





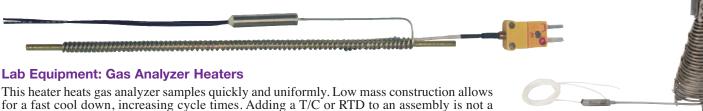
Spiral-wound Tempco-Pak heater cables are low profile and capable of generating high operating temperatures in restricted areas. The built-in thermocouple eliminates the need for a separate thermocouple. Works especially well as an alternative heat source for flat surface heating applications where other types of heaters cannot be used due to space restrictions. Consult Tempco with your requirements.

Compression fittings are available on straight cable heaters of various diameters (1/8", 3/16", 1/4", 5/16" and 3/8"). This fitting enables adjustment of the insertion length during installation. Compression fittings are available in Brass or Stainless Steel with standard male NPT threads. When ordering, specify heater sheath material, NPT size and material for compression fittings, insertion length, thermocouple type and type of junction (grounded or ungrounded), thermocouple and heater lead lengths, watts and volts. Optional—thermocouple location and cooler or unheated cable lengths. Consult Tempco with your requirements.

MMM

Sinuated (formed) Tempco-Pak heater cables are low profile and capable of generating high operating temperatures in restricted areas. The built-in thermocouple eliminates the need for a separate thermocouple. Works especially well as an alternative heat source for flat surface heating applications where other types of heaters cannot be used due to space restrictions. The sinuated cable can also be formed to conform to a cylindrical inside or outside surface. Consult Tempco with your requirements.

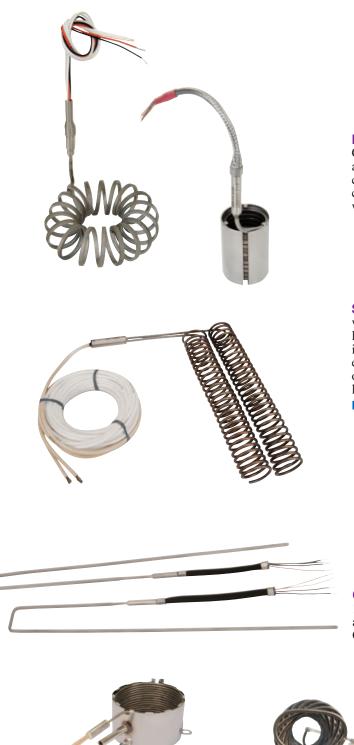
problem. Straight lengths are also available for manual custom bending requirements.







Tempco-Pak Heaters



Miniature-Coil heaters are made for special applications. Cable diameter is less than .100". They work especially well as an alternative heat source for demanding and high temperature applications where other types of heaters have failed. Available with cooler or unheated cable section toward lead end. Consult Tempco with your requirements.



Stainless steel mounting flange is 1" diameter × .060" thick with two 1/4" holes on a 3/4" bolt circle. When ordering, specify location of mounting flange, cable diameter, length, sheath material, thermocouple type and type of junction (grounded or ungrounded), thermocouple and heater lead lengths, watts and voltsoptional: thermocouple location and cooler or unheated cable lengths. Consult Tempco with your requirements.

NOTE: Mounting flange to be located over a cold or cooler section.



Gas or Air Heaters rated 1050 watts at 240 volts. One end has 1/4" MNPT and the other end has 1/4" FNPT so that you can have a series of the heaters for higher wattage requirements. It has 1-1/8" $OD \times 8^{"}$ long stainless steel tubing body with 9-3/8" overall length.





Star-Wound Coil

Star wound formations are usually inserted into pipes or ducts and are used to heat moving air or liquids. The offset coils create a turbulent flow. This allows the flowing material to have better contact with the heater surface resulting in more efficient heat transfer.

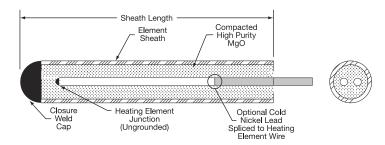
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Tempco-Pak Heaters



Tempco-Pak Heaters — Design Constructions



Tempco-Pak Heaters with Straight Wire

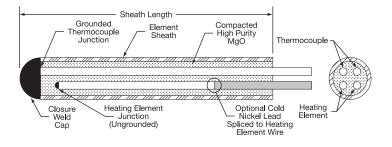
Tempco-Pak heaters are made from M.I. cable having 2 straight heating element wires insulated from the sheath by high purity MgO.

