

Revolutionizing the Heater Industry

The Watlow® FIREROD® cartridge heater incorporates engineering excellence and is supported by over 60 years of solid industry performance across a broad range of simple and complex applications. As the premier choice in swaged cartridge heating, thousands of industrial manufacturers continue to choose Watlow as their trusted thermal partner and certified cartridge heater supplier.

Built using premium materials and tight manufacturing controls, the FIREROD heater provides superior heat transfer, uniform temperatures, resistance to oxidation and corrosion and a long life even at high temperatures. Every system component that leaves our manufacturing facilities meets our strict quality assurance specifications, in addition to those set forth by leading standards and regulating industries.

To meet our customer's individual needs, there are many delivery options available for FIREROD heaters.

Performance Capabilities

- Part temperatures up to 1400°F (760°C) on alloy 800 sheath
- Watt densities up to 400 W/in² (62 W/cm²)
- Maximum voltage up to 480V

Features and Benefits

Nickel-chromium resistance wire

- Ensures even and efficient distribution of heat to the sheath

Metalurgically-bonded conductor pins

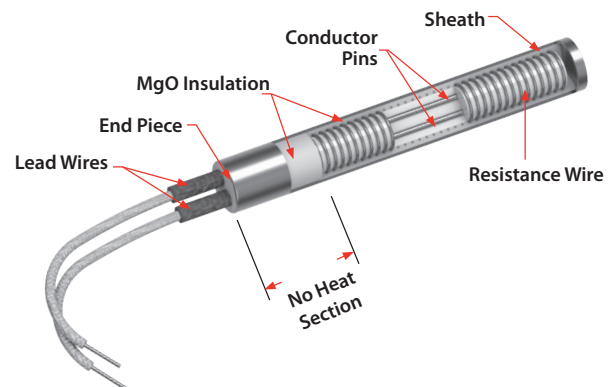
- Ensure a trouble-free electrical connection

Magnesium oxide insulation of specific grain and purity

- Results in high dielectric strength and contributes to faster heat-up

Alloy 800 sheath

- Resists oxidation and corrosion from heat, many chemicals and atmospheres



Features and Benefits (con't)

Minimal spacing between the element wire and sheath

- Results in lower internal temperature
- Accommodates a design with fewer or smaller heaters operating at higher watt densities

International Organization for Standardization (ISO) 9001 certified

- Provides confidence that quality and reliability expectations are met

UL® and CSA approved flexible stranded wires

- Lead insulation rated to temperatures up to 840°F (450°C)

Patented lead adapter (LA) method

- Allows same day shipment on more than 150,000 configurations of stock FIREROD heaters and lead combinations

Typical Applications

- Semiconductor chamber heating
- Semiconductor wire and die bonding
- Freeze protection and deicing of equipment in cold climates or applications
- Humidity control
- Patient comfort heating used in medical devices
- Mold die and platen heating
- Seal bars used in packaging equipment
- Test sample heating in gas chromatography equipment
- High temperature glass forming equipment

Applications and Technical Data

Tolerances

Diameter

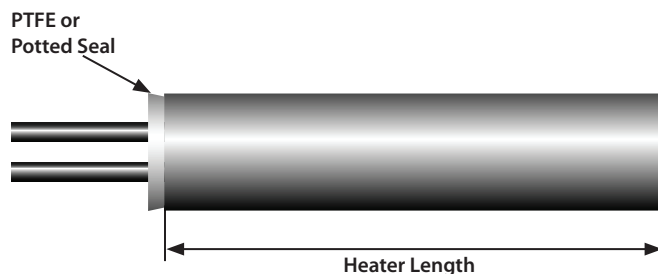
- 1 in. (25 mm) units: ± 0.003 in. (± 0.08 mm)
- All other units: ± 0.002 in. (± 0.05 mm)

Sheath Length

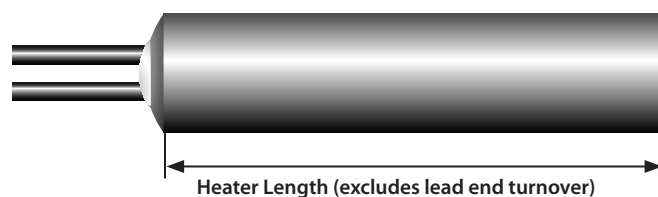
- All units to $4\frac{1}{2}$ in. (114 mm) long: $\pm \frac{3}{32}$ in. (± 2.4 mm)
- $\frac{1}{8}$ in. diameter units over $4\frac{1}{2}$ in. (114 mm) long: $\pm 3\%$
- All other units over $4\frac{1}{2}$ in. (114 mm) long: $\pm 2\%$

