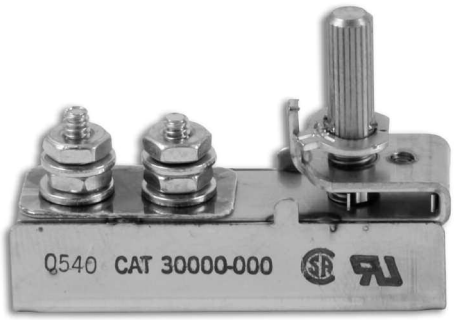


Controls

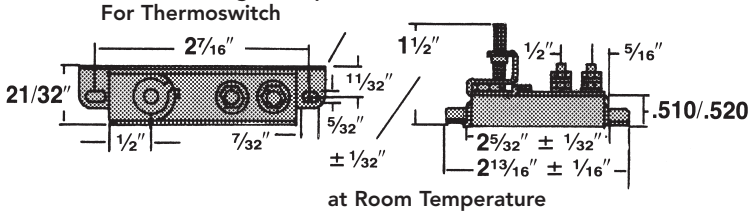
Temperature Controlling Devices

▼ IN STOCK ITEMS ▼

Surface Mount Thermostat



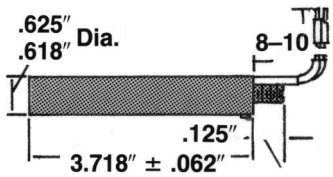
"C" Mounting Clamp
For Thermoswitch



at Room Temperature

Cartridge Thermostat





.375" to .625" at
Room Temperature

Features

- Small size: 2" X ½" X ⅝".
- Economical.
- Sensitive and accurate.
- Fast response.
- Adjustable through temperature range with stop tab to prevent setting in excess of limits.
- Stainless steel shell.
- Mounting bracket included.
- Contacts open on temperature rise.
- 10 amps @ 120 VAC, 5 amps @ 240 VAC.

Catalog Number	Range	Approx. °F/Full Turn Adj. Screw
30000-0	50° to 300°F	250°F
30000-48	85° to 250°F	175°F
30002-0	50° to 600°F	575°F

Features

- Fast response.
- Extreme sensitivity of 0.1°F.
- Vibration resistance.
- Adjustable through temperature range with optional locking device.
- Close control.
- 10 amps @ 120 VAC, 5 amps @ 240 VAC.
- Locating pin prevents unit from turning when adjusting temperature (pin is removable).

Catalog Number	Sheath Material	Range	Approx. °F/Full Turn Adj. Screw
17002-0	St. Steel	-100° to 400°F	110°F

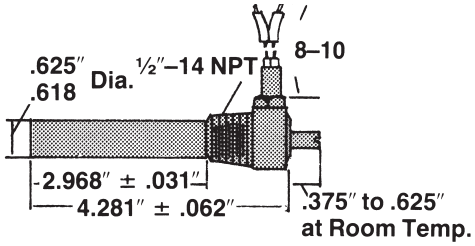
Controls

Temperature Controlling Devices

▼ IN STOCK ITEMS ▼

Hex Head

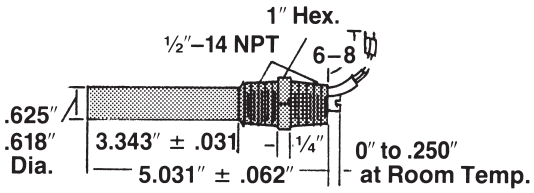




Catalog Number	Shell and Head	Range
17100-0	⅝″ X 4 ³²⁄₃₂″ All Brass	-100˚ to 400˚F
17102-0	St. St. Shell Brass Head	-100˚ to 600˚F

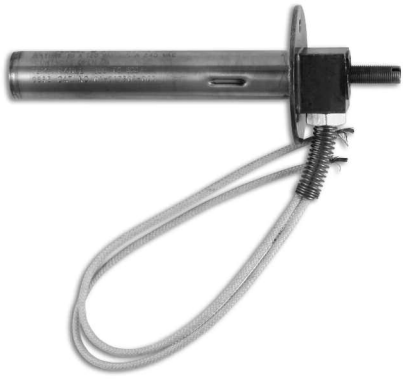
Coupling Head

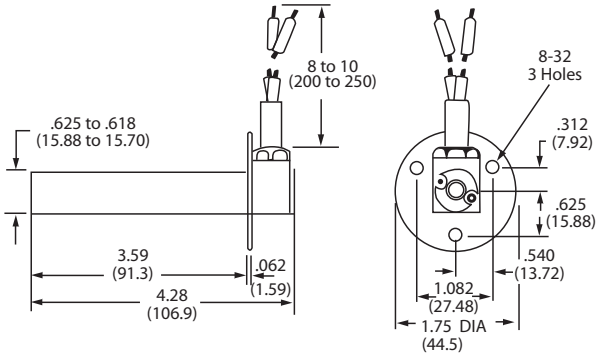




Catalog Number	Shell and Head	Range
18000-0	⅝″ X 4 ²¹⁄₃₂″ All Brass	-100˚ to 400˚F
18002-0	St. St. Shell Brass Head	-100˚ to 600˚F

Flange Head





Catalog Number	Shell and Head	Range
17300-0	⅝″ X 4 ³²⁄₃₂″ All Brass	-100˚ to 400˚F
17302-0	St. St. Shell Brass Head	-100˚ to 600˚F

▼ IN STOCK ITEMS ▼

Series 100, Sub-Panel-Thermocouple Temperature Controller



Specifications

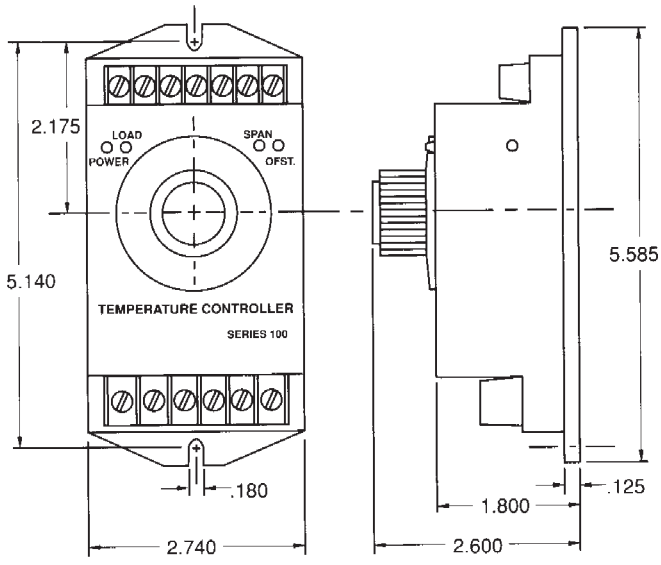
- **Power Input:** 115/230VAC ± 10%, 50/60Hz (field selectable); 24VAC ± 10% optional.
- **Sensor:** Thermocouple, type J.
- **Setpoint Range:** 0˚F to 1000˚F.
- **Control Modes:** Proportioning with adjustable Bandwidth (1˚C to 10˚C) and cycle rate of 2 sec for Triac or 10 sec for relay outputs.
- **Setpoint Adjustment:** Local Potentiometer.
- **Control Accuracy:** Typically better that 0.5% of range.
- **Control Stability:** Typically better than ± 1˚C with ± 10˚C change in ambient temperature or ± 10% change in line voltage.
- **Sensor Fault Protection:** Open sensor causes output to de-energize (Thermocouple).
- **Operating Ambient temperature:** 0˚C to 55˚C (32˚F to 130˚F).

Description

The Series 100 controller was designed for general purpose commercial and industrial temperature regulating applications. The latest solid state technology and an innovative modular packaging concept has produced a uniquely flexible family of controllers. Low cost, a choice of many standard features and fast delivery make this series of controllers equally to both the OEM and the end users.

Features

- 120/240 VAC power input.
- Power and load lamps.
- Adjustable span and offset.
- Adjustable bandwidth or hysteresis.
- Process and set point display capability.
- Triac output.
- Proportioning
- 24 V to drive solid state relay.
- Designed to UL and CSA standards.



How To Order

Specify catalog numbers as follows:

– 10 Amp Triac	Cat. No. AC100-2A040-JT03
– 28 VDC output to drive SSR	Cat. No. AC100-2A090-JT03

Controls

Temperature Controlling Devices

▼ IN STOCK ITEMS ▼

Series 120R, Panel Mounting, Solid State Temperature Controller



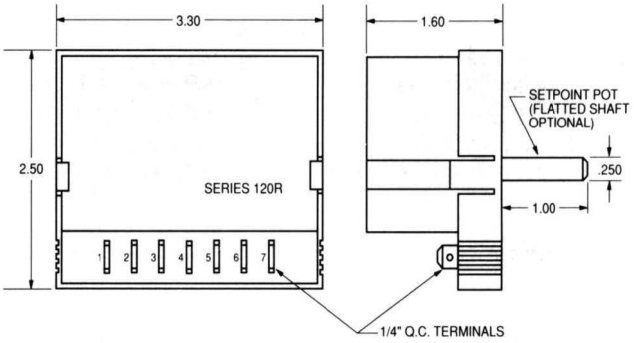


Specifications

- **Power Input:** 115/230VAC ± 15%, 50/60Hz (field selection).
- **Control Mode:** On-off with 2˚F hysteresis typical.
- **Setpoint Range:** 0˚ - 500˚F
- **Setpoint Accuracy:** Typically better than 1% of span.
- **Setpoint Stability:** Typically better that ± 1˚F over allowable operating ambient temperature or with ± 10% line voltage variation.
- **Sensor:** Type J thermocoupe
- **Sensor Fault Protection:** Open or shorted sensor causes output to de-energize.
- **Operating Ambient Temperature:** 0˚C to 70˚C (32˚ to 158˚F).

Description

The Series 120R controller is an economical alternative to the fluid filled (bulb and capillary) type thermostat for any application which could benefit from the improved performance and reliability of an electronic temperature control. Its compact, completely enclosed construction with industry standard mounting, integral setpoint, high current output capability and wide variety of sensor configurations, make this controller an ideal choice to replace mechanical thermostats in many industrial and commercial applications.



Features

- 115/230 VAC power inputs.
- UL class 2 low voltage sensor circuit.
- Completely enclosed design.
- UL recognized (file no. E105669).
- 24 volts to drive SSR.

Advantages Over Bulb & Cap Thermostat

- Faster response.
- Better accuracy and sensitivity.

How To Order

Specify catalog number as follows:

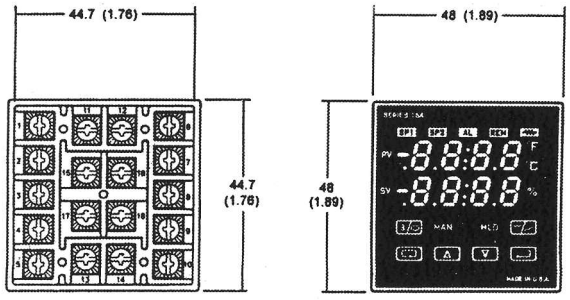
AC120R-D38-JT02

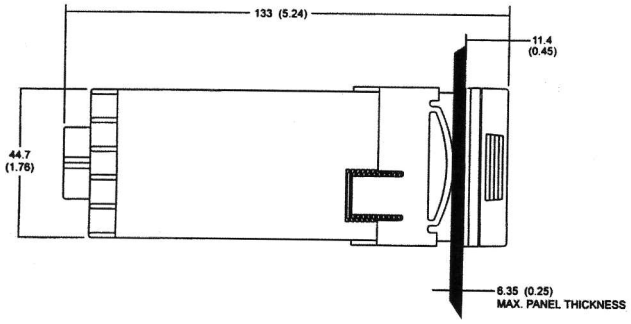
Controls

Digital Indicating Temperature controller
Model 16A 2123, Mini 1/16 DIN Thermocouple Sensing

▼ IN STOCK ITEMS ▼







All Dimensions in MM (Inches)
Panel Cut-Out 45 + 0.6 (1.77 +0.02) square

Specifications

Selectable Inputs: Thermocouple, RTD, DC voltage, or DC current selectable

Input Impedance: Thermocouple = 3 megohms minimum
Current = 10 ohms
RTD current = 200uA
Voltage = 5000ohms

Sensor Break Protection: User determines control output to protect system after customer set time

Display: Two 4 digit, 7 segment .30" high LEDs

Control Action: Reverse (usually heating)
Direct (usually cooling) selectable

Proportional Band: 1 to 9999˚F, ˚C, or counts

Reset Time: (Integral): Off or .1 to 99.9 minutes

Rate Time: (Derivative): Off or .01 to 99.99 minutes

Cycle Rate: 1 to 80 seconds

On-Off Differential: Adjustable 1˚F, 1˚C or 1 count to full scale in 1˚F, 1˚C, or 1 count steps

Alarm On-Off Differential: 1˚F, 1˚C, or 1 count

Accuracy: ± .25% of span, ± 1 least significant digit

Supply Voltage: 100 to 240 VAC, nominal., +10-15%, 50 to 400 Hz. single phase; 132 to 240 VDC, nominal., + 10-20%

Power Consumption: 5VA maximum

Operating Temperature: -10 to +55˚C (+14 to 131˚F)

Storage Temperature: -40 to +80˚C (-40 to 176˚F)

Control Output Ratings:
Relay: SPDT, 3 A @ 240 VAC resistive; 1.5 A @ 240 VAC inductive; Pilot duty rating: 250 VA 2 A @ 120 VAC or 1A @ 240 VAC

Alarm Relay: SPST, 3 A @ 240 VAC resistive; 1.5 A @ 240 VAC inductive; Polit duty rating: 240 VA, 2 A @ 120 VAC or 1A @ 240 VAC

Switched Voltage (isolated): 15 VDC @ 20 mA

Panel Cutout: 45 mm x 45mm (1.775" x 1.775")

Depth Behind Mounting Surface: 115.3 mm (4.54")

Weight: 227 g (8oz)

Front Panel Rating: Type 4X, (IP65)

How To Order

To order, specify part number

Model	16 A	2	1	2	3
		Features	Alarm	Output A	Output B
		2 = Standard	1 = Yes	2 = 15VDC	3 = Relay

Controls

Temperature Controlling Devices

CONTROL

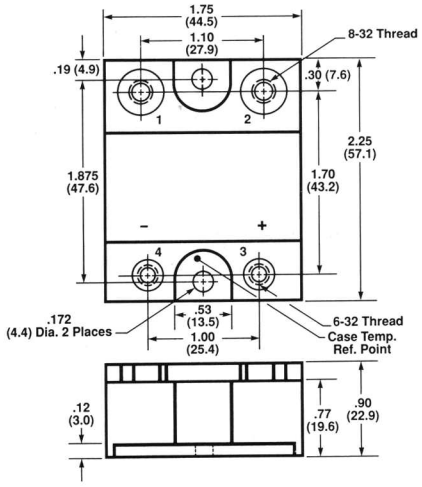
▼ IN STOCK ITEMS ▼

Solid State Relays



Features

- 3-32 VDC Input
- 600 volt blocking voltage
- 4000 volt isolation
- Zero voltage turn-on
- Built-in snubber
- 100% tested at rate current
- High surge capability
- U.L. recognized
- C.S.A. certified



How To Order

Specify Catalog Number per table below

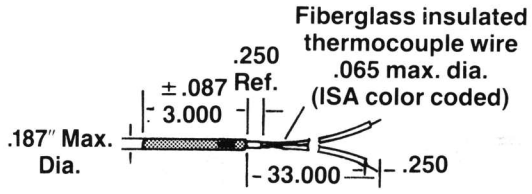
Line Volts	Maximum Load Current	Catalog Number
24-330 VAC	25 Amps	AC-D1225

Thermocouple Probes Features

- Thermocouples are precise temperature-sensing devices manufactured of the highest grade materials to provide maximum performance and reliability.
- Tip Style: Closed end-grounded.
- Probe size and material: .187" dia., 316 stainless steel.
- Lead wire: 20 gage fiberglass insulated. Standard commercial tolerances of ¾%.
- Thermocouple material and temperature range: Iron/Constantin-type J, 0-1200˚F.
- ISA color coded:

Iron	White
Constantin	Red with white tracer

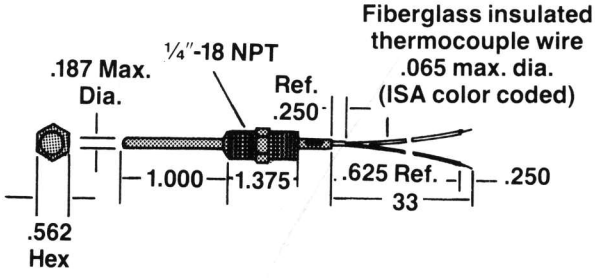
3/16" Diameter Cartridge Type



Temp Range	Catalog Number	ISA Type
0˚F to 1200˚F	HT-111206-001	J

For compression fittings, consult factory.

Coupling Head Type

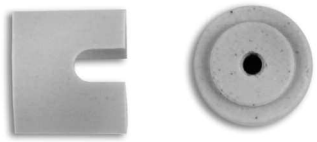


Temp Range	Catalog Number	ISA Type
0˚F to 1200˚F	AC HT-121202-001	J

Accessories

▼ IN STOCK ITEMS ▼

Terminal Covers: High Temperature
(for use with post terminals)

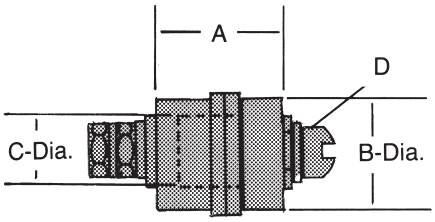


Individual ceramic terminal covers are designed to protect the operator from exposed terminals. The cover body is slotted to receive two wires and may be installed after wiring has been completed.