Available in nominal sheath diameters from 0.040" to 0.375" (1mm to 9.5mm) in 304 stainless steel and Inconel[®] 600 for Tempco-Pak heaters with straight wire. Optional cold nickel lead spliced to heating element wire is available in 0.125" diameter or larger depending on conductor material.

Nominal Sheath O.D.		-	ximum er Length	-	ninal h O.D.	Maximum Heater Length		
in	mm	ft	meters	in	mm	ft	meters	
.040	1.00	25	7.6	.188	4.77	100	30.5	
.063	1.60	70	21.0	.250	6.35	59	18.0	
.125	3.18	120	36.5	.312	7.93	38	11.5	
.163	4.14	130	39.6	.375	9.53	26	8.0	

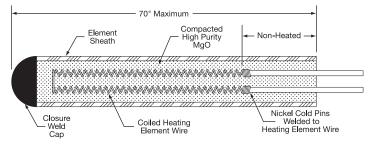


Note: Consult Tempco for diameters other than those listed above.



Tempco-Pak Heaters with Straight Wire and Built-In Thermocouple

Tempco-Pak heaters with 0.125" or larger diameter are also made from M.I. cable having 2 straight heating element wires and 2 straight thermocouple wires insulated from the sheath by high purity MgO. Optional cold nickel lead spliced to heating element wire is available in 0.125" diameter or larger depending on conductor material.



Tempco-Pak Heaters with Helically Coiled Wire

Hi-Density Tempco-Pak heaters are manufactured from sheathed M.I. cable having 2 coiled heating element wires or 2 coiled heating element wires and 2 straight thermocouple wires. The non-heated portion has the largest possible diameter solid nickel cold pins attached to the heating element wires, providing maximum current carrying capacity within the same continuous sheath.

Available in nominal sheath diameters from 0.120" to 0.153" (3.05 mm to 3.9 mm) including 0.125" O.D., 0.132" O.D. and 0.143" O.D. Tempco also manufactures $0.110" \times 0.160"$ rectangular cable as well as 0.125" square cable.

Maximum sheath length including non-heated section is 70 inches (1778 mm).

Optional Built-in Thermocouple is ANSI Type J or Type K grounded at tip (end farthest from cold end) or ungrounded anywhere along heater length for .125" diameter and larger.



Tempco-Pak Cable Heaters

Since 1972

The densely compacted MgO insulation used in Tempco-Pak heaters produces excellent high temperature insulation resistance and dielectric strength. Heaters can be manufactured with the optional cold nickel leads internally spliced to the heating element wires within the same continuous sheath.

Generally speaking, there is very little temperature difference between the sheath and heater wires. Tempco recommends not exceeding 150 watts per square inch of sheath surface area with the sheath operating temperature at 1000°F (537°C) or less. As temperature increases above 1000°F, the maximum watt density should be decreased.

Performance Ratings

Watt Density:	75 watts per square inch of sheath surface
	area maximum with factory approval
Maximum temperature:	1500°F (815°C) for 304 stainless steel sheath 1800°F (982°C) for Income [®] 600 sheath
-	1800°F (982°C) for Inconel [®] 600 sheath

Specifications

Electrical

Resistance:	$\dots \pm 10\%$ unless otherwise specified
Voltage:	120V and 240V standard
Thermocouples:	
	Type K to 1800°F (982°C)
All thermocouples and their junctions are intern	al to the heater sheath. A grounded junc-
tion at the heater tip is standard. An ungrounded	d junction anywhere along the heater's

length is optional. Available in sheath diameters .125" and larger.

Dimensional

... 0.040", 0.062", 0.115", 0.120", 0.125", 0.132", 0.153", 0.163", 0.174", 0.188", 0.220", 0.250". Others available upon request.

Cable diameter tolerance: $\pm .005$ Heater length tolerance: $\ldots 0$ to 6" (+1/8", -0), 6 to 18" (+1/4", -0)

Ordering Information

18 to 24" (+3/8", -0), 24 to 120" (+3/4", -0) 120 to 300" (±1")

The maximum recommended operating temperature is 1800°F (982°C) with Inconel[®] 600 sheath and ANSI Type K thermocouple if required. Heater life in any specific situation or application is impossible to predict. However, heater life generally decreases as temperature and/or the number of thermal cycles increases.

Tempco-Pak heaters are flexible and can be readily formed or bent by hand or production machinery, with the minimum bend radius equal to twice the sheath diameter. The heater sheath can be welded, brazed or soldered without changing its electrical characteristics.