Length Measurements

Pin Style and Potted FIRERODs



PTFE - Swaged-in Leads FIRERODs



Wattage

- $\frac{1}{8}$ in. units: +10%, -15%
- All other units: +5%, -10%

Resistance

- $\frac{1}{8}$ in. units: +15%, -10%
- All other units: +10%, -5%

Resistance changes with temperature. There are three circumstances under which resistance can be measured:

1. Room temperature (before use): nominal ohms are 90% of Ohm's law calculation.
2. Room temperature (after use): nominal ohms are 95% of Ohm's law calculation.
3. At temperature (during use): depending on application nominal ohms are approximately 100% of Ohm's law.

Note: Resistance and wattage values are approximate depending on application conditions.

Component Recognition File Numbers

- UL® component rated to 240VAC (file number E52951)
- CSA component rated to 240VAC (file number LR7392)
- VDE component rated to 240VAC (file number 1164800-4911-0009) (file number 1164800-4911-0004)

Note: Not all options or combinations of options are covered. UL®, CSA, VDE and CE marking is available upon request.

Dimensional Data

This table shows minimum/maximum sheath lengths for available FIREROD diameters.

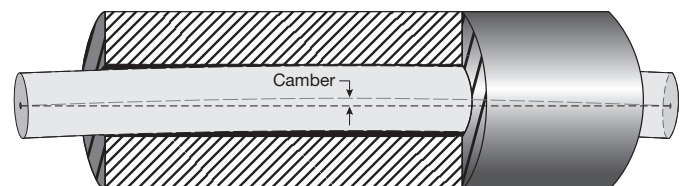
FIREROD Diameter			Length	
Nominal in.	Actual in.	(mm)	Min. in. (mm)	Max. in. (mm)
$\frac{1}{8}$	0.122	(3.1)	$\frac{7}{8}$ (22.2)	12 (305)
$\frac{1}{4}$	0.246	(6.3)	$\frac{7}{8}$ (22.2)	36 (915)
$\frac{3}{8}$	0.371	(9.4)	$\frac{7}{8}$ (22.2)	48 (1220)
$\frac{1}{2}$	0.496	(12.6)	$\frac{7}{8}$ (22.2)	60 (1520)
$\frac{5}{8}$	0.621	(15.8)	1 (25.0)	72 (1830)
$\frac{3}{4}$	0.746	(18.9)	1 (25.0)	72 (1830)
1	0.996	(25.3)	$1\frac{1}{4}$ (32.0)	72 (1830)

Indicates **recommended** maximum sheath length; however, longer lengths may be available.

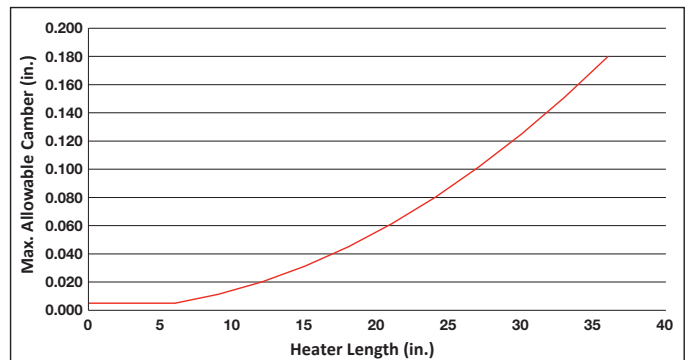
Camber

Camber is defined as the maximum deviation of the heater's centerline from straight. FIREROD camber within allowable tolerances is verified via passage through a cylindrical gauge of specified length and diameter. Normally, slight camber does not present a problem since the heater will flex enough to fit into a straight, close-fit hole.

Camber Measurement



Allowable Camber Versus Length

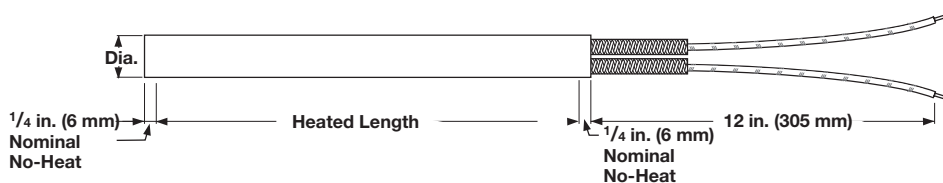


Max. camber = $0.020 \text{ in.} \times (\text{length in feet})^2$ or 0.005 in., whichever is greater.