Catalog Number	Post Size
CC10-24	10-24 threads
CC10-32	10-32 threads
CC80-32	8-32 threads
CC60-32	6-32 threads

Ceramic Feed Throughs





Catalog No.	A-Length	B-Dia	C-Mounting Hole Dia	D-Screw Size
AC2C0042	.505″	.545″	.375″	8-32 x 1¼″
AC2C0500	.312″	.375″	.250″	6-32 x 1″
AC2C0101	1.000″	1.000″	.560″	¼″-20 x 1¾″

Each assembly consists of a male and a female ceramic insulator with stainless steel screw with two flat washers, one lockwasher, two hex nuts, and two fiberwashers.

Ceramic bushings without hardware are also available.

Ceramic Insulating Beads: High Temperature



Trade Size	Catalog Number	Dimensions I.D.	O.D.	Length
1	AC2C5000-5	.056″	.110″	.110″
2	AC2C5000-4	.068″	.170″	.170″
3	AC2C5000-3	.092″	.200″	.200″
4	AC2C5000-2	.156″	.260″	.260″

Trade Size	Wire Size	Beads/Foot	Beads/Std Package
1	16AWG	134	670
2	14AWG	86	430
3	12AWG	70	350
4	8AWG	54	270
6	8AWG	34	170

Sleeving: Non-Fraying Fiberglass

Temperatures up to 1200˚F (650˚C) - for abrasion protection and extra electrical insulation.



Natural (tan) Coloring
100 foot spools

Catalog No.	Size	Nom. I.D.	Fits Lead Wire
AC10G0001-17	#17	.047″	#26
AC10G0001-14	#14	.066″	#24
AC10G0001-10	#10	.106″	#20
AC10G0001-8	#8	.133″	#16
AC10G0001-4	#4	.208″	#10

Sleeving: Silicone Rubber Coated Fiberglass

Temperatures up to 428˚F (220˚C) - for abrasion protection, extra electrical insulation and moisture resistance.



White
100 foot spools

Catalog No.	Size	Nom. I.D.	Fits Lead Wire
AC10S0000-13	#13	.076″	#24
AC10S0000-10	#10	.105″	#20
AC10S0000-8	#8	.133″	#16
AC10S0000-6	#6	.166″	#14
AC10S0000-4	#4	.208″	#10

Accessories

▼ IN STOCK ITEMS ▼

Conduit: High Temperature, Stainless Steel, Flexible Type (for abrasion and flexing protection)



Catalog Number	I.D.	O.D.
C-250	5/32"	1/4"
C-350	1/4"	11/32"
C-375	5/32"	3/8"
C-500	3/8"	15/32"

Terminals: High Temperature Nickel



Serviceable to 1200°F (649°C)
Nickel Plated S.S.

Catalog Number	Awg. Size	Stud
HTR2218-6	22-18	6
HTR2218-8	22-18	8
HTR2218-10	22-18	10
HTR1614-6	16-14	6
HTR1614-8	16-14	8
HTR1614-10	16-14	10
HTR1210-8	12-10	8
HTR1210-10	12-10	10

Tape: Glass Cloth (High temperature electrical wiring tape)



• Glass cloth tape no. 27 is a high heat splicing tape composed of a glass cloth locking and an adhseive that thermosets in high application enviroments. It is a Class B 266°F (130°C) electrical insulation.

• Catalog no. 27 - ½" wide x 66' long

Cement: High temperature



• This cement insulates electricity but radiates heat. It also resists acids, oils, and temperatures up to 3000°F. This is the same cement Hotwatt uses in electic heating elements and can be used for electric kilns, furnaces, and resistors. The cement hardens into a porcelain-like body by air drying without the use of kilns or injury to the resistant wire.

• Catalog No. C-78 - 1 quart container.

Phone: 978-777-0070 ■ Fax: 978-774-2409

Accessories

▼ IN STOCK ITEMS ▼

Wire: High Temperature Hook-up

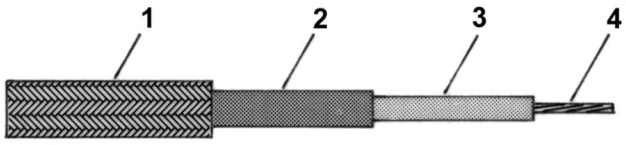


Features

- The high temperture insulated wires are for use in internal wiring of domestic, commercial, and industrial heating, cooking, and process equipment.
- Wires are suitable for service up to rated voltage in damp and dry applications with wire temperatures up to 250˚C (482˚F); with intermittent use in ambients as high as 650˚F.
- Wires are identical to that used on our own heating elements.
- Available in 100 foot and 250 foot spools.

300 Volt - 250˚C Wire

U.L. and C.S.A. rated for 300V/250˚C



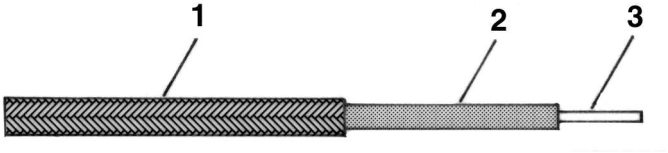
Construction

1 Teflon treated fiberglass braid.
2 Fiberglass.
3 Teflon tape wrap.
4 Flexible, stranded nickel conductor.

Part No.	Awg. Wire Size	Max. O.D.	Maximum Amp. cap at ambient of: 30˚C	225˚C
9G-N12T-1	12	.165	16.8	8.0
9G-N14T-1	14	.141	12.5	6.0
9G-N16T-1	16	.126	9.2	4.2
9G-N18T-1	18	.110	7.1	3.3
9G-N20T-1	20	.097	5.4	2.4

600 Volt - 250˚C Wire

U.L. and C.S.A. rated for 600V/250˚C



Construction

1 Teflon treated fiberglass braid.
2 Teflon tape wrap.
3 Flexible, stranded nickel plated copper conductor.

Part No.	Awg. Wire Size	Max. O.D.	Maximum Amp. cap at ambient of: 30˚C	225˚C
9G-P10T-2	10	.195	35	22.0
9G-P12T-2	12	.168	28	16.2
9G-P14T-2	14	.147	21	12.0
9G-P16T-2	16	.126	15.4	8.7
9G-P18T-2	18	.116	11.9	6.9
9G-P20T-2	20	.105	9.1	4.8

Accessories

▼ IN STOCK ITEMS ▼

Resistance Wire: Nickel Chromium

Features

- Hotwatt's nickel-chromium wire (80ni-20cr) is proven to deliver outstanding performance over extended periods of time and is the same wire we use in our own electrical heating elements.
- Uniformity of resistance.
- Mechanical stability.
- Fine surface finish.
- Consult factory for specifications on other sizes and different alloys which are available. Typically Iron-Chromium-Aluminum alloy, Nickel-Iron Alloy and Thermocouple Alloys.

Round Wire



Catalog Number	AWG Size	Nominal Wire Dia.	Ohms/Ft.
R15	15	.057	.20
R16	16	.051	.25
R17	17	.045	.32
R18	18	.04	.41
R19	19	.036	.50
R20	20	.032	.65
R21	21	.028	.80
R22	22	.025	1.02
R24	24	.02	1.61
R26	26	.016	2.57
R27	27	.014	3.22
R28	28	.013	4.09
R29	29	.011	5.09
R30	30	.01	6.50
R31	31	.009	8.20
R32	32	.008	10.16
R33	33	.007	12.89
R34	34	.006	16.38

Ribbon Wire



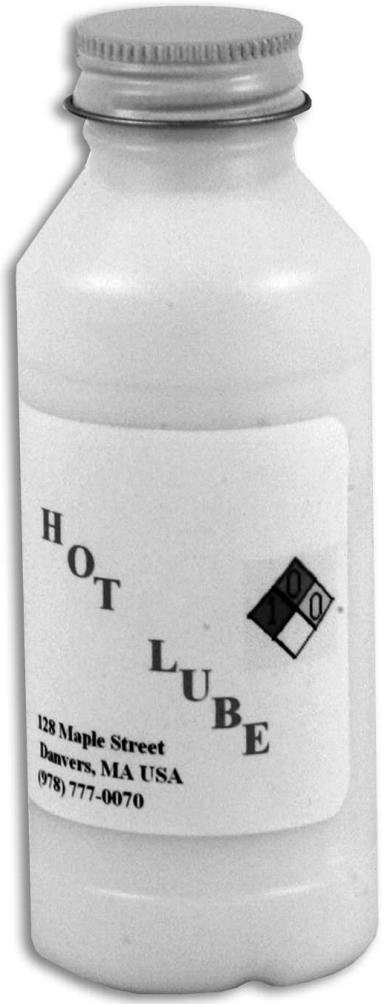
Catalog Number	Thickness	Width	Ohms/Ft.
RR-1	.0015"	1/64"	22.75
RR-2	.002"	1/64"	17.36
RR-3	.0031"	1/64"	11.20
RR-4	.0035"	1/64"	9.99
RR-5	.004"	1/64"	8.68
RR-6	.0045"	1/64"	7.12
RR-7	.005"	1/64"	6.95
RR-8	.0056"	1/64"	6.20
RR-9	.0063"	1/64"	5.51
RR-10	.002"	1/32"	9.83
RR-11	.0031"	1/32"	5.60
RR-12	.0035"	1/32"	4.96
RR-13	.004"	1/32"	4.34
RR-14	.0045"	1/32"	3.86
RR-15	.005"	1/32"	3.47
RR-16	.0063"	1/32"	2.76
RR-17	.0031"	1/16"	3.17
RR-18	.0035"	1/16"	2.81
RR-19	.004"	1/16"	2.46
RR-20	.0045"	1/16"	1.93
RR-21	.005"	1/16"	1.74
RR-22	.0056"	1/16"	1.55
RR-23	.0063"	1/16"	1.38
RR-25	.0031"	3/32"	2.11
RR-26	.0035"	3/32"	1.87
RR-27	.0045"	3/32"	1.46
RR-28	.0063"	3/32"	.91
RR-29	.0031"	1/8"	1.59
RR-30	.0035"	1/8" 1	1.40
RR-32	.0045"	1/8"	1.09
RR-33	.005"	1/8"	.98
RR-35	.0031"	3/16"	.88
RR-36	.0035"	3/16"	.78
RR-37	.004"	3/16"	.68
RR-38	.0045"	3/16"	.60
RR-39	.005"	3/16"	.54

- Hotwatt will also supply resistance wire in coil form to your specifications. Consult factory for details.
- Refer to current carrying capacity tables on page 170.

Accessories

▼ IN STOCK ITEMS ▼

Hot Lube



- Hot Lube can greatly reduce heater-to-bore seizure when properly applied.
- Improves thermal conductivity. Heat transfers more quickly from heater to part being heated when Hot Lube is used.
- Increased heater life. Tighter fit made practical with use of Hot Lube.
- Not electrically conductive.
- Hot Lube solution is not considered hazardous.
- Easy to use.
- Withstands temperatures to 1600˚F (875˚C)

Available from stock, call you nearest Hotwatt Distributor.

Ordering Information:

4 ounce container catalog no. - ACHOTLUBE044

Directions

- Heater surface should be clean and dry.
- Shake Hot Lube well before use.
- Brush on a light uniform coat of Hot Lub.
- Allow to air dry for 20 minutes or oven dry at low temperature (140˚F maximum).

CAUTION: DO NOT ALLOW HOT LUBE TO COME IN TO CONTACT WITH LEAD WIRES OR LEAD END OF HEATER.

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Wattage Calculation Formulas

Wattage Calculation Data

Basic Heating Formulas

The following formulae can be employed in determining wattage capacity required for different materials.

Formula A: Wattage required for heat-up = $\frac{\text{Weight of material (lbs) x Specific Heat x Temperature Rise °F}}{\text{3.412 x Time (Hours of fraction Thereof)}}$

For specific heat and weights of each material being heated, see tables 1, 2, and 3 on pages 145, 146, and 147

Formula B: Wattage losses at operating temperature = Wattage loss/sq. ft. x Area in sq. ft.
See curves on pages 150-151.

Formula C: Wattage for melting or vaporizing = $\frac{\text{Weight of material (lbs) x Heat of fusion or vaporization (BTU/lb)}}{\text{3.412 x Heat up time (Hours of fraction Thereof)}}$

When the specific heat of a material changes at some temperature during the heat-up, due to melting (fusion) or evaporation (vaporization), perform Formula A for heat absorbed from the initial temperature up to the temperature at the point of change, add Formula B, then repeat Formula A for heat absorbed from the point of change to the final operating temperature. See tables 1, 2, and 3 on pages 145-147, for heats of fusion and vaporization and temperatures at which these changes in state occur.

Specific Applications

For specific applications, substitute the Basic Heat Formulas (A, B, or C above) into the following:

To Heat Liquids
Wattage for initial heat-up = (a) + $\frac{(b)}{2}$

Wattage for operating requirements = (a) for new material added + (b)
To insure adequate capacity, add 20% to final wattage figures. This will compensate for added losses not readily computed.

To Melt Soft Metals
Wattage for initial heat-up = (a) to melting point + (c) to melt + (a) to heat above melting point + $\frac{(b)}{2}$

Wattage for operating requirements = [(a) to melting point + (c) to melt + (a) to heat above melting point] for added material + 11. To insure adequate capacity, add 20% to final wattage figures. This will compensate for added heat losses not really computed.

To Heat Ovens
Wattage = (a) (for air) + (a) (all material introduced into oven) + (b)
Add 25% to cover door heat losses

Forced Air Heating

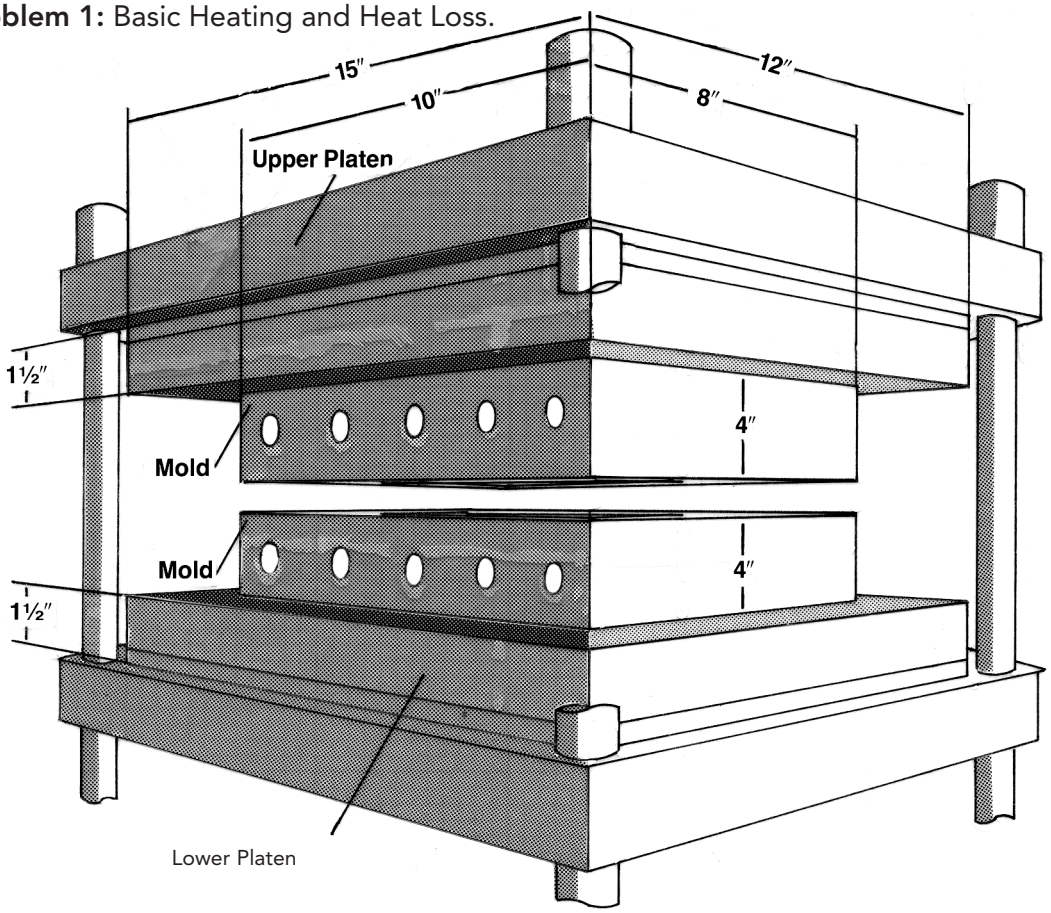
Wattage = $\frac{\text{C.F.M. x temperature rise (°F)}}{3}$

For explanation of Basic Heat Formulas, see examples on pages 142-144.

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Wattage Calculation Formulas

Problem 1: Basic Heating and Heat Loss.



A steel mold is being used to form polyethelyne parts. Each hour, 90 ounces of nylon is introduced to the mold. The mold itself measures 10″ x 8″ x 4″. The mold is attached between two stainless steel platens, each measuring 15″ x 12″ 1½″ thick. The platens are insulated from the press mechanism with ½″ thick insulation. Operating temperature of the mold is 400˚F and is required to reach this temperature in 1 hour with an ambient temperature of 70˚F.