Transition and Termination Construction Specifications

Transition (potting) adapters: 5/16" O.D. $\times 1-1/2"$ long for heater cable 0.163" diameter and smaller. 1/2" O.D. $\times 1-1/2"$ long for heater cable diameters above 0.163"

Transition Temperature Rating: Standard transition is rated to 482°F (250°C).

Optional High Temperature Transition is rated to 842°F (450°C).

Standard heater lead wire insulation is TGGT (Teflon[®], double fiberglass, Teflon[®] impregnation), which is rated to 482°F (250°C).

Optional high temperature insulation is MGT (mica, fiberglass, Teflon[®] impregnation) which is rated to $842^{\circ}F$ (450°C).

Thermocouple: Standard leads use a fiberglass insulation rated to 900°F (482°C). Teflon[®] insulation is available upon request.

Optional lead protection: Stainless steel overbraid or galvanized armor cable.

Standard Heaters

Order by Part Number for standard heaters listed in Tables on pages 5-21 through 5-23.

Part Numbers are for heaters with standard lead length of 24" unless otherwise specified. Longer lead length as well as stainless steel wire braid protection or armored cable protection are available upon request.

Heaters under 72" (1829 mm) will be shipped straight; longer heaters will be shipped in coils a minimum of 24" (610 mm) in diameter.

Custom Engineered/Manufactured Heaters

For sizes, ratings and terminations not listed, **TEMPCO** will design and manufacture a Tempco-Pak heater to meet your requirements. *Standard lead time is 3-4 weeks.*

Please Specify the following:

- □ Wattage and Voltage
- □ Sheath Diameter
- Heater length
- □ Sheath material 304 stainless steel or Inconel[®] 600
- Length of internal nickel cold, or if a neck down design, length of cold section. See page 5-5.
- Thermocouple if required— Type J or K
- □ Thermocouple Junction— Grounded or Ungrounded. If ungrounded, specify location (.115" and larger).
- Transition type: M1, M2, M3, A1, A2, A3, B1, B2, B3, C1, C2, C3, S1, S2 or S3. See page 5-5.
- □ Lead length if other than 24"
- □ Supply a sketch or drawing.

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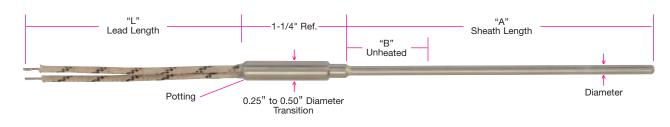
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Tempco-Pak Heaters

.125 & .153 Diameter Cable Heaters With and Without Thermocouples



Design Features

- * For temperatures up to 1500°F (815°C) with 304 SS sheath or 1800°F (982°C) with Inconel 600 sheath.
- * Heater can be formed into almost any shape.
- * Available with optional type J or K thermocouples.

* Watt densities up to 40 watts /square inch and as high as 75 watts/square inch in certain applications.

Ordering Code: Lead Insulation BOX 12 Heater Type BOX 1 "A" Dimension BOX 6 $\mathbf{M} = \text{Plain Leads}$ (Heater Length) $\mathbf{M} =$ With thermocouple \mathbf{B} = Stainless Steel Overbraid **H** = Without thermocouple Whole inches **C** = Galvanized Armor Cable 00 to 99 A = Stainless Steel Armor Cable **S** = Fiberglass Sleeve **Diameter** BOX 2 **F** = .125" "A" Dimension BOX 7 **G** = .153" (Heater Length) **Transition Temperature Rating** BOX 13 Fractional inches **4** = 1/2" 0 = 0" $1 = 482^{\circ}F(250^{\circ}C) - TGGT$ Wire with High Temperature Cement Potting Thermocouple Type BOX 3 $2 = 392^{\circ}F(200^{\circ}C) - TFE$ Wire with Epoxy Potting $\mathbf{0} =$ No Thermocouple $3 = 842^{\circ}F (450^{\circ}C) - MGT$ Wire with High $\mathbf{J} = \mathbf{T}\mathbf{y}\mathbf{p}\mathbf{e} \mathbf{J}$ Thermocouple "B" Dimension BOX 8 Temperature Cement Potting **K** = Type K Thermocouple (Unheated Length) Whole inches 0 to 9 Special Requirement BOX 14 **Thermocouple Junction** BOX 4 $\mathbf{X} = \text{Specify}$ **0** = No Thermocouple $\mathbf{G} = \mathbf{G}$ rounded at Tip $\mathbf{0} = \text{None}$ Wattage BOX 9 **U** = Ungrounded at Tip Examples: Enter **090** for 90 watts $\mathbf{M} =$ Ungrounded in the Middle Enter 250 for 250 watts Ordering Sheath Material BOX 5 Voltage BOX 10 Information B = 304 SS1 = 120 Volts $\mathbf{A} = \text{Inconel}^{\otimes} 600$ 2 = 240 Volts Cable Heaters are offered with the options listed in the worksheet. Create an ordering code by filling in the boxes "L" Dimension BOX 11 with the appropriate number Whole inches and/or letter designation for 001 to 999 your requirements, and a part number will be assigned.