Electrical Data

The table below will assist you in selecting the correct FIREROD heater for your application, according to available voltage, amperage and wattage.

Please note, some combinations of minimum and maximum wattages are not available on the same heater diameter. If your application exceeds the limitations shown, contact your Watlow representative.



FIREROD Diameter in.	Volts Max.	Ampere Max. ^①	Min. Watts @ 120V ^③ Heater Length			Max. Watts				
			1 in. (25 mm)	1 1/2 in. (38 mm)	2 in. (50 mm)	120V 1-phase	240V 1-phase	480V 1-phase	240V 3-phase	480V 3-phase
1/8	240	3.1	—	8	5	360	720	—	—	—
1/4	240	4.4 ^②	100	55	40	525	1050	—	—	—
3/8	240	6.7	65	35	25	800	1600	—	—	—
1/2	240	9.7	40	25	20	1160	2320	—	—	—
5/8	480	23.0	35	20	15	2760	5520	11,000	⑤	⑤
3/4	480	23.0	30	15	10	2760 ^④	5520	11,000	9550	19,100
1 ^⑦	480	23.0	—	15	10	2760 ^④	5520	11,000	9550 ^④	19,100 ^④

Number Of Circuits ^⑥		
Diameter in.	1-phase	3-phase
3/4	3	1
1	5	2

- ① Determined by the current carrying capacity of internal parts and lead wire. Alternate material may be available.
- ② For 1/4 in. (6 mm) units with thermocouple maximum amperage is 3.1A.
- ③ Determined by the limitation of space for resistance winding. For minimum wattage of 240VAC multiply value by four.
- ④ Higher wattages are available using more than one set of power leads. Multiply the wattage from the table by the applicable factor.
- ⑤ Contact your Watlow representative for data.
- ⑥ On 3/4 in. (19 mm) diameter units, either three single-phase circuits or one three-phase delta or wye circuit is available. On 1 in. (25 mm) diameter units, either five single-phase or two three-phase delta circuits are available.
- ⑦ A minimum charge per line item applies.

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UL® is a registered trademark of Underwriter's Laboratories, Inc.

Powered by Possibility

To be automatically connected to the nearest North American Technical Sales Office:

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Taiwan	+886 7 288 5168
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Cartridge/Insertion Heaters