1) From Table 1, page 145: Specific heat of steel - .12/BTU/lb ˚F
2) From Table 1, page 145: Specific heat of stainless steel - .12/BTU/lb ˚F
3) From Table 2, page 146: Specific heat of polyethelyne - .55/BTU/lb ˚F
4) From Graph 1, page 150: Heat losses curves – A + B @ 400˚F
5) From Table 1, page 145: Converting cubic inches into pounds (density lb/cu. in.)

Formula A: Wattage required for heat-up

To heat mold $\frac{(10″ \times 8″ \times 4″) = 320 \text{ cu.in.} \times 2 \times .284 = 181.7 \text{ (lbs)} \times .12 \text{ BTU/lb ˚F} \times (400 - 70)˚F}{3.412 \times 1} =$ 2,110 watts

To heat Platens $\frac{(15″ \times 12″ \times 1½″) = 270 \text{ cu.in.} \times 2 \times .286 = 154.5 \text{ (lbs)} \times .12 \text{ BTU/lb ˚F} \times (400\text{-}70) ˚F}{3.412 \times 1} =$ 1,800 watts

To heat Polyethelyne $\frac{90}{16} = \frac{5.6 \text{ (lbs)} \times .55\text{BTU/lb ˚F} \times (400\text{-}70) ˚F}{3.412 \times 1} =$ 300 watts

Compensation Factor 20% (2,110 + 1,800 + 300) = 840 watts

Total wattage required for Heat-up = **5,050 watts**

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Technical

Wattage Calculation Formulas

Formula B: Wattage losses at operating temperature (see graphs on pages 150 and 151).

Heat loss from mold (vertical surfaces)

$$\frac{10" \times 4" \times 4" + 8" \times 4" \times 4"}{144"} = 2 \text{ sq. ft.} \times 350\text{w/sq.ft./hr.} =$$ 700 watts

Heat loss from platen (vertical surfaces)

$$\frac{1\frac{1}{2}" \times 15" \times 4" + 1\frac{1}{2}" \times 12" \times 4"}{144"} = 1.1 \text{ sq. ft.} \times 350\text{w/sq.ft./hr.} =$$ 385 watts

Heat loss from platen (horizontal surfaces, uninsulated)

$$\frac{15" \times 12" \times 2" - (10" \times 8" \times 2")}{144"} = 1.3 \text{ sq. ft.} \times 250\text{w/sq.ft./hr.} =$$ 350 watts

Heat loss from platen (insulated surface) 250 watts

$$\frac{15" \times 12" \times 2"}{144"} = 2.5 \text{ sq. ft.} \times 100\text{w/sq.ft./hr.} =$$

Compensation factor:	20% (700w + 385w + 350w + 250w) =	340 watts
	Total wattage losses at operating temperature =	2,025 watts
	Total wattage required for heat-up =	5,050 watts
	Total wattage required =	**7,075 watts**

The number of holes in the mold would dictate the number of heaters required. Divided the wattages by the number of heaters will equal the wattage rating of each heater.

Problem 2: Paraffin melting

An open top uninsulated steel tank: 18" wide, 24" long and 18" deep weighs 140 pounds. This tank contains 168 pounds of paraffin which needs to be heated from 72˚F to 150˚F in 2 ½" hours.

1.) From Table 1, page 145: Specific heat of steel - .12 BTU/lb-˚F
2.) From Table 2, page 146: Specific heat of solid paraffin - .70 BTU/lb-˚F
3.) From Table 2, page 146: Melting point of paraffin: -133˚F
4.) From Table 3, page 147: Heat of fusion of paraffin - 63 BTU/lb
5.) From Table 3, page 147: Specific heat of melted paraffin - .71 BTU/lb-˚F
6.) From Graph 5, page 151: Surface loss at 150˚F:70w/sq.ft./hr.
7.) From Graph 1, page 150: Surface loss at 150˚F:55w/sq.ft./hr.

Formula A: Wattage required for heat-up

To heat tank

$$\frac{140\text{lb} \times .12 \text{ BTU/lb-˚F} \times (150 - 72)}{3.412 \times 2.5} =$$ 155 watts

To heat paraffin

$$\frac{168\text{lb} \times .70 \text{ BTU/lb-˚F} \times (133 - 72) \text{ ˚F}}{3.412 \times 2.5} =$$ 845 watts

To heat melted paraffin (fusion occurs at melting point)

$$\frac{168\text{lb} \times .71 \text{ BTU/lb-˚F} \times (150 - 133) \text{ ˚F}}{3.412 \times 2.5} =$$ 240 watts

Formula C: Wattage for melting or vaporizing
Heat of fusion to melt paraffin

$$\frac{168\text{lb} \times 63 \text{ BTU/lb}}{3.412 \times 2.5} =$$ 1,245 watts

Technical

Wattage Calculation Formulas

Formula B: Wattage losses at operating temperature (see graphs on pages 150 and 151)

Average paraffin surface loss
3sq.ft. x 70w/hr. = 210 watts

Total losses
13.5sq.ft. x 55w/hr. = 740 watts

Compensation factor
20% (155 + 845 + 239 + 1,245 + 210 + 740) = 685 watts

Total wattage required = 4,120 watts

In addition to calculating the watts required for initial heat-up and heat losses, operating heat requirements must be calculated. Steel pins, each weighing .175 pounds, are to be placed in a 70 pound steel rack and dip-coated in the melted paraffin. 1,750 pins can be processed per hour with 25 pounds of paraffin.

Formula A: Wattage required for heat-up

To heat pins and rack

$$\frac{(1750 \times .175 + 70)\text{lbs/hr} \times .12\text{BTU/lb/°F} \times (150 - 72)\ °\text{F}}{3.412 \times 1\ \text{hour}} = 1{,}030\ \text{watts}$$

To heat additional solid paraffin

$$\frac{25\text{lbs/hr} \times .70\text{BTU/lb°F} \times (133 - 72)\ °\text{F}}{3.412 \times 1\ \text{hour}} = 310\ \text{watts}$$

To heat additional melted paraffin (fusion occurs at melting point)

$$\frac{25\text{lbs/hr} \times .71\text{BTU/lb°F} \times (150\text{-}133)°\text{F}}{3.412 \times 1\ \text{hour}} = 90\ \text{watts}$$

Formula C: Wattage for melting or vaporizing
Heat of fusion, to melt additional paraffin

$$\frac{25\text{lbs/hr} \times 63\text{BTU/lb}}{3.412 \times 1\ \text{hour}} = 460\ \text{watts}$$

Formula B: Wattage losses at operating temperature (see graphs on pages 150 and 151).
Paraffin surface loss
3sq.ft. x 70w/sq.ft./hr. = 210 watts

Tank surface loss
13.5sq.ft./ x 55w/sq.ft./hr = 740 watts

Compensation factor
20% (1,058 + 310 + 90 + 460 + 210 + 740) = 575 watts

Total wattage required = 3,415 watts

In the above calculations, the heat-up requirement is the greatest, therefore a heater with a wattage rating of 4,120 watts should be used in this application. The recommended watt density on the heater for this application is 16 watts per square inch (see page 148, table 1).

Technical

Properties of Metals

Table 1: Properties of Metals

Material	Density (at or near room temp.) (lb/cu.in.)	Average Specific Heat (BTU/lb/°F)	Thermal Conductivity (at or near room temp.) K(BTU/hr./sq.ft./°F)	Melting Point (°F)	Latent Heat of Fusion (BTU/lb)
Aluminum 2024-IT3	.100	.24	840	935	167
Aluminum 1100-00	.098	.24	1540	1190	169
Aluminum 30003	.099	.24	—	1190	167
Antimony	.245	.052	—	1166	25
Brass, Yellow	.306	.096	830	1710	—
Brass, Red	.316	.100	—	1877	—
Bronze	.318	.104	—	1832	75
Copper	.322	.095	2680	1981	91.1
Gold	.697	.030	—	1945	29
Incoloy 800	.290	.13	80	2475	—
Inconel 600	.304	.126	103	2500	—
Iron, Cast	.260	.12	346	2150	—
Iron, Wrought	.278	.12	—	2800	—
Lead, Solid	.410	.032	240	620	11.3
Lead, Liquid	.387	.037	108	—	—
Magnesium	.063	.27	1106	1202	160
Monel 400	.319	.11	151	2370	133
Monel 200	.321	.12	436	2615	133
Nickel 200	.321	.12	436	2615	133
Nickel Silver 18%80%NI20%CN	.314	.095	—	1931	—
Nichrome	.303	.11	—	2550	—
Platinum	.775	.032	—	3224	49
Silver	.379	.057	2900	1760	38
Solder 50%Pb 50%SN	.323	.051	310	361	17
Steel	.284	.122	460	2760	—
Stainless Steel 304	.286	.12	105	2550	—
Stainless Steel 316	.288	.118	108	2650	—
Stainless Steel 430	.275	.11	—	2650	—
Tin, Solid	.263	.065	455	450	26.1
Tin, Liquid	.253	.052	218	—	—
Titanium 99%	.164	.13	112	3035	—
Type Metal 85%Pb 15%Sb	.387	.040	—	500	14±

Technical

Properties of Non-Metallic Solids

Table 2: Properties of Non-Metallic Solids

Material	Density (at or near room temp.) (lb/cu.in.)	Average Specific Heat (BTU/lb/°F)	Thermal Conductivity (at or near room temp.) K(BTU/hr./sq.ft./°F)	Melting Point (°F)
Asbestos	.070	.25±	5.2	—
Asphalt	.076	.40	5.3	—
Brickwork & Masonry	.076	.22	3.7	—
Beeswax	.035	—	—	144
Carbon	.080	.28	165	6700
Cellulose Acetate	.047	.3 to .5	1.2 to 2.3	—
Butyrate	.043	.3 to .4	1.2 to 2.3	—
Delrin	.051	.35	1.6	—
Glass	.101	.161	7.5	—
Graphite	.075	.20	—	—
Lava, Grade A	.085	—	9±	2912
Mica	.102	.21	3.0	—
Magnesium, Compacted	.112	.209	20	—
Nylon	.040	.4	1.5	—
Paper	.034	.45	.62	—
Paraffin	.032	.70	1.6	133
Phenolic (general)	.046	.40	.6 to 1.2	—
Porcelain	.114	.26	—	3326
Polyethylene	.035	.55	2.3	—
Polystyrene	.038	.32	.7 to 1.0	—
Quartz	.080	.21	—	3150
Rubber	.044	.44	1.1	—
Rosin	.380	.5	—	—
Sugar	.073	.30	—	—
Steatite	.094	.20	17.5 to 23	2500±
Sulfur	.075	.175	1.9	246
Teflon	.078	.25	1.7	—
Vinyl	.046	.3 to .5	.8 to 2.0	—
Wood, Oak	.029	.57	1.1	—

Technical

Properties of Liquids and Gases

Table 3: Properties of Liquids

Liquids	Density (at or near room temp.) (lb/cu.ft.)	Average Specific Heat (BTU/lb/°F)	Boiling Point (°F)	Heat of Vaperation (BTU/lb)
Acetic Acid 20%	64.1	.91	214 ±	810 ±
Alcohol (Ethyl)	49.6	.60	173	367
Benzene	56	.45	175	166
Brine (25% NaCL)	74	.81	221 ±	728 ±
Caustic Soda (18% NaOH)	74.9	.84	221 ±	795 ±
Dowtherm A	66.1	.44	496	42.2
Ether	46	.503	95	160
Ethylene Glycol	70.5	.602	387	—
Fish Oil	70.5	.602	387	—
Fuel Oil, Bunker C	61	.50	—	145-150
Freon 12	82.7@70psig	.23	-21.6	62
Gasoline	48.6	.675	158-194	137
Glue (⅓ dry glue, ⅔ water)	69	.895	—	—
Glycerine	79	.58	554	—
Kerosene	51.5	.47	—	108
Mercury	845	.0333	675	117
Milk	64.5	1(approx.)	—	—
Molasses	87.4	.6	—	—
NaK (78%K)	46.2	.21	1446	—
Nitric Acid 7%	64.7	.92	220 ±	918 ±
Oil, Cottonseed	60	.47	—	—
Oil, Machine	58	.40	—	—
Oil, Olive	58	.471	570 ±	—
Paraffin (melted)	47.1	.71	1400	63
Petroleum	56	.51	—	—
Potassium (K)	44.6	.18	—	—
Sodium (Na)	51.2	.3	1621	1810
Sulfur (melted)	—	.234	601	652
Thermonal FR-2	90.6	.3	648 ±	—
Turpentine	54.3	.41	318	123
Vegetable Oil	57.5	.43 ±	—	—
Water	62.3	1.0	212	970

Table 4: Properties of Gases

Gasses	Density (at or near room temp. and atmospheric pressures) (lbs/cu.ft.)	Specific Heat (BTU/LB/°F)
Air @ 80°F	.073	.240
Air @ 400°F	.046	.245
Ammonia	.044	.523
Acetylene	.073	.35
Argon	.102	.125
Carbon Dioxide	.113	.199
Carbon Monoxide	.072	.248
Chlorine	.184	.115
Hydrochloric Acid	.094	.194
Hydrogen	.0052	3.39
Methane	.041	.528
Nitrogen	.072	.248
Oxygen	.082	.218
Sulphur Dioxide	.172	.152
Water Vapor @ 212°F	.037	.482

Technical

Suggested Watt Densities

The rates below are recommended watt densities for use with various materials. Safe values vary with operating temperature, flow velocity, and heat transfer rates. In general, the higher the material temperature, the lower the watt density should be, especially those materials which coke or carbonize, such as oils. Watt densities should be low if a material is being heated to a temperature near where the change of state to a vapor occurs (water to steam @212˚F.) since the vapor state has much poorer heat transfer capabilities.

Material being heated	Maximum Operating Temp. ˚F	Maximum Watts Per Sq. In.*
Acid Solutions:		
Acetic	212	40
Chromic (5%)	Boiling	40
Citric	Boiling	40
Ferric	Boiling	40
Chloride (40%)		
Hydrochloric	150	30
Nitric (50%)	Boiling	40
Sulphuric	Boiling	30
Alkai & selected oakite		
cleaning solution	212	40
Asphalt binder, tar, other		
viscous compounds	200	8
	300	7
	400	6
	500	5
Caustic Soda 2%	210	45
10%	210	25
75%	180	25
Coffee (direct immersion)	Boiling	90
Dowtherm A®		
Flowing at 1ft/sec or more	750	22
Non-flowing	750	10
Ethylene Glycol	300	30
± Fuel Oils		
Grades 1 & 2 (Distillate)	200	22
Grades 4 & 5 (Residual)	200	13
Grades 6 & Bunker C (Residual)	160	8
Gasoline, Kerosene	300	20
Glue (heat indirectly using water bath)	100	
Liquid ammonia plating baths	50	25
** Lubrication Oils		
SAE 10, @ 130˚F	250	22
SAE 20, @ 130˚F	250	22
SAE 30, @ 130˚F	250	22
SAE 40, @ 210˚F	250	13
SAE 50, @ 210˚F	250	13

**Some oils contain additives that will boil or carbonize at low watt densities. Where oils of this type are encountered a watt density test should be made to determine a satisfactory watt density.

Material being heated	Maximum Operating Temp. ˚F	Maximum Watts Per Sq. In.*
Metal melting pot	500 to 900	20-27
Mineral oil	200	20
	400	16
Molasses	100	2-3
Molten salt bath	800-950	40
Molten tin	600	20
Oil draw bath	600	20
	400	24
Paraffin or wax	150	16
Photographic solutions	150	70
Plating solutions:		
Cadmium plating		40
Chrome plating		40
Copper plating		40
Nickel plating		40
Tin plating		40
Zinc plating		40
Salt Bath	900	30
Sea Water	Boiling	90
Sodium cyanide	140	40
Steel tubing cast into aluminum	500 to 750	50
Steel tubing cast into iron	750 to 1000	55
Heat transfer oils	500	22
flowing at 1 ft/sec or more	600	22
	650	22
	750	15
Tricholretylene	150	20
Vapor degreasing solutions	275	20
Vegetable oil (fry kettle)	400	30
Water (process)	212	60
Water (washroom)	140	80-90

* Maximum watt densities are based on heated length, and may vary depending upon concentration of some solutions. Watt density should be kept as low as possible in corrosive applications since higher watt densities accelerate corrosive attack on element sheaths. Consult factory for limitations.

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Estimates of Wattage Required

Kilowatt Hours to Heat Steel

Lbs. of Steel	Temperature Rise F°						
	50°	100°	200°	300°	400°	500°	600°
	Kilowatts to heat in one hour						
25	.06	.12	.25	.37	.50	.65	.75
50	.12	.25	.50	.75	1.00	1.25	1.50
100	.25	.50	1.00	1.50	2.00	2.50	3.00
150	.37	.75	1.50	2.25	3.00	3.75	4.50
200	.50	1.00	2.00	3.00	4.00	5.00	6.00
250	.65	1.25	2.50	3.75	5.00	6.25	7.50
300	.75	1.50	3.00	4.50	6.00	7.50	9.00
400	1.00	2.00	4.00	6.00	8.00	10.00	12.00
500	1.25	2.50	5.00	7.50	10.00	12.50	15.00
600	1.50	3.00	6.00	9.00	12.00	15.00	18.00
700	1.75	3.50	7.00	10.50	14.00	17.50	21.00
800	2.00	4.00	8.00	12.00	16.00	20.00	24.00
900	2.25	4.50	9.00	13.50	18.00	22.50	27.00
1000	2.50	5.00	10.00	15.00	20.00	25.00	30.00

A 20% Safety Factor is included to compensate for high heat losses and/or low voltage.