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Tempco-Pak Heaters

Standard (Non-Stock) Round Straight Tempco-Pak Cable Heaters

Part numbers are for 304 SS sheath heaters (except HHS00003 with Inconel[®] 600) with 24" plain leads, and a type J thermocouple junction grounded at the tip of the cable, except those marked with a $\frac{1}{2}$ (0.062" cable).

Cable Diameter	Shea in	th Length mm	Watts	Watt W/in ²	Density W/cm ²	Volts	Part Number
	34	863.6	400	60	9.30	120	HHS00001
+.062 "	42	1066.8	400	49	7.59	120	HHS00002
(1.57 mm)	60	1524.0	200	19	2.94	120	HHS00003
	88	2235.2	450	26	4.03	120	HHS00004
.115"	49	1244.6	425	24	3.72	120	MHS00002
(2.92 mm)	73	1854.2	450	17	2.63	120	MHS00003
(= 0, =)	87	2209.8	750	24	3.72	240	MHS00004
	30 35	762.0 889.0	300 330	30 24	4.65 3.72	120 240	MHS00005 MHS00006
	41	1041.4	365	24 23	3.56	120	MHS00007
	52	1320.8	400	$\frac{23}{20}$	3.10	240	MHS00008
.125"	62	1574.8	780	32	4.96	240	MHS00009
(3.18 mm)	68	1727.2	300	11	1.70	120	MHS00010
	68	1727.2	300	11	1.70	240	MHS00011
	84	2133.6	780	24	3.72	120	MHS00012
	90	2286.0	660	19	2.94	120	MHS00013
	17	431.8	200	24	3.72	240	MHS00014
	17	431.8	375	46	7.13	240	MHS00015
	18	457.2	250	29	4.49	240	MHS00016
.153"	20	508.0	125	13	2.01	230	MHS00017
(3.89 mm)	20 22	508.0 558.8	250 250	26 24	4.03 3.72	230 240	MHS00018 MHS00019
(3.69 11111)	25	635.0	380	32	4.96	240	MHS00019 MHS00020
	34	863.6	480	29	4.49	240	MHS00020 MHS00021
	40	1016.0	550	29	4.49	240	MHS00021 MHS00022
	51	1295.4	650	27	4.18	240	MHS00023
	88	2235.2	1800	37	5.73	220	MHS00024
.174"	93	2362.2	1700	33	5.11	220	MHS00025
(4.42 mm)	109	2768.6	1500	25	3.87	220	MHS00026
(4.42 11111)	166	4216.4	3350	37	5.73	220	MHS00027
	220	5588.0	2850	24	3.72	220	MHS00028
	77	1955.8	1700	34	5.27	220	MHS00029①
.188"	90	2286.0	2000	37	5.73	220	MHS00030
(4.78 mm)	105 180	2667.0 4572.0	1800 3900	29 37	4.49 5.73	220 220	MHS00031 MHS00032
(4.78 mm)	191	4851.4	1000	9	1.39	220	MHS00032 MHS00033
	198	5029.2	3600	31	4.80	220	MHS00034
	146	3708.4	2850	31	4.80	380	MHS00035
.203"	182	4622.8	3900	34	5.27	480	MHS00036
(5.16 mm)	200	5080.0	4300	34	5.27	220	MHS00037
	223	5664.2	4000	28	4.34	220	MHS00038
	107	2717.8	2500	32	4.96	220	MHS00039
.220"	123	3124.2	2100	31	4.80	220	MHS00040
(5.59 mm)	205	5207.0	4800	34	5.27	220	MHS00041
	217 109	5511.8	3800	25 34	<u>3.87</u> 5.27	220 220	MHS00042
	109	2768.6 3022.6	2700 2550	29	3.27 4.49	220	MHS00043 MHS00044
.232"	204	5181.6	4500	30	4.65	480	MHS00044 MHS00045
(5.89 mm)	211	5359.4	5000	32	4.96	220	MHS00045 MHS00046
	222	5638.8	4800	30	4.65	220	MHS00047
	89	2260.6	2600	37	5.73	220	MHS00048
	100	2540.0	2200	38	5.89	220	MHS00049
	103	2616.2	2750	34	5.27	220	MHS00050
	105	2667.0	2100	25	3.87	220	MHS00051
	115	2921.0	2450	27	4.18	220	MHS00052
.250"	118	2997.2	2600	28	4.34	220	MHS00053
(6.35 mm)	123	3124.2	2700	28	4.34	220	MHS00054
, í	130 138	<u>3302.0</u> 3505.2	2600 2300	25 21	<u>3.87</u> 3.25	220 220	MHS00055 MHS00056
	205	5207.0	4200	$\frac{21}{30}$	3.25 4.65	220	MHS00056 MHS00057
	205	5461.0	4000	28	4.34	220	MHS00058
	240	6096.0	5500	26	4.03	220	MHS00059
	281	7137.4	4700	19	2.94	220	MHS00060 /