FIREROD Cartridge Heaters

Heater Part Numbers

Diameter in.	Sheath Length in. (mm)	Volts	Watts	Watt Density W/in ² (W/cm ²)	Approx. Net Wt. lbs (kg)	Part Number
3/8	1 (25.0)	120	55	95 (15)	0.03 (0.014)	G1A71
	1 (25.0)	120	100	172 (26)	0.03 (0.014)	G1A29
	1 (25.0)	120	150	259 (40)	0.03 (0.014)	G1A38
	1 (25.0)	240	200	344 (53)	0.03 (0.014)	G1A83
	1 1/4 (32.0)	120	100	115 (18)	0.03 (0.014)	G1E91
	1 1/4 (32.0)	120	125	144 (22)	0.03 (0.014)	G1E74
	1 1/4 (32.0)	120	150	172 (27)	0.03 (0.014)	G1E92
	1 1/4 (32.0)	240	150	172 (27)	0.03 (0.014)	G1E93
	1 1/4 (32.0)	120	200	230 (35)	0.03 (0.014)	G1E94
	1 1/4 (32.0)	240	200	230 (35)	0.03 (0.014)	G1E95
	1 1/4 (32.0)	120	400	426 (66)	0.03 (0.014)	G1E99
	1 1/2 (38.0)	120	50	43 (7)	0.04 (0.018)	G1J25
	1 1/2 (38.0)	120	75	65 (10)	0.04 (0.018)	G1J70
	1 1/2 (38.0)	120	80	68 (11)	0.04 (0.018)	G1J66
	1 1/2 (38.0)	120	100	86 (13)	0.04 (0.018)	G1J59
	1 1/2 (38.0)	240	100	86 (13)	0.04 (0.018)	G1J110
	1 1/2 (38.0)	240	125	106 (16)	0.04 (0.018)	G1J182
	1 1/2 (38.0)	120	150	129 (20)	0.04 (0.018)	G1J31
	1 1/2 (38.0)	240	150	129 (20)	0.04 (0.018)	G1J39
	1 1/2 (38.0)	120	200	173 (27)	0.04 (0.018)	G1J85
	1 1/2 (38.0)	240	200	173 (27)	0.04 (0.018)	G1J73
	1 1/2 (38.0)	120	250	216 (33)	0.04 (0.018)	G1J86
	1 1/2 (38.0)	240	250	216 (33)	0.04 (0.018)	G1J54
	1 3/4 (45.0)	120	125	86 (13)	0.05 (0.023)	G1N45
	1 3/4 (45.0)	120	175	122 (19)	0.05 (0.023)	G1N46
	1 3/4 (45.0)	120	250	172 (27)	0.05 (0.023)	G1N43
	1 3/4 (45.0)	240	250	172 (27)	0.05 (0.023)	G1N32
	2 (51.0)	120	50	29 (5)	0.06 (0.027)	G2A53
	2 (51.0)	120	75	42 (7)	0.06 (0.027)	G2A192
	2 (51.0)	120	100	57 (9)	0.06 (0.027)	G2A84
	2 (51.0)	240	100	57 (9)	0.06 (0.027)	G2A76
	2 (51.0)	120	150	86 (13)	0.06 (0.027)	G2A56
	2 (51.0)	240	150	86 (13)	0.06 (0.027)	G2A81
	2 (51.0)	120	200	115 (18)	0.06 (0.027)	G2A127
	2 (51.0)	240	200	115 (18)	0.06 (0.027)	G2A37
	2 (51.0)	120	250	144 (22)	0.06 (0.027)	G2A47
	2 (51.0)	240	250	144 (22)	0.06 (0.027)	G2A73
	2 (51.0)	120	300	172 (27)	0.06 (0.027)	G2A139
	2 (51.0)	240	300	172 (27)	0.06 (0.027)	G2A98
	2 (51.0)	120	400	230 (36)	0.06 (0.027)	G2A153
	2 (51.0)	240	400	230 (36)	0.06 (0.027)	G2A146
	2 (51.0)	120	500	282 (44)	0.06 (0.027)	G2A95
	2 (51.0)	240	500	282 (44)	0.06 (0.027)	G2A97
	2 1/4 (57.0)	120	75	37 (6)	0.07 (0.032)	G2E88
	2 1/4 (57.0)	120	125	62 (10)	0.07 (0.032)	G2E89

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Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.