Kilowatt Hours to Heat Water

Amount of Liquid		Temperature Rise F°						
Cubic Ft.	Gallons	20°	40°	60°	80°	100°	120°	140°
		Kilowatts to heat in one hour						
.66	5	0.3	0.5	0.8	1.1	1.3	1.6	1.9
1.3	10	0.5	1.1	1.6	2.1	2.7	3.2	3.7
2.0	13	0.8	1.6	2.4	3.2	4	4.8	5.6
2.7	20	1.1	2.2	3.2	4.3	5.3	6.4	7.5
3.3	25	1.3	2.7	4	5.3	6.7	8	9.3
4.0	30	1.6	3.2	4.8	6.4	8	9.6	12
5.3	40	2.1	4	6.4	8.5	11	13	15
6.7	50	2.7	5.4	8	10.7	13	16	19
8.0	60	3.3	6.4	9.6	12.8	16	19	22
9.4	70	3.7	7.5	11.2	15	19	22	26
10.7	80	4.3	8.5	13	17	21	26	30
12.0	90	5	10	14.5	19	24	29	34
13.4	100	5.5	11	16	21	27	32	37
16.7	125	7	13	20	27	33	40	47
20.0	150	8	16	24	32	40	48	56
23.4	175	9	18	28	37	47	56	65
26.7	200	11	21	32	43	53	64	75
33.7	250	13	27	40	53	67	80	93
40	300	16	32	47	64	80	96	112
53.4	400	21	43	64	85	107	128	149
66.8	500	27	53	80	107	133	160	187

Kilowatt Hours to Heat Oil

Amount of Oil		Temperature Rise F°					
Cubic Ft.	Gallons	50	100	200	300	400	500
.5	3.74	.3	.5	1	2	2	3
1	7.48	.5	1	2	3	4	6
2	14.96	1	1	2	4	6	11
3	22.25	2	3	6	9	12	16
4	29.9	2	4	8	12	16	22
5	37.4	3	4	9	15	20	25
10	74.8	5	9	18	29	40	52
15	112.5	7	14	28	44	60	77
20	149.6	9	18	37	58	80	102
25	187	11	22	46	72	100	127
30	222.5	13	27	56	86	120	151
35	252	16	31	65	100	139	176
40	299	18	36	74	115	158	201
45	336.5	20	40	84	129	178	226
50	374	22	45	93	144	197	252
55	412	25	49	102	158	217	276
60	449	27	54	112	172	236	302
65	486	29	58	121	186	255	326
70	524	32	62	130	200	275	350
75	562	34	67	140	215	294	375

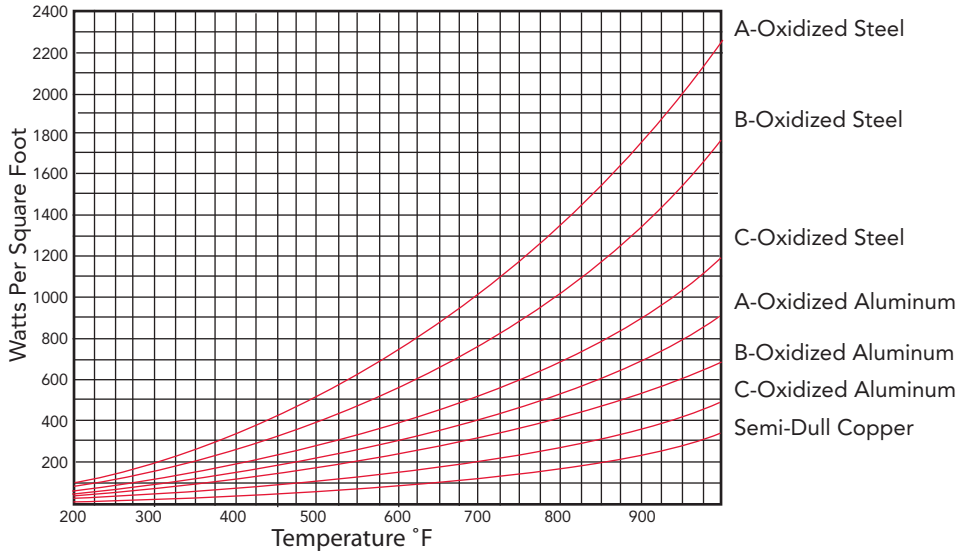
Add 5% for uninsulated tanks.

A 20% Safety Factor is included to compensate for high heat losses and/or low voltage.

Technical

Guide for Heat Losses

Graph 1: Losses from Uninsulated Metal Surfaces.



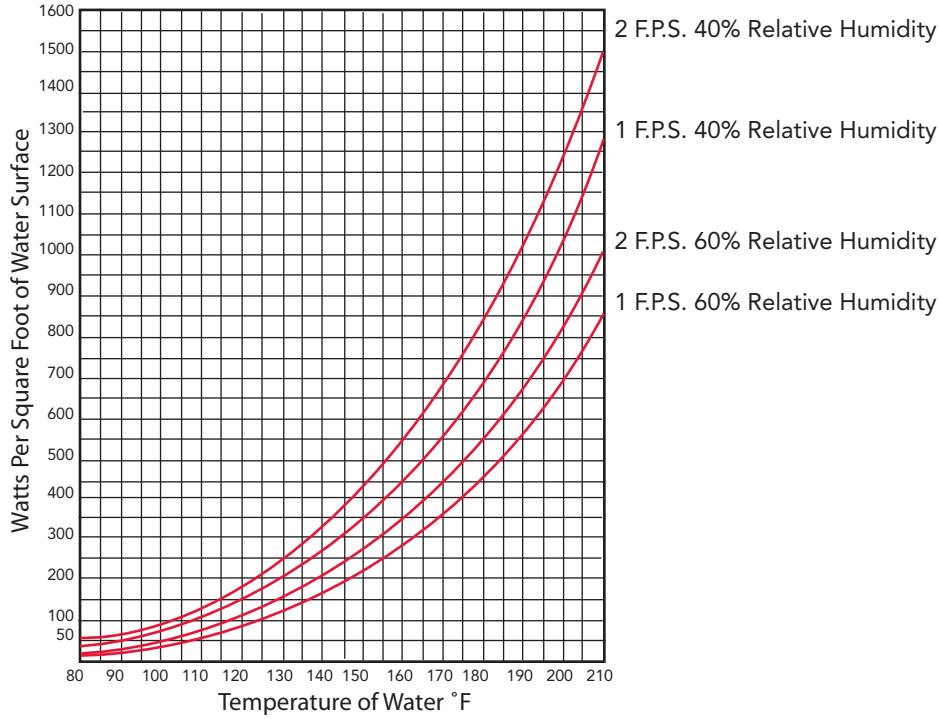
Curves "A" show heat losses from vertical surfaces of tanks, pipes, etc. and also top surface losses from a horizontal surface laid flat.

Curves "B" show average heat losses from top and bottom surfaces of a horizontal surface laid flat.

Curves "C" show heat losses from bottom surface of a horizontal surface laid flat.

All curves presuppose still air (approx. one foot per second) at 70˚F.

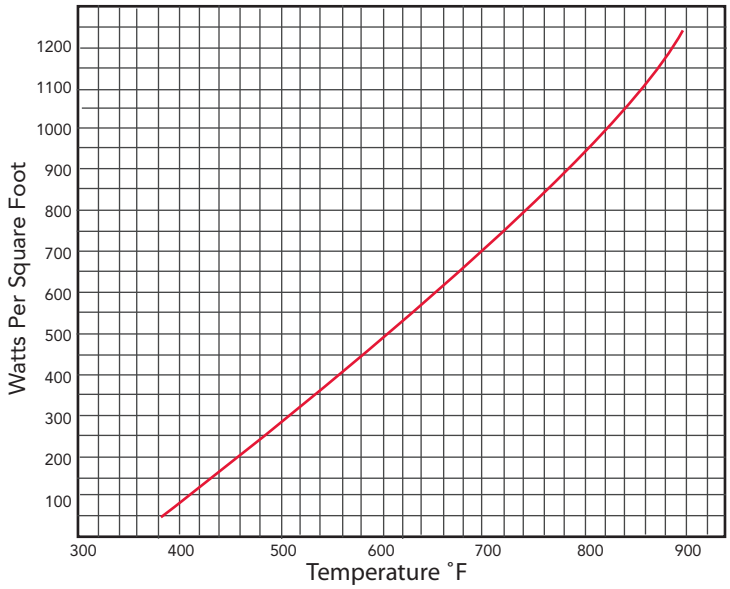
Graph 2: Losses from Open Hot Water Tanks



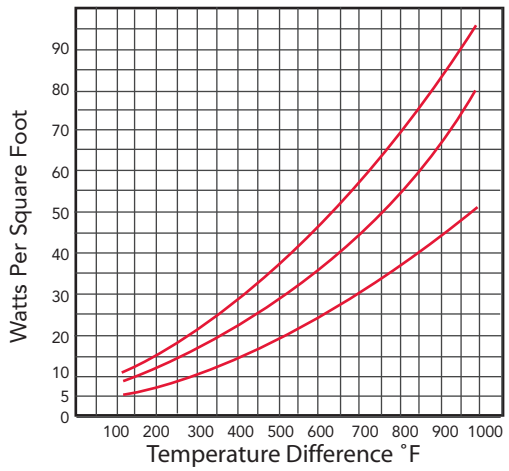
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Graph 3: Losses from Molten Metal Surfaces.



Graph 4: Losses through Insulated Walls (ovens, pipes, etx.)

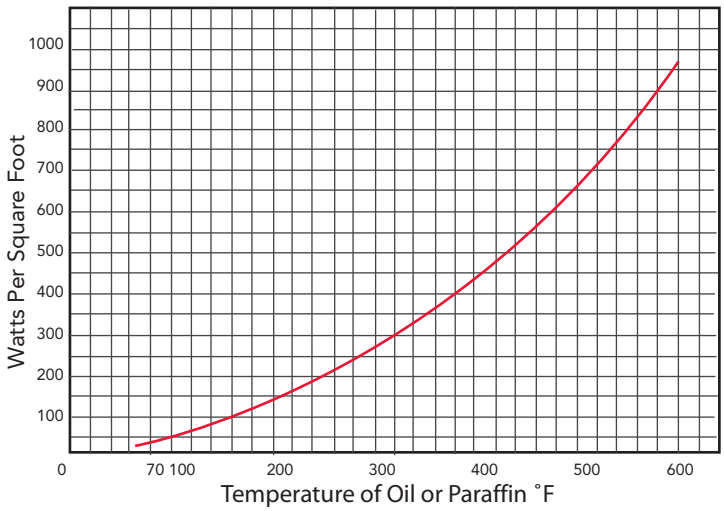


2"Thickness of Insulation

3"Thinkness of Insulation

4"Thickness of Insulation

Graph 5: Losses from Surfaces of Oil Baths.



TECHNICAL

Technical

Suggested Sheath Materials

The following table of recommendations should only be used as a guide. The proper choice should be based upon your knowledge of the conditions which exist in each application.

Compound	Copper	Lead	Aluminum	Nickel	Iron and Steel	Cast Iron NI Resist	300 Series Stainless	Monel	Inconel Incoloy
Acetic Acid,									
Crude	2	x	2	2	x	3	2	2	3
Pure	2	2	1	2	—	x	—	1	3
Vapors	2	x	3	2	—	x	—	2	3
150 PSI; 400˚F	2	x	3	2	—	—	—	2	3
Acetone	—	—	—	—	3	2	1	—	—
Alboloy Process	—	—	—	—	1	—	—	—	—
Aluminum Sulphate	2	1	3	3	x	3	2	2	—
Ammonia Gas									
Cold	3	1	1	—	1	1	1	1	—
Hot	x	x	—	—	3	3	3	3	—
Ammonia and Oil	—	—	—	—	1	—	—	—	—
Ammonium Chloride	x	1	x	2	3	1	2	2	—
Ammonium Hydroxide	x	1	2	—	1	1	1	3	1
Ammonium Nitrate	x	x	2	—	1	3	1	3	—
Ammonium Sulphate	2	1	—	—	1	1	1	1	—
Amyl Alcohol	1	—	—	—	—	—	—	1	—
Anhydrous Ammonia	x	—	—	—	1	—	—	—	—
Aniline, Aniline Oil	x	—	x	—	1	—	1	1	—
Aniline Dyes	—	—	—	—	—	—	1	1	—
Anodizing Solutions 10%	—	—	—	—	3	—	1	—	—
Chromic Acid 96˚F	—	—	—	—	3	—	1	—	—
Sulphuric Acid 70˚F	—	1	—	—	—	—	—	—	—
Sodium Hydroxide Alkaline	—	—	—	—	1	—	—	—	—
Nigrosine Black Dye	—	—	—	2	—	—	—	1	—
Nickel Acetate	—	3	—	2	—	—	—	1	—
Barium Hydroxide	x	x	x	1	—	—	1	—	—
Barium Sulphide	x	1	—	—	—	—	1	1	—
Bleaching Solution	—	—	—	2	—	—	—	1	—
1½lb. Oxalic Acid per Gallon of H_2O at 212˚F	—	—	—	—	—	—	—	—	—
Bonderizing	—	—	—	—	3	2	1	—	—
Cadmium Plating	—	—	—	—	—	—	—	—	1
Carbolic Acid, Phenol	x	1	1	—	3	3	1	1	1
Carbon Dioxide									
Dry	1	1	1	—	1	1	1	1	1
Wet	2	x	2	—	2	3	1	1	1
Carbon Tetrachloride	3	2	3	—	3	3	3	1	1
Castor Oil	—	—	1	—	1	—	1	1	1
Chloroacetic Acid	x	x	x	2	x	—	x	—	—
Chlorine									
Dry	1	1	1	—	1	1	1	1	—
Wet	x	2	x	—	x	x	x	x	—
Chromic Acid	x	1	x	—	3	3	1	2	3
Chrome Plating	—	1	—	—	—	—	—	—	—
Citric Acid	1	1	1	—	x	3	1	1	1
Cobalt Acetate 130˚F	—	—	—	—	—	—	—	1	1
Coconut Oil	—	—	—	1	—	—	—	2	—
Copper Chloride	3	1	x	—	2	—	x	2	—
Copper Cyanide	—	—	—	—	1	—	—	—	—
Copper Plating	—	—	—	—	1	—	—	—	—
Copper Sulphate	3	1	x	—	x	3	1	1	1
Creosote	1	—	1	—	1	1	1	1	—

Resistance Ratings: 1 = Good 2 = Fair 3 = Depends on Conditions x = Unsuitable

Technical

Suggested Sheath Materials (con't)

Compound	Copper	Lead	Aluminum	Nickel	Iron and Steel	Cast Iron NI Resist	300 Series Stainless	Monel	Inconel Incoloy
Deoxidine	—	—	—	—	—	—	1	—	—
Deoxylyle	—	—	—	—	—	—	1	—	—
Dipenyl 300° - 350°F	—	—	—	—	1	—	—	—	—
Di Sodium Phosphate									
25% 180°F	—	—	—	—	1	—	—	—	—
Diversey No. 99	—	—	—	—	1	—	—	—	—
Downtherm	—	—	—	—	1	—	—	—	—
Ethers	1	1	1	—	1	—	—	1	1
Ethyl Chloride	1	—	—	1	1	—	1	1	—
Ethylene Gycol 300°F	—	—	—	—	—	—	1	1	—
Ferric Chloride	x	x	x	x	x	x	x	x	x
Ferric Sulphate	x	1	x	x	x	x	2-304	x	3
	—	—	—	—	—	—	1-316	—	—
Formaldehyde	2	x	2	—	2	2	1	1	1
Formic Acid	2	x	x	3	x	—	2	3	3
Freon	1	1	1	—	3	1	3	1	—
Fuel Oil	1	1	—	—	1	—	1	1	—
Fuel Oil, Acid	3	1	—	—	3	—	3	1	—
Gasoline, Sour	3	1	3	—	3	3	1	1	1
Gasoline, Refined	1	1	1	—	1	1	1	1	1
Glycerin, Glycerol	2	1	1	—	1	1	1	1	—
Holdens 310A Tempering Bath	—	—	—	1	—	—	—	—	—
Houghtons Mar Tempering Salt	—	—	—	3	3	—	—	—	—
Hydrochloric Acid									
< 150°F	x	2	x	3	x	x	x	3	—
> 150°F	x	x	x	3	x	—	x	3	—
Hydrofluoric Acid									
Cold < 65%	3	2	x	x	x	x	x	2	—
> 65%	2	3	x	—	2	—	x	1	—
Hot < 65%	x	x	x	x	x	—	x	3	—
> 65%	2	x	x	—	3	—	x	1	—
Hydrogen Peroxide	x	2	1	2	x	x	1	2	1
Irdite 1-part and 5-parts water 200°F	—	1	—	—	—	—	—	—	—
Isoproponel	2	—	—	—	3	—	—	1	—
Kerosene	1	1	—	—	1	—	1	1	1
Kolene	—	—	—	1	—	—	—	—	—
Lacquer solvents	3	—	1	—	3	1	1	1	—
Lard	—	—	—	—	2	—	—	—	—
Linseed oil	1	1	1	—	1	—	1	1	1
Magnesium chloride	2	x	x	2	2	2	2	2	—
Magnesium hydroxide	x	—	x	1	1	1	1	1	—
Magnesium sulphate	1	—	2	—	1	1	1	1	—
Mercuric chloride	x	—	x	x	3	3	x	x	x
Mercury	x	—	x	—	1	1	1	1	1
Methyl alcohol, methanol	1	1	1	—	1	—	1	1	—
Methyl chloride	1	1	—	1	1	—	—	1	—
Mineral oils	1	1	1	—	1	—	1	1	1
Naphthalene	—	—	—	—	1	—	—	—	—
Nickel chloride	x	—	x	—	—	—	2	3	—
Nickel plating, bright	—	1	—	—	—	—	—	—	—
Nickel plating, dull	—	1	—	—	—	—	—	—	—
Nickel sulphate	x	—	x	—	—	—	1	3	x
Nitric acid,									
Crude	x	x	3	x	x	—	3	x	x
Concentrated	x	x	1	x	x	—	2	x	x
Diluted	x	x	x	x	x	—	1	x	x