Longer lead length as well as optional stainless steel wire braid (B), fiberglass sleeve (S), stainless steel armored cable (A), or galvanized armored cable (C) protection is available upon request. See ordering code worksheet below for lead wire protection and lead length desired.

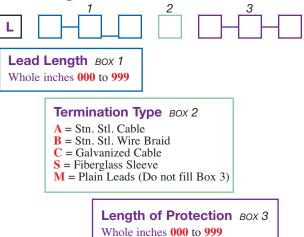
NOTE: Complete termination descriptions are on page 5-5.



Ordering Information Standard Straight Tempco-Pak heaters are

offered with plain lead wires. Use the part numbers at the left for 24" plain lead wires. If you need other than standard 24" leads and/or wire protection use the following ordering codes and a part number will be assigned.

Ordering Code:



NOTE: ① Maximum Operating Temperature 500°C.

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Tempco-Pak Heaters

Standard (Non-Stock) Square Straight Tempco-Pak Cable Heaters

Part Numbers are for heaters with 48" plain leads.

Longer lead length as well as optional stainless steel wire braid (B), fiberglass sleeve (S), stainless steel armored cable (A) or galvanized armored cable (C) protection is available upon request. See ordering code worksheet below for lead wire protection and lead length desired.

Cable Cross Section	Sheath in	Length mm	Cold L in	.ength mm	Watts	Watt I W/in ²	Density W/cm²	Volts	"J" T/C Junction	Part Number
	141/8	359	2	51	250	41.2	6.39	240	UG-T	MHS00128
	181/4	464	13/4	44	250	30.3	4.70	240	UG-T	MHS00129
	221/8	581	21/8	54	250	24.0	3.72	240	GRD	MHS00121
	231/4	591	$1\frac{1}{2}$	38	450	41.3	6.40	240	UG-M	MHS00122
.125" x .125"	26	660	4	101	300	27.2	4.22	240	GRD	MHS00123
(Square)	29	737	11/2	38	450	32.7	5.06	240	UG-N	MHS00124
	361/8	936	2	51	300	17.2	2.66	240	GRD	MHS00125
	41%	1045	11%	47	300	15.2	2.35	240	UG-M	MHS00126
	43%	1108	11%	47	300	14.3	2.21	240	UG-M	MHS00127
	20	508	21/2	64	315	36.0	5.58	240	N/A	HHS00167
	31½	800	21/2	64	315	21.7	3.36	240	N/A	HHS00168
	31¾	806	21/2	64	600	41.0	6.36	240	N/A	HHS00169

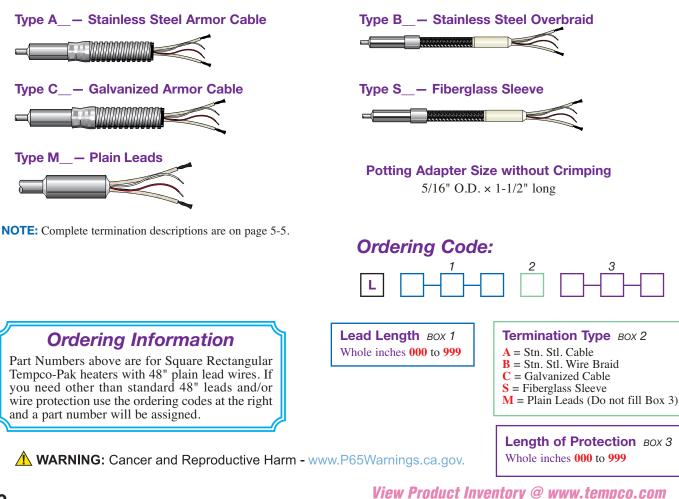
Standard Tempco-Pak Heaters are made with 304 Stainless Steel Sheath.