Cartridge/Insertion Heaters



FIREROD Cartridge Heaters

Heater Part Numbers

Diameter in.	Sheath Length in. (mm)	Volts	Watts	Watt Density W/in ² (W/cm ²)		Approx. Net Wt. lbs (kg)		Part Number
3/8	2 1/4 (57.0)	240	125	62	(10)	0.07	(0.032)	G2E138
	2 1/4 (57.0)	240	150	73	(11)	0.07	(0.032)	G2E68
	2 1/4 (57.0)	120	175	86	(13)	0.07	(0.032)	G2E90
	2 1/4 (57.0)	120	250	123	(19)	0.07	(0.032)	G2E2
	2 1/4 (57.0)	240	250	123	(19)	0.07	(0.032)	G2E78
	2 1/4 (57.0)	120	300	148	(23)	0.07	(0.032)	G2E108
	2 1/4 (57.0)	240	300	148	(23)	0.07	(0.032)	G2E12
	2 1/4 (57.0)	120	350	173	(27)	0.07	(0.032)	G2E91
	2 1/4 (57.0)	240	350	173	(27)	0.07	(0.032)	G2E75
	2 1/2 (64.0)	120	200	87	(13)	0.07	(0.032)	G2J110
	2 1/2 (64.0)	240	200	87	(13)	0.07	(0.032)	G2J81
	2 1/2 (64.0)	120	250	108	(17)	0.07	(0.032)	G2J46
	2 1/2 (64.0)	240	250	108	(17)	0.07	(0.032)	G2J80
	2 1/2 (64.0)	120	300	130	(20)	0.07	(0.032)	G2J118
	2 1/2 (64.0)	240	300	130	(20)	0.07	(0.032)	G2J119
	2 1/2 (64.0)	120	400	174	(27)	0.07	(0.032)	G2J26
	2 1/2 (64.0)	240	400	174	(27)	0.07	(0.032)	G2J146
	2 1/2 (64.0)	120	500	216	(33)	0.07	(0.032)	G2J109
	2 1/2 (64.0)	240	500	216	(33)	0.07	(0.032)	G2J52
	3 (76.0)	120	100	34	(5)	0.08	(0.036)	G3A55
	3 (76.0)	240	100	34	(5)	0.08	(0.036)	G3A137
	3 (76.0)	120	150	52	(8)	0.08	(0.036)	G3A121
	3 (76.0)	120	200	69	(11)	0.08	(0.036)	G3A61
	3 (76.0)	240	200	69	(11)	0.08	(0.036)	G3A39
	3 (76.0)	120	250	86	(13)	0.08	(0.036)	G3A52
	3 (76.0)	240	250	86	(13)	0.08	(0.036)	G3A54
	3 (76.0)	120	300	104	(16)	0.08	(0.036)	G3A73
	3 (76.0)	240	300	104	(16)	0.08	(0.036)	G3A92
	3 (76.0)	120	400	138	(21)	0.08	(0.036)	G3A44
	3 (76.0)	240	400	138	(21)	0.08	(0.036)	G3A65
	3 (76.0)	120	500	173	(27)	0.08	(0.036)	G3A119
	3 (76.0)	240	500	173	(27)	0.08	(0.036)	G3A120
	3 (76.0)	240	600	208	(32)	0.08	(0.036)	G3A133
	3 1/2 (89.0)	120	250	72	(11)	0.09	(0.041)	G3J77
	3 1/2 (89.0)	240	250	72	(11)	0.09	(0.041)	G3J65
	3 1/2 (89.0)	120	300	87	(13)	0.09	(0.041)	G3J87
	3 1/2 (89.0)	240	300	87	(13)	0.09	(0.041)	G3J68
	3 1/2 (89.0)	120	500	144	(22)	0.09	(0.041)	G3J22
	3 1/2 (89.0)	240	500	144	(22)	0.09	(0.041)	G3J63
	4 (102.0)	120	125	31	(5)	0.09	(0.041)	G4A54
	4 (102.0)	240	125	31	(5)	0.09	(0.041)	G4A163
	4 (102.0)	120	150	37	(6)	0.09	(0.041)	G4A78
	4 (102.0)	120	175	43	(7)	0.09	(0.041)	G4A191
	4 (102.0)	120	250	62	(10)	0.09	(0.041)	G4A40
	4 (102.0)	240	250	62	(10)	0.09	(0.041)	G4A87
	4 (102.0)	120	300	74	(11)	0.09	(0.041)	G4A94
	4 (102.0)	240	300	74	(11)	0.09	(0.041)	G4A95
	4 (102.0)	120	400	99	(15)	0.09	(0.041)	G4A48
	4 (102.0)	240	400	99	(15)	0.09	(0.041)	G4A44
	4 (102.0)	240	450	109	(17)	0.09	(0.041)	G4A64
	4 (102.0)	120	500	123	(19)	0.09	(0.041)	G4A96
	4 (102.0)	240	500	123	(19)	0.09	(0.041)	G4A92