Resistance Ratings: 1 = Good 2 = Fair 3 = Depends on Conditions x = Unsuitable

TECHNICAL

Technical

Suggested Sheath Materials (con't)

Compound	Copper	Lead	Aluminum	Nickel	Iron and Steel	Cast Iron NI Resist	300 Series Stainless	Monel	Inconel Incoloy
Nitrbenzene	2	—	—	—	1	—	1	—	—
Oakite No. 20	—	—	—	—	1	—	—	—	—
Oakite No. 23	—	—	—	—	1	—	—	—	—
Oakite No. 24	—	—	—	—	1	—	—	—	—
Oakite No. 30	—	—	—	—	1	—	—	—	—
Oakite No. 32	—	—	—	—	—	—	—	—	—
Oakite No. 33	—	—	—	—	—	1-347	—	—	—
Oakite No. 36	—	—	—	—	—	—	—	—	—
Oakite No. 51	—	—	—	—	1	—	—	—	—
Oakite No. 90 @ 180˚F	—	—	—	—	1	—	—	—	—
Oleic acid	x	x	1	1	3	3	1	1	1
Oxalic acid	3	x	1	—	3	3	3	1	—
Paraffin	—	—	—	—	1	—	—	—	—
Parkerizing	—	—	—	—	3	2	1	—	—
Perchlorethylene	—	—	—	—	—	—	1	—	—
Permachlor	—	—	—	—	—	—	1	—	—
Petroleum oils, crude									
<500˚F	3	3	1	3	1	1	1	3	—
>500˚F	x	x	1	x	1	1	1	x	—
<1000˚F	x	x	x	x	x	—	3	x	—
	—	—	—	—	—	—	1-347	—	—
Phenol 85%, 120˚F	—	—	—	1	3	—	1	—	—
Phosphoric acid									
Crude	x	3	x	x	3	—	3	x	—
Pure <45%	2	1	3	3	x	—	1	2	—
>45% Cold	2	1	x	3	x	—	1	2	—
>45% Hot	3	x	x	—	x	—	x-304	3	—
	—	—	—	—	—	—	3-316	—	—
Photo fixing bath	—	—	—	—	—	—	1	3	—
Picric acid water solution	x	x	x	x	3	—	1	3	—
Potassium chloride	1	1	3	1	1	1	1	1	—
Potassium cyanide	x	x	x	—	1	—	1	1	—
Potassium dichromate 208˚F	—	—	—	—	—	—	1-347	—	—
Potassium hydroxide	x	x	x	1	3	1	2	1	—
Potassium sulphate	1	1	1	1	1	1	2	1	—
Prestone 350˚F	—	—	—	—	1	—	—	1	—
R5 Bright Dip for copper polish @ 180˚F	—	—	—	—	—	—	1-316	—	—
Soap solutions	3	1	—	—	1	1	1	1	—
Sodium carbonate <20%	—	—	—	—	1	—	—	—	—
Sodium chloride	2	1	x	1	1	1	2-304	1	1
	—	—	—	—	—	—	1-316	—	—
Sodium cyanide	x	x	x	—	1	3	1-316	2	—
Sodium hydroxide	x	2	x	1	1	1	2	1	1
Sodium hypochlorite	3	x	x	3	x	3	x	3	—
Sodium nitrate	2	1	1	1	1	1	2-304	1	1
	—	—	—	—	—	—	1-316	—	—
Sodium peroxide	—	—	1	1	3	1	1	1	—
Sodium silicate	3	x	x	1	1	1	1-316	1	—
Sodium sulphate	1	1	3	1	1	1	1	1	1
Sodium sulphide	x	1	x	2	1	1	1	2	1
Soybean oil	—	—	—	—	—	—	1	—	—
Steam									
<500˚F	1	3	1	1	1	—	1	1	1
500-1000˚F	3	x	3	3	3	—	1	3	1
>1000˚F	x	—	x	x	x	—	1	x	1
Stearic acid	3	1	3	1	3	3	1	1	1

Resistance Ratings: 1 = Good 2 = Fair 3 = Depends on Conditions x = Unsuitable

Technical

Suggested Sheath Materials (con't)

Compound	Copper	Lead	Aluminum	Nickel	Iron and Steel	Cast Iron NI Resist	300 Series Stainless	Monel	Inconel Incoloy
Sulphur	x	—	1	x	1	3	2	x	1
Sulphuric acid<10%									
Cold	3	1	3	3	x	—	2	3	—
Hot	x	1	3	x	x	—	2-316	3	—
	—	—	—	—	—	—	x-304	—	—
10-75% Cold	x	1	3	3	x	—	x-304	3	—
	—	—	—	—	—	—	2-316	—	—
Hot	x	1	x	x	x	—	x	3	—
75-95% Cold	x	1	3	3	3	—	1	3	—
Hot	x	1	x	x	2	—	x	3	—
Fuming	x	1	3	x	3	2	3-304	x	—
	—	—	—	—	—	—	2-316	—	—
Sulphurous acid	3	1	3	x	1	—	3-316	x	—
	—	—	—	—	—	—	x-304	—	—
Tannic acid	1	x	x	1	—	—	2	1	—
Tar	—	—	1	—	1	—	1	—	1
Tartaric acid	—	1	1	3	—	—	3-304	3	—
	—	—	—	—	—	—	1-316	—	—
Tetrachlorethylene	—	—	—	—	1	—	—	—	—
Thermoil Granodine™	—	—	—	—	2	—	—	—	—
Therminol™									
Fr. 1-8-12W/Sq.In.640°F	—	—	—	—	1	—	—	—	—
Tin plating	—	—	—	1	—	—	—	—	—
Toluene	—	1	1	—	1	—	1	1	—
Triad solvent	—	—	—	—	3	—	—	—	—
Trichloroethylene	3	2	3	—	3	3	3	1	—
Turco No. 2623	—	—	—	—	1	—	—	—	—
Turpentine	3	1	1	—	3	1	1	1	—
Urea ammonia liquor 48°F	—	—	—	—	1	—	—	—	—
Vegetable oil	—	—	—	—	—	—	1	—	—
Vinegar	—	—	3	—	3	—	2-304	1	—
	—	—	—	—	—	—	1-316	—	—
Water, acid mine									
containing oxidizing salts	3	3	3	3	x	3	1	x	—
no oxidizing salts	—	—	1	—	3	1	x	1	—
Water, fresh	1	1	1	—	3	1	1	1	1
Distilled, Lab grade	x	x	1	1	x	x	1	3	1
Return condensate	1	1	1	—	1	1	1	1	1
Water, sea water	3	1	x	—	3	1	2	1	2
Whiskey and wines	1	—	—	—	x	3	2-304	1	1
	—	—	—	—	—	—	1-316	—	—
X-ray solution	—	—	—	—	—	—	1	—	—
Zinc chloride	x	1	x	—	3	3	x	1	—
Zinc plating	—	—	—	—	1	—	—	—	—
Zinc sulphate	x	—	3	—	3	1	1	1	1

Resistance Ratings: 1 = Good 2 = Fair 3 = Depends on Conditions x = Unsuitable

Because so many Factors are beyond our Power to control we cannot be responsible for any electric immersion heater failure that can be attributed to corrosion. This is in view of any warranties, written or verbal, relative to heater performance in a corrosive environment.

Technical

Thermal Systems

Thermal Systems

The result obtained with a precision temperature controller, as with any tool, depend upon how skillfully it is used. Close temperature control can be maintained only if the thermal system is properly designed so that it responds quickly and accurately to operating conditions.

Thermal systems have four elements, all of which contribute to systems control performance. They are: 1. WORK (or load) — the material or product which must be maintained at a controlled temperature; 2. HEAT SOURCE — the device which delivers the heat used by the system, such as gas, oil, or electric heaters; 3. HEAT TRANSFER MEDIUM — the material which transmits the heat from the heat source to the work; 4. CONTROLLER — the instrument which controls the heat flow on the basis of the difference between sensed temperature and controller's set point.

In addition, careful consideration must be given to the physical make-up of the system. The proper location of heat sensor and work-load, a good selection of the heat transfer medium, and use of reliable components are all essential to the development of a **good thermal system.**

Although in practice, thermal systems are not purely steady or variable, they usually are predominantly one or the other.

For basic system design, the following rule of thumb will be helpful: where the heat demand is relatively steady, the sensing element of the controller should be placed **close** to the **heat source**; where the demand is largely variable, it should be near the **work area.** A complicated system may require several different sensing element locations before a suitable one is found. One should always remember, however that the element should be closer to the area where a temperature change must be sensed with minimum **thermal lag.** (Thermal lag is the delay in heat transfer from place to place in the thermal system).

The effect of various sensing element locations on the control of predominantly static or dynamic systems is clearly illustrated in **Fig. 1.**

Fig 2 applies to liquid and gas systems which require additional considerations. Because the heat demand is basically steady, the sensing element should normally be located close to and above the heat source to minimize system **bandwidth.** (Bandwidth is the total temperature variation above and below the average operating temperature measured at some point in the system).

Fig. 1

Poor Liquid Heating Control

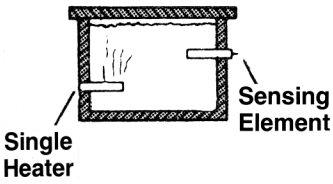


Fig. 2

Optimum Liquid Heating Control

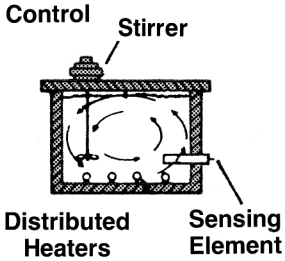
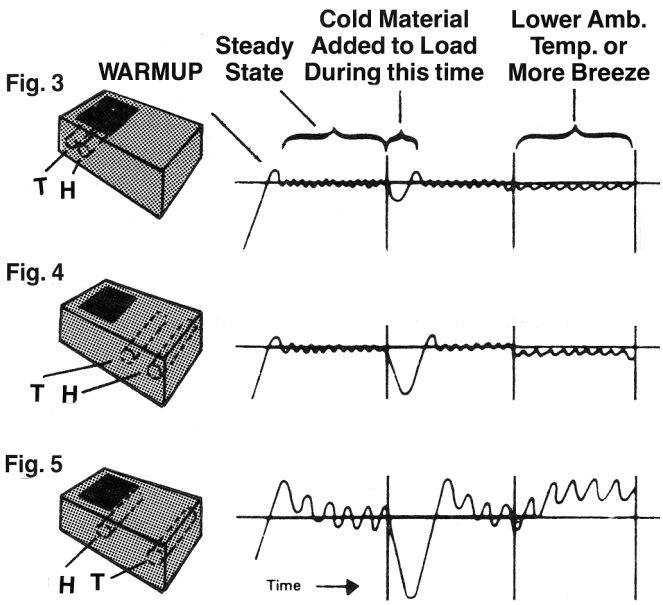


Fig. 3: Close grouping of heater, sensing element and work. Where this layout is feasible, it gives excellent control under most conditions and is desirable when the thermal load changes frequently. The heat transfer paths from he work and heater to the thermostat are short, so that thermal lag is slight. System inertia is low because of the small mass of heat transfer medium. Rapid cycling will hasten recovery of the system from thermal upsets.

Fig. 4: Thermostat between heater and load. This is a "general purpose" arrangement for installations where the heat demand my be alternately steady and variable. By being midway between them, the sensing element can respond to changes at the work and the heater without excessive lag in either instance.

Fig. 5: Heater at load, thermostat distant. This arrangement practically guarantees poor control. The sensing element is too far from either the heater or the load to respond to temperature changes from either one without excessive lag. The arrangement is presented primarily to emphasize that, unless you are careful in placing the element, the controller may find it impossible to maintain even fair control.

Temperature of the Load



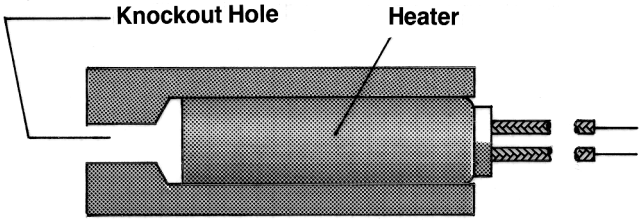
TECHNICAL

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Cartridge/Superwatt Heater

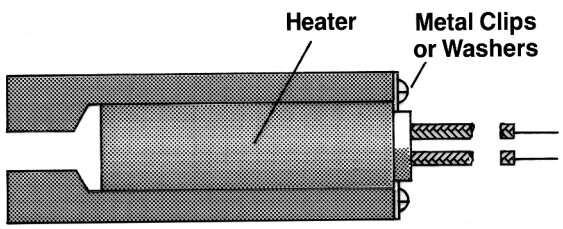
The most important thing to remember about the installation of a cartridge heater is that the cartridge should be a close fit in the hole into which it is inserted. This results in fast heat transfer to the surrounding material and aids in keeping the element as cool as possible for long life.
Cartridge units are made with special tubing which is a few thousandths undersize to insure a free fit for easy installation. To install cartridge heaters, drill and ream holes to proper length and the nominal diameter plus .001" maximum minus .000" of the cartridge heater (3/16", 3/8", 1/2", 5/8", etc.) For example, a 1/2" cartridge heater actually measures .497" diameter. A hole should be drilled and reamed to 1/2" diameter + .001" – .000" to insure proper fit. Always finish-ream drilled or cast holes to insure smooth, uniform metal to metal contact. A knockout hole (Fig. 1) should be provided if possible to facilitate cartridge removal. The receptacle hole should be free from oil before cartridge installation to avoid contamination and shorter heater life.

Fig. 1



If there is danger of a heater slipping from its hole, it should be held in place with metal clips (Fig 2).

Fig. 2



Do not use set screws to hold cartridge heaters in place.
Lead wires, especially when the heater is used in a moving die or platen, should be supported (Fig. 3) or protected with a lead spring (Fig. 4) See SF5 on page 22.

Fig. 3

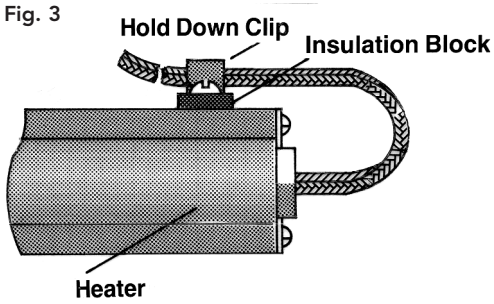
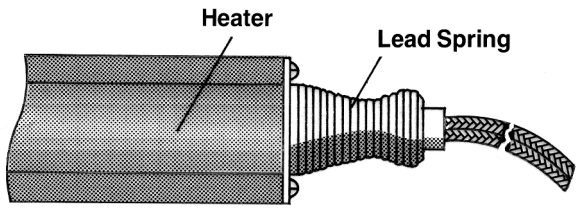
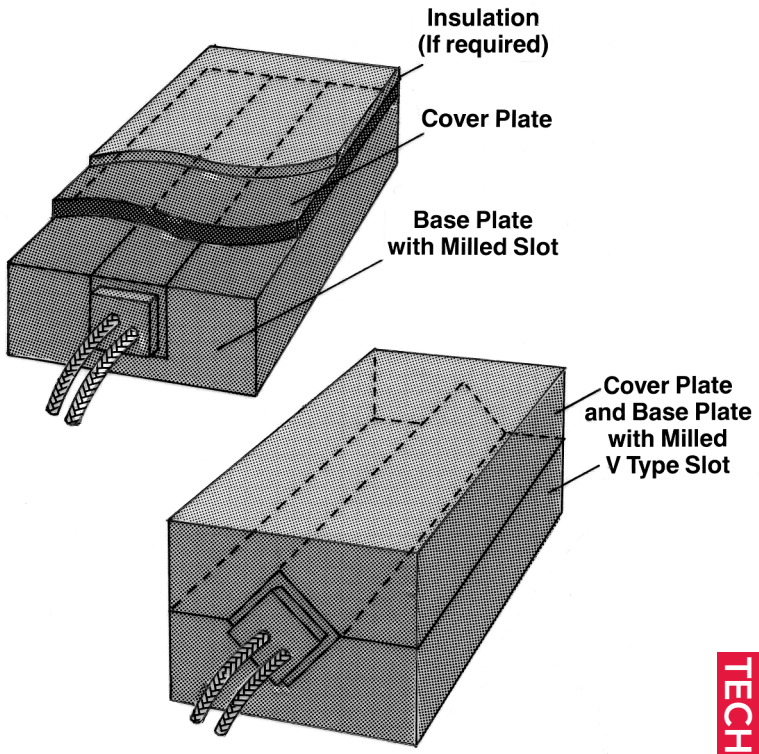


Fig. 4



On many applications plastic material, machine oil, and/or Moisture may be present. Cycling of a cartridge heater causes these materials to be absorbed. Heaters, therefore, should be carefully selected for these applications utilizing protective conduit for leads and if necessary, hermetic sealing for long heater life. Theses extras are available form the factory at a nominal additional charge (See pages 22-27).