(UG-M) — Ungrounded T/C junction is at the middle of the hot section

(UG-T) – Ungrounded T/C junction is at the tip

(UG-N) - Ungrounded T/C junction is 7" from the tip

Lead Wire Abrasion Protection Terminations



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Standard (Non-Stock) Rectangular Straight Tempco-Pak Cable Heaters

Part Numbers are for heaters with 48" plain leads.

Longer lead length as well as optional stainless steel wire braid (B), fiberglass sleeve (S), stainless steel armored cable (A) or galvanized armored cable (C) protection is available upon request.

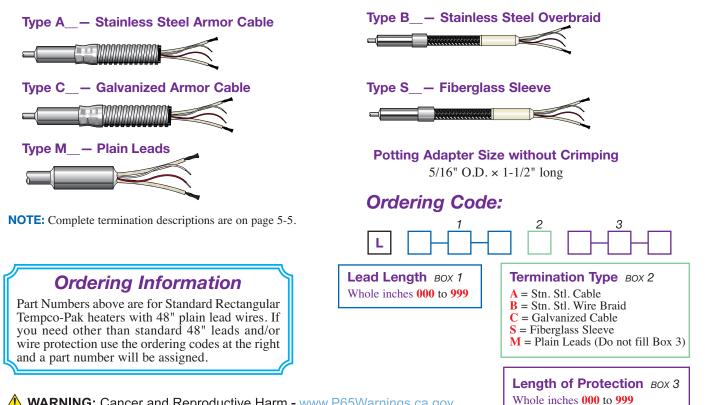
See ordering code worksheet below for lead wire protection and lead length desired.

Cable Cross Section	Sheath Length		Cold Length		Watts	Watt Density W/in ² W/cm ²		Volts	"J" T/C Junction	Part Number
01000 000000										
	21%	537	15%	41	300	28.5	4.41	240	UG-M	MHS00107
	27½	698	15/8	41	350	25.0	3.87	240	UG-M	MHS00108
	30¾	781	1%	48	400	25.6	3.97	240	UG-M	MHS00109
	32¼	819	15/8	41	400	24.2	3.74	240	UG-M	MHS00110
	35¼	895	13/4	44	450	24.8	3.86	240	UG-M	MHS00111
	35%	911	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	41	425	23.0	3.56	240	UG-M	MHS00112
	401/4	1022	11/4	32	550	26.0	4.03	240	UG-M	MHS00113
	44¼	1124	1 5/8	41	500	21.7	3.36	240	UG-M	MHS00114
	443/4	1137	11/4	32	700	29.8	4.62	240	UG-M	MHS00115
	531/2	1359	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	41	800	28.8	4.46	240	UG-M	MHS00116
.110" x .160"	57	1448	1 1 1%	41	500	16.7	2.58	240	UG-M	MHS00117
(Rectangular)	57%	1464	15%	41	550	18.1	2.81	240	UG-M	MHS00118
	62¾	1594	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	41	900	27.2	4.22	240	UG-M	MHS00119
	72	1829	15%	41	1000	26.3	4.07	240	UG-M	MHS00120
	133/4	349	1%	48	225	35.0	5.42	240	No T/C	HHS00159
	$20\frac{1}{2}$	521	15%	41	250	24.5	3.79	240	No T/C	HHS00160
	24%	619	15%	41	300	24.4	3.78	240	No T/C	HHS00161
	323%	822	15%	41	350	21.0	3.25	240	No T/C	HHS00162
	401/4	1022	15%	41	400	19.1	2.96	240	No T/C	HHS00163
	481/4	1226	15%	41	425	16.8	2.60	240	No T/C	HHS00164
	531/2	1359	15%	41	800	28.5	4.41	240	No T/C	HHS00165
	64 ¹ / ₈	1629	15%	41	500	14.8	2.29	240	No T/C	HHS00166
	0-1/8	1029	1/8	-11	500	14.0	2.27	240	1101/0	111500100

Standard Tempco-Pak Heaters are made with 304 Stainless Steel Sheath.

UG-M: — Ungrounded T/C junction is 8" to 11" from the tip

Lead Wire Abrasion Protection Terminations



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