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FIREROD Cartridge Heaters

Heater Part Numbers

Diameter in.	Sheath Length in. (mm)	Volts	Watts	Watt Density W/in ² (W/cm ²)	Approx. Net Wt. lbs (kg)	Part Number
3/8	4 (102.0)	120	550	134 (21)	0.09 (0.041)	G4A200
	4 1/4 (108.0)	240	300	67 (10)	0.09 (0.041)	G4E25
	4 1/4 (108.0)	240	750	167 (26)	0.09 (0.041)	G4E15
	4 1/2 (114.0)	120	300	65 (10)	0.10 (0.045)	G4J54
	4 1/2 (114.0)	240	300	65 (10)	0.10 (0.045)	G4J33
	4 1/2 (114.0)	120	500	108 (17)	0.10 (0.045)	G4J55
	4 1/2 (114.0)	240	500	108 (17)	0.10 (0.045)	G4J37
	5 (127.0)	120	150	29 (4)	0.11 (0.050)	G5A68
	5 (127.0)	240	150	29 (4)	0.11 (0.050)	G5A56
	5 (127.0)	120	300	58 (9)	0.11 (0.050)	G5A69
	5 (127.0)	240	300	58 (9)	0.11 (0.050)	G5A70
	5 (127.0)	120	500	96 (15)	0.11 (0.050)	G5A38
	5 (127.0)	240	500	96 (15)	0.11 (0.050)	G5A71
	5 (127.0)	240	750	144 (22)	0.11 (0.050)	G5A67
	5 (127.0)	240	1000	192 (30)	0.11 (0.050)	G5A115
	5 1/4 (133.0)	240	200	45 (7)	0.12 (0.054)	G5E16
	5 1/2 (140.0)	240	600	104 (16)	0.12 (0.054)	G5J36
	5 1/2 (140.0)	240	1000	173 (27)	0.12 (0.054)	G5J45
	6 (152.0)	120	200	31 (5)	0.13 (0.059)	G6A80
	6 (152.0)	120	250	39 (6)	0.13 (0.059)	G6A40
	6 (152.0)	240	250	39 (6)	0.13 (0.059)	G6A92
	6 (152.0)	120	400	63 (10)	0.13 (0.059)	G6A81
	6 (152.0)	240	400	63 (10)	0.13 (0.059)	G6A82
	6 (152.0)	120	500	79 (12)	0.13 (0.059)	G6A125
	6 (152.0)	240	500	79 (12)	0.13 (0.059)	G6A59
	6 (152.0)	120	600	94 (15)	0.13 (0.059)	G6A56
	6 (152.0)	240	600	94 (15)	0.13 (0.059)	G6A51
	6 (152.0)	240	750	117 (18)	0.13 (0.059)	G6A46
	6 (152.0)	240	1000	157 (24)	0.13 (0.059)	G6A83
	6 1/2 (165.0)	240	600	86 (13)	0.14 (0.064)	G6J23
	6 1/2 (165.0)	240	1000	144 (22)	0.14 (0.064)	G6J33
	7 (178.0)	120	250	33 (5)	0.14 (0.064)	G7A40
	7 (178.0)	240	250	33 (5)	0.14 (0.064)	G7A32
	7 (178.0)	240	500	65 (10)	0.14 (0.064)	G7A30
	7 (178.0)	120	600	80 (12)	0.14 (0.064)	G7A41
	7 (178.0)	240	600	80 (12)	0.14 (0.064)	G7A42
	7 (178.0)	240	1000	133 (21)	0.14 (0.064)	G7A43
	7 1/2 (191.0)	240	600	74 (11)	0.15 (0.068)	G7J27
	7 1/2 (191.0)	240	1000	124 (19)	0.15 (0.068)	G7J28
	8 (203.0)	120	300	34 (5)	0.16 (0.073)	G8A54
	8 (203.0)	240	300	34 (5)	0.16 (0.073)	G8A47
	8 (203.0)	120	400	45 (7)	0.16 (0.073)	G8A109
	8 (203.0)	120	500	58 (9)	0.16 (0.073)	G8A81
	8 (203.0)	240	500	58 (9)	0.16 (0.073)	G8A32
	8 (203.0)	120	600	69 (11)	0.16 (0.073)	G8A53
	8 (203.0)	240	600	69 (11)	0.16 (0.073)	G8A37
	8 (203.0)	240	700	79 (12)	0.16 (0.073)	G8A98
	8 (203.0)	240	1000	115 (18)	0.16 (0.073)	G8A45
	9 (229.0)	240	1000	100 (16)	0.18 (0.082)	G9A37
	9 1/2 (241.0)	240	600	57 (9)	0.19 (0.086)	G9J20
	9 1/2 (241.0)	240	1000	96 (15)	0.19 (0.086)	G9J12
	10 (254.0)	120	400	36 (6)	0.19 (0.086)	G10A48

CONTINUED

Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.



FIREROD Cartridge Heaters

Heater Part Numbers

Diameter in.	Sheath Length in. (mm)	Volts	Watts	Watt Density W/in ² (W/cm ²)	Approx. Net Wt. lbs (kg)	Part Number
3/8	10 (254.0)	120	600	54 (8)	0.19 (0.086)	G10A35
	10 (254.0)	240	600	54 (8)	0.19 (0.086)	G10A31
	10 (254.0)	240	1000	91 (14)	0.19 (0.086)	G10A32
	12 (305.0)	120	400	30 (5)	0.22 (0.100)	G12A45
	12 (305.0)	120	600	45 (7)	0.22 (0.100)	G12A29
	12 (305.0)	240	600	45 (7)	0.22 (0.100)	G12A46
	12 (305.0)	240	1000	75 (12)	0.22 (0.100)	G12A47

CONTINUED

Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.