Square/Rectangular Heaters



Technical

Installation

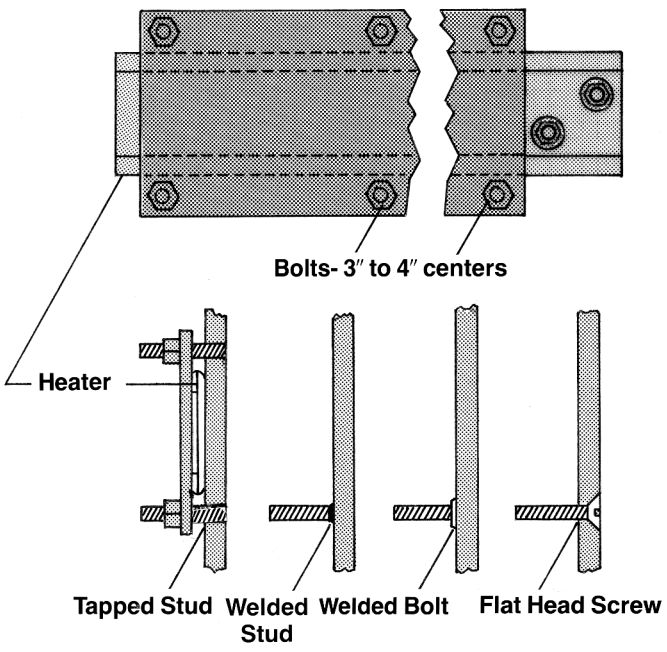
Strip Heaters

Strip heaters are designed for contact heating and therefore must be tightly clamped to the object to be heated to keep the heater from expanding away from the surface. Care should be taken to see that the heaters are placed squarely against the surface to be heated. Air gaps between the heater surface and the heater will result in poor heat transfer and shorter heater life.

Mounting

Strip Heaters should be firmly clamped with heavy metal strips. These should be arranged across the heater (or heaters) so that there will be bolts on each side of the heater. These bolts should be spaced approximately 3 to 4 inches apart (Fig 1). Use heaters with mounting holes only in air-heating applications, and only when necessary. The reason for this is that the heater heats up, it expands away from the surface to be heated causing air gaps and poor heat transfer.

Fig. 1



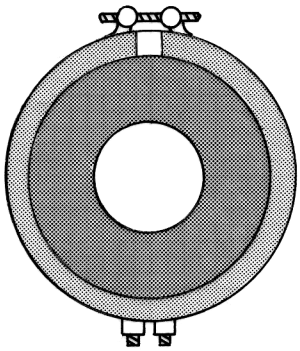
Using Mounting Holes

When strip heaters are fastened to the object to be heated utilizing mounting holes or used as an air heater, the screws that are used for mounting should be provided with lock washers and should not be drawn up tightly because the strip heater should be free to expand. Unit lengths beyond 24″ may require special mounting to allow for expansion. Consult factory.

Band Heaters

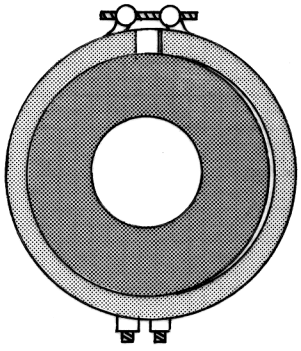
Band heaters should be clamped securely to the object to be heated. They should be mounted so that they are not tilted in assembly, but are placed squarely against the surface to be heated. Air gaps as a result of poor clamping, result in poor heat transfer, excessive heat loss, and short heater life. (Fig 2.)
Band heaters should be clamped securely and squarely to the surface to be heated, run at operating temperature and retightened to correct for the effects of expansion.

Fig. 1-Good



No Air Gap

Fig. 2-Poor



Air Gap

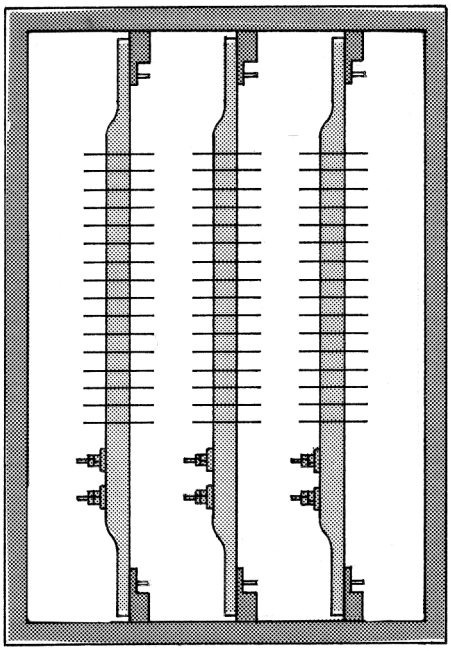
TECHNICAL

Installation in air Ducts: Finned strips and duct heater

1. Locate regulating thermostat on downstream side of heater near the top of the duct.

2. Mount heater with terminals at the duct bottom to prevent overheating.

3. As a safety feature in the event of abnormal temperatures or safety requirements, it is suggested to use a thermal cutout in conjunction with thermostatic control, or by itself when no thermostat is used.



Oven Heating (Stainless Steel Strip Heaters):

1. When mounting strip heaters in an oven, allow for expansion and contraction by loosely bolting one mounting tab and securing the other tab firmly.
2. Mount the strip with the terminals at the bottom or cooler part of the oven.
3. In a forced air system, the width of the strip should be parallel to the direction of the air flow.
4. Mount strips on edge in horizontal installation across the bottom and along the sides of the oven, allowing 3" minimum air space between the heaters and the bottom of the ovens wall to allow for proper circulation of heated air. For large ovens, allow greater clearance areas.
5. In horizontal mounting, install a protective screen or grill above the strips at the bottom of the oven.
6. Support strips on 36" centers to prevent sagging.

Technical

Ohms Law and Wiring Diagrams

Ohms Law

E = Volts, W = Watts, I = Amperes, R = Ohms

To Determine Watts (W):

$W = EI \quad W = I^2R \quad W = \frac{E^2}{R}$

To Determine Volts (E):

$E = \sqrt{WR} \quad E = \frac{W}{I} \quad E = IR$

To Determine Ohms (R):

$R = \frac{W}{I^2} \quad R = \frac{E^2}{W} \quad R = \frac{E}{I}$

To Determine Amperes (I):

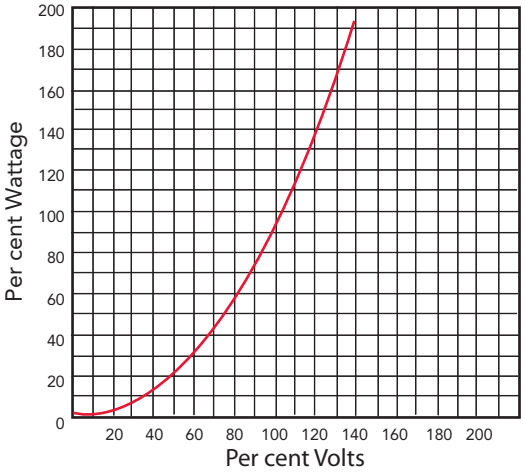
$I = \frac{E}{R} \quad I = \frac{W}{E} \quad I = \sqrt{\frac{W}{R}}$

Variation of Wattage with Voltage Change

$$W^2 = W^1\left(\frac{E^2}{E^1}\right)^2$$

E^2 = New Voltage
E^1 = Original Heater Voltage
W^2 = New Wattage
W^1 = Original Wattage

Percentage Variation of Voltage vs. Wattage



Wiring Diagrams

Fig. 1: 120V or 240V single phase two or more heaters in parallel with thermostat rating adequate for line voltage and current

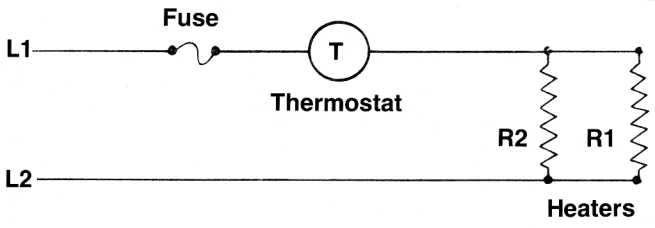


Fig. 2: 240V or 480V three phase deltas (three phase wye) with thermostat adequate for line voltage and current

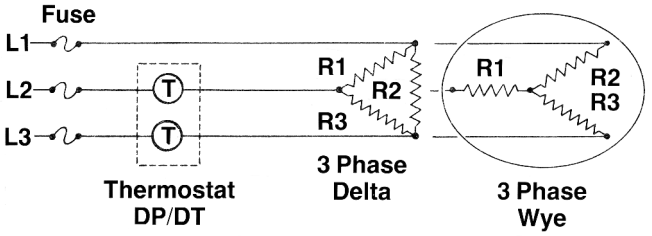


Fig. 3: 120V, 240V, 480V single phase two or more heaters in series with thermostat rating adequate for line voltage and current

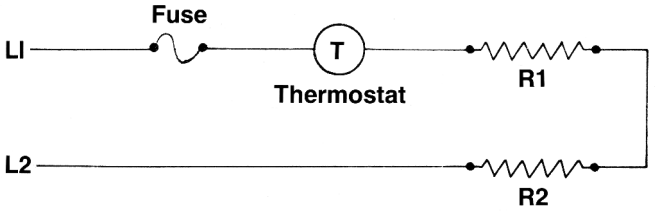
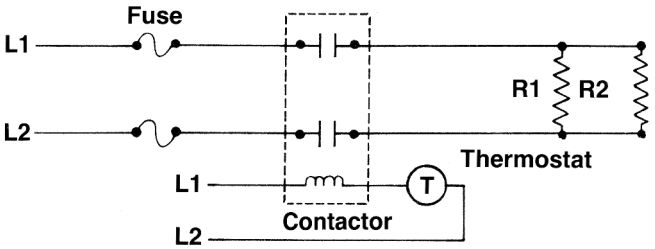


Fig. 4: Two or more heaters wired in parallel with thermostat not adequate for line current (or voltage)



TECHNICAL

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Wiring Diagrams

Fig. 5: Two or more heaters wired in parallel in each leg of a 3 phase delta circuit. Thermostat rating not adequate for line current or voltage.

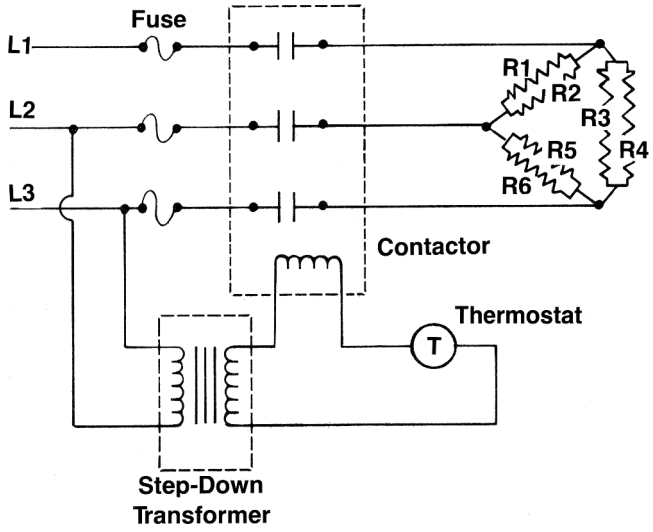


Fig. 6: Single phase or three phase AC only with properly rated SCR power control with thermocouple input temperature controller.

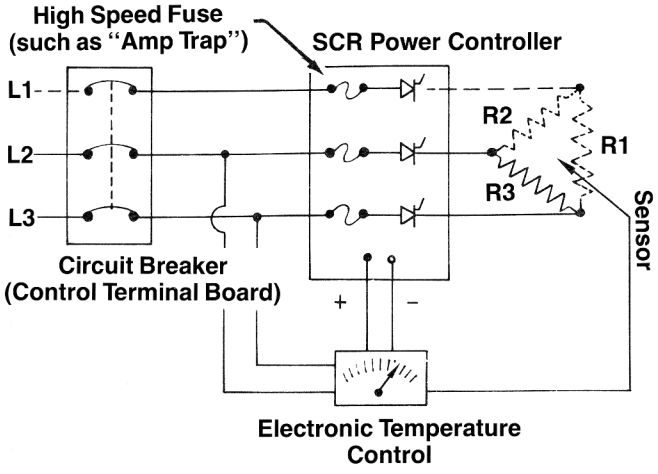


Fig. 7: Special circuit for switching from parallel operation in a 3 phase delta circuit to a pair in series operation, with both contractors closed. Circuit operates at full power at element rated voltage.

With either #1 or #2 contractor open, circuit operates at ¼ power, with voltage across each element at ½ rated voltage. Heater element wattages must be equal to give balanced 3 phase circuit for both circuits.

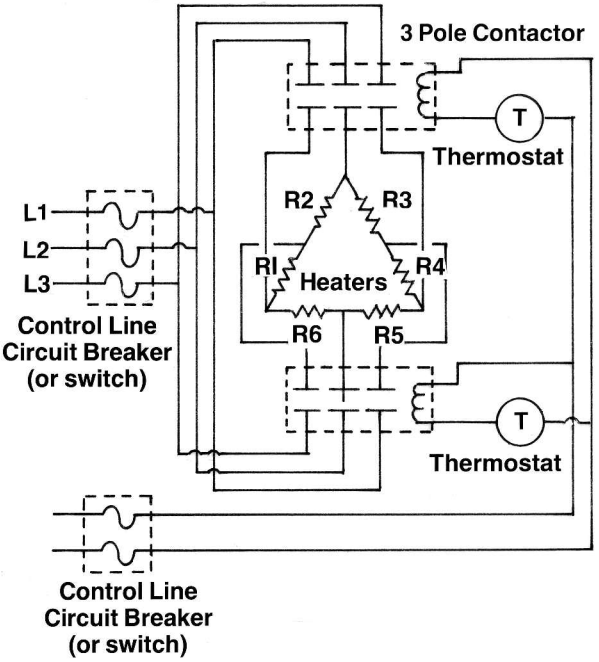
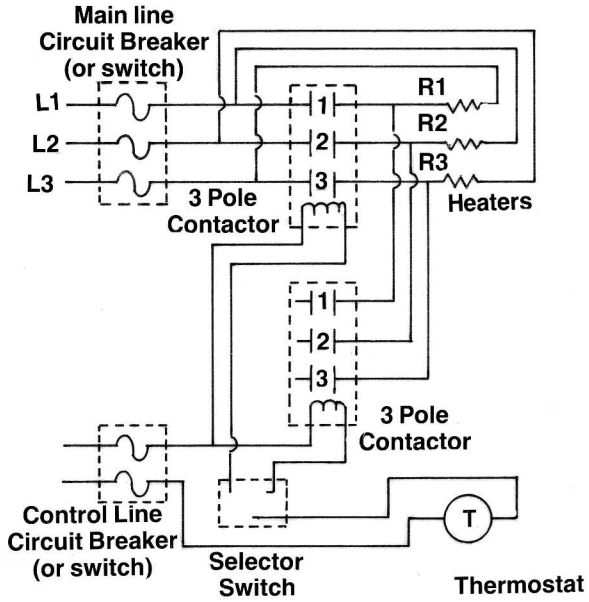


Fig. 8: Circuit for switching from a 3 phase delta circuit for full power to a 3 phase wye circuit at ⅓ power. Watt density of heaters is also dropped to ⅓ of original.



TECHNICAL

Technical

Mathematical Conversions

Inches to Millimeters

To convert to millimeters: Multiply Inches x 25.4

To convert to inches: Multiply millimeters x .03937

Inches Fraction	Decimals	Millimeters	Inches Fraction	Decimals	Millimeters	Inches Fraction	Decimals	Millimeters	Inches Fraction	Decimals	Millimeters
	.00004	.001		.13780	3.5	19/32"	.59375	15.0812		1.57480	40
	.00039	.01	9/64"	.14063	3.5719		.600	15.24		1.65354	42
	.00079	.02		.150	3.810	39/64"	.60938	15.4781	1¾"	1.750	44.45
	.001	.025	5/32"	.15625	3.9688		.61024	15.5		1.77170	45
	.00118	.03		.15748	4	5/8"	.6250	15.875		1.88976	48
	.00157	.04	11/64"	.17188	4.3656		.62992	16		1.96850	50
	.00197	.05		.1750	4.445	41/64"	.64063	16.2719	2"	2.000	50.8
	.002	.051		.17717	4.5		.64961	16.5		2.04724	55
	.00236	.06	3/16"	.18750	4.7625		.650	16.51		2.16540	53
	.00276	.07		.19685	5	21/32"	.65625	16.6688		2.20472	56
	.003	.0762		.20	5.08		.66929	17	2¼"	2.250	57.15
	.00315	.08	13/64"	.20313	5.1594	43/64"	.67188	17.0656		2.36220	60
	.00354	.09		.21654	5.5	11/16"	.68750	17.4625	2½"	2.500	63.5
	.00394	.1	7/32"	.21875	5.5562		.68898	17.5		2.51968	64
	.004	.1016		.2250	5.715		.700	17.78	2¾"	2.750	69.85
	.005	.1270	15/64"	.23438	5.9531	45/64"	.70313	17.8594		2.83464	72
	.006	.1524		.23622	6		.70866	18		2.95280	75
	.007	.1778	¼"	.250	6.35	23/32"	.71875	18.2562	3"	3.000	76.2
	.00787	.2		.25591	6.5		.72835	18.5		3.14960	80
	.008	.2032	17/64"	.26563	6.7469	47/64"	.73438	18.6531	3½"	3.500	88.9
	.009	.2286		.275	6.985		.74803	19		3.54330	90
	.00984	.25		.27559	7	¾"	.750	19.050		3.9370	100
	.01	.254	9/32"	.28125	7.1438	49/64"	.76563	19.4469	4"	4.000	101.6
	.01181	.3		.29528	7.5		.76772	19.5		4.33070	110
1/64"	.01563	.3969	19/64"	.29688	7.5406	25/32"	.78125	19.8438	4½"	4.500	114.3
	.01575	.4		.30	7.62		.78740	20		4.72440	120
	.01969	.5	5/16"	.3125	7.9375	51/64"	.79688	20.2406	5"	5.000	127
	.02	.508		.31496	8		.800	20.320		5.51180	140
	.02362	.6	21/64"	.32813	8.3344		.80709	20.5		5.90550	150
	.025	.635		.33465	8.5	13/16"	.81250	20.6375	6"	6.000	152.4
	.02756	.7	11/32"	.34375	8.7312		.82677	21		6.29920	160
	.0295	.75		.350	8.89	53/64"	.82813	21.0344		7.08660	180
	.03	.762		.35433	9	27/32"	.84375	21.4312		7.8740	200
1/32"	.03125	.7938	23/64"	.35938	9.1281		.84646	21.5	8"	8.000	203.2
	.0315	.8		.37402	9.5		.850	21.590		8.66140	220
	.03543	.9	3/8"	.375	9.526	55/64"	.85938	21.8281		9.44880	240
	.03937	1	25/64"	.39063	9.9219		.86614	22		9.84250	250
	.04	1.016		.39370	10	7/8"	.875	22.225	10"	10.000	254
3/64"	.04687	1.191		.400	10.16		.88583	22.5		10.23620	260
	.04724	1.2	13/32"	.40625	10.3188	57/64"	.89063	22.6219		11.02360	280
	.05	1.27		.41339	10.5		.900	22.860		11.8110	300
	.05512	1.4	27/64"	.42188	10.7156		.90551	23	12 (1 ft.)"	12.000	304.8
	.05906	1.5		.43307	11	29/32"	.90625	23.0188		12.59840	320
	.06	1.524	7/16"	.43750	11.1125	59/64"	.92188	23.4156		13.38580	340
1/16"	.06250	1.5875		.450	11.430		.92520	23.5		13.77950	350
	.06299	1.6		.45276	11.5	15/16"	.93750	23.8125		14.17320	360
	.06693	1.7	29/64"	.45313	11.5094		.94488	24		14.96090	380
	.07	1.778	15/32"	.46875	11.9062		.950	24.130		15.7480	400
	.07087	1.8		.47244	12	61/64"	.95313	24.2094	16"	16.000	406.4
	.075	1.905	31/64"	.48438	12.3031		.96457	24.5		17.71650	450
5/64"	.07813	1.9844		.49213	12.5	31/32"	.96875	24.6062		19.6850	500
	.07874	2	½"	.50	12.7		.98425	25	20"	20.000	508
	.08	2.032		.51181	13	63/64"	.98438	25.0031		23.6220	600
	.08661	2.2	33/64"	.51563	13.0969	1	1.00000	25.4	2 Feet	24.000	609.6
	.09	2.286	17/32"	.53125	13.4938		1.06229	27	3 Feet	36.000	914.4
	.09055	2.3		.53150	13.5		1.10240	28		39.370	1 Meter
3/32"	.09375	2.3812	35/64"	.54688	13.8906		1.18110	30	4 Feet	48.000	1,219.2
	.09843	2.5		.550	13.970	1¼"	1.250	31.75	5 Feet	60.000	1,524.0
	.1	2.54		.55118	14		1.29921	33	6 Feet	72.000	1,828.8
	.10236	2.6	9/16"	.56250	14.2875		1.3780	35		78.740	2 Meters
7/64"	.10937	2.7781		.57087	14.5		1.41732	36	8 Feet	96.000	2,438.4
	.11811	3	37/64"	.57813	14.6844	1½"	1.500	38.1		118.110	3 Meters
1/8"	.1250	3.175		.59055	15		1.53543	39		196.850	5 Meters

Technical

Mathematical Conversions

Circumferences and Areas of Circles.

Diameter	Circumference	Area	Diameter	Circumference	Area	Diameter	Circumference	Area
1/64	0.0491	0.0002	2	6.2832	3.1416	5	15.7080	19.635
1/32	0.0982	0.0008	2 1/16	6.4795	3.3410	5 1/16	15.9043	20.129
1/16	0.1963	0.0031	2 1/8	6.6759	3.5466	5 1/8	16.1007	20.629
8/32	0.2945	0.0069	2 3/16	6.8722	3.7583	5 3/16	16.2970	21.135
1/8	0.3927	0.0123	2 1/4	7.0686	3.9761	5 1/4	16.4934	21.648
5/32	0.4909	0.0192	2 5/16	7.2649	4.2000	5 5/16	16.6987	22.166
3/16	0.5890	0.0276	2 3/8	7.4613	4.4301	5 3/8	16.8861	22.691
7/32	0.6872	0.0376	2 7/16	7.6576	4.6664	5 7/16	17.0824	23.221
1/4	0.7854	0.0491	2 1/2	7.8540	4.9087	5 1/2	17.2788	23.758
9/32	0.8836	0.0621	2 9/16	8.0503	5.1572	5 9/16	17.4751	24.301
5/16	0.9817	0.0767	2 5/8	8.2467	5.4119	5 5/8	17.6715	24.850
11/32	1.0799	0.0928	2 11/16	8.4430	5.6727	5 11/16	17.8678	25.406
3/8	1.1781	0.1104	2 3/4	8.6394	5.9396	5 3/4	18.0642	25.967
13/32	1.2763	0.1296	2 13/16	8.8357	6.2126	5 13/16	18.2605	26.535
7/16	1.3744	0.1503	2 7/8	9.0321	6.4918	5 7/8	18.4569	27.109
15/32	1.4726	0.1726	2 15/16	9.2284	6.7771	5 15/16	18.6532	27.688
1/2	1.5708	0.1963	3	9.4248	7.0686	6	18.8496	28.274
17/32	1.6690	0.2217	3 1/16	9.6211	7.3662	6 1/8	19.2423	29.465
9/16	1.7671	0.2485	3 1/8	9.8175	7.6699	6 1/4	19.6350	30.680
19/32	1.8653	0.2769	3 3/16	10.0138	7.9798	6 3/8	20.0277	31.919
5/8	1.9635	0.3068	3 1/4	10.2102	8.2958	6 1/2	20.4204	33.183
21/32	2.0617	0.3382	3 5/16	10.4065	8.6179	6 5/8	20.8131	34.472
11/16	2.1598	0.3712	3 3/8	10.6029	8.9462	6 3/4	21.2058	35.785
23/32	2.2580	0.4057	3 7/16	10.7992	9.2806	6 7/8	21.5984	37.122
3/4	2.3562	0.4418	3 1/2	10.9956	9.6211	7	21.9911	38.485
25/32	2.4544	0.4794	3 9/16	11.1919	9.9678	7 1/8	22.3838	39.871
13/16	2.5525	0.5185	3 5/8	11.3883	10.321	7 1/4	22.7765	41.282
27/32	2.6507	0.5591	3 11/16	11.5846	10.680	7 3/8	23.1692	42.718
7/8	2.7489	0.6013	3 3/4	11.7810	11.045	7 1/2	23.5619	44.179
29/32	2.8471	0.6450	3 13/16	11.9773	11.416	7 5/8	23.9546	45.664
15/16	2.9452	0.6903	3 7/8	12.1737	11.793	7 3/4	24.3473	47.173
31/32	3.0434	0.7371	3 15/16	12.3700	12.177	7 7/8	24.7400	48.707
1	3.1416	0.7854	4	12.5664	12.566	8	25.1327	50.265
1 1/16	3.3379	0.8866	4 1/16	12.7627	12.962	8 1/8	25.5254	51.849
1 1/8	3.5343	0.9940	4 1/8	12.9591	13.364	8 1/4	25.9181	53.456
1 3/16	3.7306	1.1075	4 3/16	13.1554	13.772	8 3/8	26.3108	55.088
1 1/4	3.9270	1.2272	4 1/4	13.3518	14.186	8 1/2	26.7035	56.745
1 5/16	4.1233	1.3530	4 5/16	13.5481	14.607	8 5/8	27.0962	58.426
1 3/8	4.3197	1.4849	4 3/8	13.7445	15.033	8 3/4	27.4889	60.132
1 7/16	4.5160	1.6230	4 7/16	13.9408	15.466	8 7/8	27.8816	61.862
1 1/2	4.7124	1.7671	4 1/2	14.1372	15.904	9	28.2743	63.617
1 9/16	4.9087	1.9175	4 9/16	14.3335	16.349	9 1/8	28.6670	65.397
1 5/8	5.1051	2.0739	4 5/8	14.5299	16.800	9 1/4	29.0597	67.201
1 11/16	5.3014	2.2365	4 11/16	14.7262	17.257	9 3/8	29.4524	69.029
1 3/4	5.4978	2.4053	4 3/4	14.9226	17.721	9 1/2	29.8451	70.882
1 13/16	5.6941	2.5802	4 13/16	15.1189	18.190	9 5/8	30.2378	72.760
1 7/8	5.8905	2.7612	4 7/8	15.3153	18.665	9 3/4	30.6305	74.662
1 15/16	6.0868	2.9483	4 15/16	15.5116	19.147	9 7/8	31.0232	76.589

Technical

Mathematical Conversions

Areas and Volume

Circles

To find circumference - Multiply the diameter by 3.1416; or, divide diameter by 0.3183.

To find diameter - Multiply the circumference by 0.3183; or, divide circumference by 3.1416.

To find radius - Multiply the circumference by 0.15915; or divide circumference by 6.28318; or, divide diameter by 2.

To find the side of a square to be inscribed in a circle - Multiply diameter by 0.7071; or, multiply the circumference by 0.2251; or, divide the circumference by 4.4428.

To find the side of a square to equal the area of a circle - Multiply the diameter by 0.8862; or, divide diameter by 1,1284; or, multiply the circumference by 0.2821; or, divide circumference by 3.545.

To find the area of a circle - Multiply the circumference by one-quarter of the diameter; or, multiply the square of the diameter by 0.7854; or, multiply the square of the circumference by 0.7958; or, multiply the square of one-half the diameter by 3.1416.

Doubling the diameter of a circle increases the area 4 times.

Squares

A side multiplied by 1.412 = the diameter of a circle which will circumscribe circle.

A side multiplied by 4.443 = the circumference of its circumscribing the given square.

A side multiplied by 1.1284 = the diameter of a circle equal in area to that given square.

A side multiplied by 3.545 = circumference of an equal circle.
To find diagonal of a square - multiply side by 1.4142.

Measurements From Other Geometrical Forms

To find the area of a ellipse - multiply the product of its axes by 0.7854; or, multiply the product of its semi-axes by 3.14159.

Contents of a cylinder = area of end X length

Contents of a wedge = area of triangular base X altitude.

Surface of a cylinder = length X circumference plus area of both ends.

Surface of a sphere = diameter squared X 3.1416; or. diameter X circumference.

Contents of a sphere = diameter cubed X 0.5236

Contents of a pyramid or cone, right or oblique, regular or irregular = area of base X one-third of the altitude.

Area of a triangle = base X one-half the altitude.

Area of parallelogram = base X altitude.

Area of a trapezoid = altitude X one-half the sum of parallel sides.

To find distance across the corners of hexagons - multiply the distance across the flats by 1.1547.

Conversion Factors

1 gal. water = 8.3 lb.
1 hp = 745.2 watts
1 BTU = .252 kg calories = 0.2930 watt hours
1 BTU per lb. = 1.8 cal per gram.
1 kw-hr = 3412 BTU per hour
1 kw-hr will evaporate 3.5 lb. of water at 212˚F
1 kw-hr will raise 22.75 lb. of water from 62˚F to 212˚F
1 gal. = 231 cu.in. = 3.785 lites = .1337 cu.ft.
1 cu.ft. = 1728 cu.in = .03704 cu.yd. = 7.481 gal.

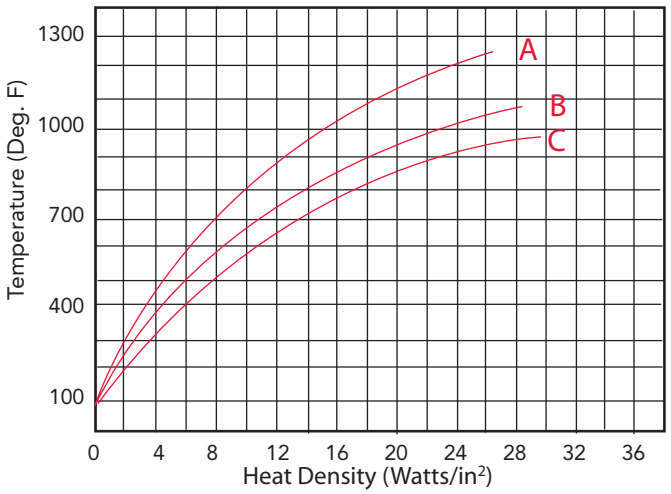
To find the equivalent, in terms of a unit in the customary system, of a given number of metric units, multiply or divide their number (as indicated) by the factor shown. Thus: 10 millimeters are equivalent to 10 x 0.03937 inches or to 10 ÷ 25.4 inches.)

Millimeters x .03937 = inches; or, ÷ 25.4 inches
Centimeters x .3937 = inches; or, ÷ 2.54 inches
Meters x 39.37 = inches
Meters x 3.28 = feet
Kilometers x 3280.8 = feet
Square meters x 10.764 = square feet
Cubic centimeters ÷ 16.387 = cubic inches
Cubic centimeters ÷ 3.70 = fluid drams (U.S.P.)
Cubic centimeters ÷ 29.57 = fluid ounces (U.S.P.)
Cubic centimeters x 3.531 x 10^{-5} = cubic feet
Cubic meters x 35.314 = cubic feet
Liters x 61.025 = cubic inches
Liters x 33.81 = fluid ounces (U.S.P.)
Liters x .2642 = gallons (231 cubic inches)
Liters÷ 3.785 = gallons (231 cubic inches)
Liters÷ 28.317 = cubic feet
Grams x 15.432 = grains
Grams (water) ÷ 29.57 = fluid ounces
Grams ÷ 28.35 = ounces avoirdupois
Grams per cubic centimeter ÷ 27.7 = lbs. per cubic inch
Kilograms x 2.2046 = pounds
Kilograms x 35.3 - ounces avoirdupois
Kilograms per square centimeter x 14.223 = pounds per square inch
Kilo per meter x .672 = pounds per foot
Kilo per cubic meter x .062 = pounds per foot
Kilowatts x 1.34 = h. p. (33,000 foot pounds per minute)
Watts÷ 746 = horse power
Centigrade x 1.8 + 32 = degrees fahrenheit

Technical

Temperature Conversions

Sheath Temperatures vs. Watt Density of Electric Heaters in Air



A: Sheath temperature of Cartridge, Superwatt, and Magnesium Oxide Stainless Steel Strip Heaters.
B: Sheath temperature of Mica Strip, Band, and Rectangular Ceramic Heaters.
C: Sheath temperature of Round Ceramic Heaters.

High Temperature Judged by color

Degrees Centigrade	Degrees Fahrenheit	High Temperatures Judged by Color
400	752	Red heat visible in the dark
474	885	Red heat visible in the twilight
525	975	Red heat visible in the daylight
531	1077	Red heat visible in the sunlight
700	1292	Dark red
800	1472	Dull cherry red
900	1652	Cherry red
1000	1832	Bright cherry red
1100	2012	Orange-red
1200	2192	Orange-yellow
1300	2372	Yellow-white
1400	2552	White welding heat
1500	2732	Brilliant White
1600	2912	Dazzling white (bluish white)

Centigrade to Fahrenheit

Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.
-50°	-58°	75°	167°	200°	392°	325°	617°
-45°	-49°	80°	176°	205°	401°	330°	626°
-40°	-40°	85°	185°	210°	410°	335°	635°
-35°	-31°	90°	194°	215°	419°	340°	644°
-30°	-22°	95°	203°	220°	428°	345°	653°
-25°	-13°	100°	212°	225°	437°	350°	662°
-20°	-4°	105°	221°	230°	446°	355°	671°
-15°	-5°	110°	230°	235°	455°	360°	680°
-10°	14°	115°	239°	240°	464°	365°	689°
-5°	23°	120°	248°	245°	473°	370°	698°
0°	32°	125°	257°	250°	482°	375°	707°
5°	41°	130°	266°	255°	491°	380°	716°
10°	50°	135°	275°	260°	500°	385°	725°
15°	59°	140°	284°	265°	509°	390°	734°
20°	68°	145°	293°	270°	518°	395°	743°
25°	77°	150°	302°	275°	527°	400°	752°
30°	86°	155°	311°	280°	536°	405°	761°
35°	95°	160°	320°	285°	545°	410°	770°
40°	104°	165°	329°	290°	554°	415°	779°
45°	113°	170°	338°	295°	563°	420°	788°
50°	122°	175°	347°	300°	572°	425°	797°
55°	131°	180°	356°	305°	581°	430°	806°
60°	140°	185°	365°	310°	590°	435°	815°
65°	149°	190°	374°	315°	599°	440°	824°
70°	158°	195°	383°	320°	608°	445°	833°
Cent.	**Fahr.**	**Cent.**	**Fahr.**	**Cent.**	**Fahr.**	**Cent.**	**Fahr.**
450°	842°	575°	1067°	700°	1292°	825°	1517°
455°	851°	580°	1076°	705°	1301°	830°	1526°
460°	860°	585°	1085°	710°	1310°	835°	1535°
465°	869°	590°	1094°	715°	1319°	840°	1544°
470°	878°	595°	1103°	720°	1328°	845°	1553°
475°	887°	600°	1112°	725°	1337°	850°	1562°
480°	896°	605°	1121°	730°	1346°	855°	1571°
485°	905°	610°	1130°	735°	1355°	860°	1580°
490°	914°	615°	1139°	740°	1364°	865°	1589°
495°	923°	620°	1148°	745°	1373°	870°	1598°
500°	932°	625°	1157°	750°	1382°	875°	1607°
505°	941°	630°	1166°	755°	1391°	880°	1616°
510°	950°	635°	1175°	760°	1400°	885°	1625°
515°	959°	640°	1184°	765°	1409°	890°	1634°
520°	968°	645°	1193°	770°	1418°	895°	1643°
525°	977°	650°	1202°	775°	1427°	900°	1652°
530°	986°	655°	1211°	780°	1436°	905°	1661°
535°	995°	660°	1220°	785°	1445°	910°	1670°
540°	1004°	665°	1229°	790°	1454°	915°	1679°
545°	1013°	670°	1238°	795°	1463°	920°	1688°
550°	1022°	675°	1247°	800°	1472°	925°	1697°
555°	1031°	680°	1256°	805°	1481°	930°	1706°
560°	1040°	685°	1265°	810°	1490°	935°	1715°
565°	1049°	690°	1274°	815°	1499°	940°	1724°
570°	1058°	695°	1283°	820°	1508°	945°	1733°

Table of Values for Interpolation in Above Chart

1°C = 1.8°F	4°C = 7.2°F	7°C = 12.6°F
2°C = 3.6°F	5°C = 9.0°F	8°C = 14.4°F
3°C = 5.4°F	6°C = 10.8°F	9°C = 16.2°F
1°F = 0.55°C	4°F = 2.22°C	7°F = 3.88°C
2°F = 1.11°C	5°F = 2.77°C	8°F = 4.44°C
3°F = 1.66°C	6°F = 3.33°C	9°F = 5.00°C

Technical

Empirical Guideline for Cartridge Heater Life

1. Record block operating temperature 1._____
2. Determine heater density-watts/square inch_____
3. Determine heater fit in block_____
4. From Chart A determine the delta T (Temperature drop) across block hole. 4._____
5. From Chart B determine the heater internal delta T (Temperature drop) 5._____
6. Add steps 1, 4 and 5 to determine approximate heater internal wire temp.
7. Figure estimated heater life from internal wire temperature based on the following table:

Internal Wire temp.	Approximate Life
1200˚ F or less	years
1500˚F	2 years
1600˚F	1 year
1700˚F	3 months
1800˚F	20 days
1900˚F	Less than 100 hours

Chart "A"

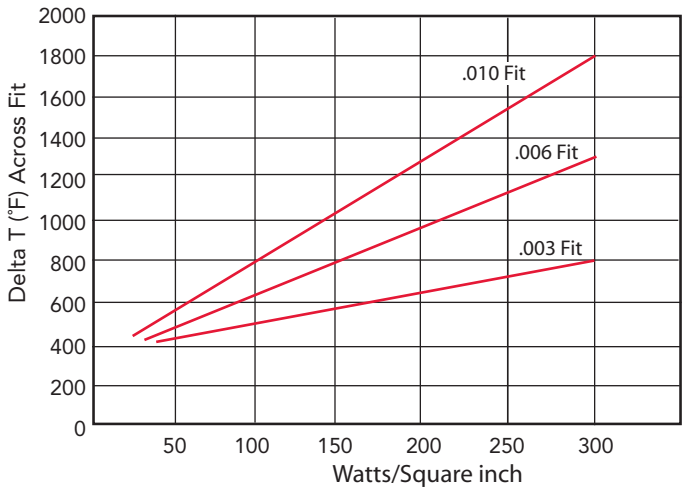
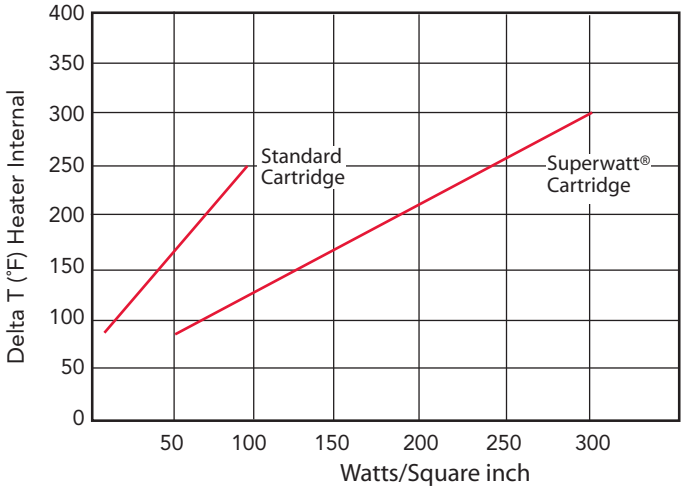


Chart "B"



TECHNICAL

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Technical

Wire, Cable and Current Capacities

Guide to High Temperature Wire and Cable

Common Wire and Cable Abbreviations

AWM – Appliance Wiring Material.

MGT – Stranded nickel conductor, mica, glass, and teflon - 450˚C

MTW – Thermoplastic insulated machine tool wire.

SF – Silicone rubber insulated fixture wire, solid or 7/strand conductor, 200˚C.

SFF – Same as SF, except flexible stranding 150˚C.

SPT-1 – Thermoplastic 300volt two conductor light cord 300 volt.

-2 – Same only heavier construction

-3 – Same only still heavier construction (refrigerators/room air conditioners)

TBS – Switchboard wire, thermoplastic insulation, flameproof cotton braid, 600 Volt, 90˚C.

TEW – CSA type appliance wire solid or stranded plastic insulated, 600 Volt, 150˚C.

TF – Thermoplastic solid or 7/strand fixture wire 60˚C.

TFF – Same as TF only flexible stranding 60˚C

TGS – Solid or flexible copper, nickel-clad iron or copper, or nickel conductor. Teflon tape, silicone glass braid, 600 Volt, 250˚C.

TGGT – Stranded nickel conductor, teflon, glass, teflon-250˚C.

Approximate Current Carrying Capacities For Fiberglass Insulated Copper, Nickel Clad Copper, and Nickel (Grade D) Based on Ambient Temperature or 86˚F.

Conductor Size (AWG)	Copper	Ni-Clad Copper	Nickel
24	7.5	5.3	3.1
22	10	7.0	4.1
20	13	9.1	5.4
18	17	11.9	7.1
16	22	15.4	9.2
14	30	21.0	12.5
12	40	28	16.8
10	50	35	21.0
8	65	45.5	27.0
6	85	59.5	36.0
4	115	80.5	48.0
3	131	91.7	55.0
2	147	103.0	62.0
1	172	120.4	72.0

Approximate Current Carrying Capacities of Copper Conductors in Amperes (not more than three conductors in cable)

Based on Ambient Temperature of 30˚C

Size (AWG)	Rubber Type R Type RW type RU	Rubber Type RII	Thermoplastic Type I Type IW
14	15	15	15
12	20	20	20
10	30	30	30
8	40	45	40
6	55	65	55
4	70	85	70
3	80	100	80
2	95	115	95
1	110	130	110
0	125	150	125
00	145	175	145

Technical

Wire Gage Data

Wire Gauge Size Equivalents.

AWG or B & S Number	Diameter Inches	Diameter MM	Cross Section Area Square Inches	Cross Section Area Square MM	Circular Mils
0000	.4600	11.68	.1662	107.2	211600.
000	.4096	10.40	.1318	85.03	167800.
00	.3648	9.266	.1045	67.43	133100.
0	.3249	8.252	.08289	53.48	105500.
1	.2893	7.348	.06573	42.41	83690.
2	.2576	6.543	.05123	33.63	66370.
3	.2294	5.827	.04134	26.27	52630.
4	.2043	5.189	.03278	21.15	41740.
5	.1819	4.620	.02600	16.77	33100.
6	.1620	4.115	.02062	13.30	26250.
7	.1443	3.665	.01635	10.55	20820.
8	.1285	3.264	.01297	8.366	16510.
9	.1144	2.906	.01028	6.634	13090.
10	.1019	2.588	.008156	5.261	10380.
11	.09074	2.305	.006467	4.172	8234.
12	.08081	2.053	.005129	3.309	6530.
13	.07196	1.828	.004067	2.624	5178.
14	.06408	1.628	.003225	2.081	4107.
15	.05707	1.450	.002558	1.650	3257.
16	.05082	1.291	.002028	1.309	2583.
17	.04526	1.150	.001609	1.038	2048.
18	.04030	1.024	.001276	.8231	1600.
19	.03589	.9116	.001012	.6527	1288.
20	.03196	.8118	.0008023	.5176	1022.
21	.02846	.7229	.0006363	.4105	810.1
22	.02535	.6439	.0005046	.3256	642.4
23	.02257	.5733	.0004001	.2582	509.5
24	.02010	.5105	.0003173	.2047	404.0
25	.01790	.4547	.0002517	.1624	320.4
26	.01584	.4049	.0001996	.1288	254.1
27	.01420	.3607	.0001583	.1021	201.5
28	.01264	.3211	.0001255	.08098	159.8
29	.01126	.2860	.00009954	.06422	126.7
30	.01003	.2548	.00007894	.05093	100.5
31	.008928	.2268	.00006260	.04039	79.7
32	.007950	.2019	.00004964	.03023	63.21
33	.007080	.1796	.00003944	.02545	50.22
34	.006305	.1601	.00003122	.02014	39.75
35	.005615	.1426	.00002476	.01597	31.52
36	.005000	.1270	.00001963	.01267	25.00
37	.004453	.1131	.00001557	.01005	19.83
38	.003965	.1007	.00001235	.00797	15.72
39	.003531	.0897	.00000979	.00632	12.47
40	.003145	.0799	.00000777	.00501	9.888
41	.002800	.0711	.00000616	.00397	7.842
42	.002494	.0633	.00000488	.00315	6.219
43	.002221	.0564	.00000387	.00250	4.932
44	.001978	.0502	.00000307	.00198	3.911
45	.001761	.0447	.00000244	.00157	3.102
46	.001568	.0398	.00000193	.00125	2.460
47	.001397	.0355	.00000153	.00099	1.951
48	.001244	.0316	.00000122	.00078	1.547
49	.001107	.0281	.00000096	.00062	1.227
50	.000986	.0251	.00000076	.00049	.973

Technical

Pipe Sizes and Threads

Stainless Steel Pipe Sizes

Nominal Size (inches)	Outside Diameter (inches)	Schedule 5 Extra Light Weight Wall (inches)	Schedule 5 Extra Light Weight I.D. (inches)	Schedule 5 Extra Light Weight Wt./Ft. (lbs)	Schedule 10 Light Weight Wall (inches)	Schedule 10 Light Weight I.D. (inches)	Schedule 10 Light Weight Wt./Ft. (lbs)	Schedule 40 Standard Weight Wall (inches)	Schedule 40 Standard Weight I.D. (inches)	Schedule 40 Standard Weight Wt./Ft. (lbs)
⅛"	0.405	–	–	–	.049	.307	.1863	.068	.269	.2447
¼"	0.540	–	–	–	.065	.410	.3297	.088	.364	.4248
⅜"	0.675	–	–	–	.065	.545	.4235	.091	.493	.5576
½"	0.840	.065	.710	.3580	.083	.674	.6710	.109	.622	.8510
¾"	1.050	.065	.920	.6838	.083	.884	.8572	.113	.824	1.131
1"	1.315	.065	1.185	.8678	.109	1.097	1.404	.133	1.049	1.679
1¼"	1.660	.065	1.530	1.107	.109	1.442	1.806	.140	1.380	2.273
1½"	1.900	.065	1.770	1.274	.109	1.682	2.085	.145	1.610	2.718
2"	2.375	.065	2.245	1.604	.109	2.157	2.638	.154	2.067	3.653
2½"	2.875	.083	2.709	2.475	.120	2.635	3.531	.203	2.469	5.793
3"	3.500	.083	3.334	3.029	.120	3.260	4.332	.216	3.068	7.576
3½"	4.000	.083	3.834	3.472	.120	3.760	4.973	.226	3.548	9.109
4"	4.500	.085	4.334	3.915	.120	4.260	5.613	.237	4.026	10.79
5"	5.568	.109	5.345	6.349	.134	5.295	7.770	.258	5.047	14.62
6"	6.625	.109	6.407	7.585	.134	6.357	9.289	.280	6.065	18.97

American Standard Taper Pipe Threads

Nominal Pipe Size	Outside Diameter or Pipe (Inches)	Threads per Inch	Pitch of Thread (Inches)	Pitch Diameter at Beginning of external Thread (Inches)	Handtight Engagement (Inches)	Effective Thread External (Inches)
1/16"	0.3125	27	0.03704	0.27118	0.160	0.2611
⅛"	0.405	27	0.03704	0.36351	0.1615	0.2639
¼"	0.540	18	0.05556	0.47789	0.2278	0.4018
⅜"	0.675	18	0.05556	0.61201	0.240	0.4078
½"	0.840	14	0.07143	0.75843	0.320	0.5337
¾"	1.050	14	0.07143	0.96768	0.339	0.5457
1"	1.315	11½	0.08696	1.21363	0.400	0.6828
1¼"	1.660	11½	0.08696	1.55713	0.420	0.7668
1½"	1.900	11½	0.08696	1.79609	0.420	0.7285
2"	2.375	11½	0.08696	2.26902	0.436	0.7565
2½"	2.875	8	0.12500	2.71953	0.682	1.1375

Technical

Resistance wire – Current vs. Temperature

Current Carrying Capacity of Straight Nickel Chromium Wire

Approximate amperes to heat straight, oxidized wire in quiet air to given temperature

Degrees F Degrees C		400 205	600 315	800 427	1000 538	1200 649	1400 760
A.W.G or B. & S.	Inches Diameter	Amperes					
15	.057	7.2	10.0	12.8	16.1	20.0	24.5
16	.051	6.4	8.7	10.9	13.7	17.0	20.9
17	.045	5.5	7.5	9.5	11.7	14.5	17.6
18	.040	4.8	6.5	8.2	10.1	12.2	14.8
19	.036	4.3	5.8	7.2	8.7	10.6	12.7
20	.032	3.8	5.1	6.3	7.6	9.1	11.0
21	.0285	3.3	4.3	5.3	6.5	7.8	9.4
22	.0253	2.9	3.7	4.5	5.6	6.8	8.2
23	.0226	2.58	3.3	4.0	4.9	5.9	7.0
24	.0201	2.21	2.9	3.4	4.2	5.1	6.0
25	.0179	1.92	2.52	3.0	3.6	4.3	5.2
26	.0159	1.67	2.14	2.60	3.2	3.8	4.5
27	.0142	1.44	1.84	2.25	2.73	3.3	3.9
28	.0126	1.24	1.61	1.95	2.38	2.85	3.4
29	.0113	1.08	1.41	1.73	2.10	2.51	2.95
30	.0100	.92	1.19	1.47	1.78	2.14	2.52
31	.0089	.77	1.03	1.28	1.54	1.84	2.17
32	.0080	.68	.90	1.13	1.36	1.62	1.89
33	.0071	.59	.79	.97	1.17	1.40	1.62
34	.0063	.50	.68	.83	1.00	1.20	1.41
35	.0056	.43	.57	.72	.87	1.03	1.21
36	.0050	.38	.52	.63	.77	.89	1.04
37	.0045	.35	.46	.57	.68	.78	.90
38	.0040	.30	.41	.50	.59	.68	.78
39	.0035	.27	.36	.42	.49	.58	.66
40	.0031	.24	.31	.36	.43	.50	.57

Current Carrying Capacity of Ribbon Nickel Chromium Wire

At 1200˚ F approximate

	Width-Inches					
	1/64	1/32	1/16	3/32	1/8	3/16
Thickness Inches	Amps					
.0063	1.56	2.89	5.5	8.2	10.1	16.6
.0056	1.45	2.69	5.2	7.2	9.5	15.6
.0050	1.35	2.52	4.9	6.8	9.0	14.7
.0045	1.26	2.38	4.6	6.4	8.5	14.0
.0040	1.18	2.23	4.1	6.0	8.0	13.1
.0035	1.09	2.07	3.8	5.6	7.5	12.3
.0031	1.01	1.94	3.6	5.3	7.0	11.5
.0020	-	-	-	-	-	-
.0015	4	-	-	-	-	-

The current values in these are based on actual sheets of single strands of oxidized wire mounted in quiet air and operated at 1200˚F. The tables are calculated for wire having a resistivity at 1200˚F and a total surface watts-density of 28 watts per square inch.

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Tubular-Stainless Steel Sheath	79	TT
Tubular-Steel Sheath	80	TS