

CARTRIDGE HEATERS

component parts



WATTCO™



OVERVIEW

WATTCO™ cartridge heaters are made of a swaged construction that consists in a high-grade nickel chromium resistance wire wound around a high-quality MgO core that is centered in a stainless steel casing.

Cartridge heaters are used for several heating metal parts and can be fitted with threaded bushings for liquid heating for certain applications. Cartridge heaters will reach metal temperatures of up to 1400°F (760°C) with the appropriate material, watt density, and fit selections (see Figure 2 on Page 7.2). Maximize element life and value with WATTCO™ cartridge heaters.

FEATURES

KEY FEATURES

- Main components:
 - High-grade nickel chromium resistance wire
 - MgO core
 - Stainless steel casing
 - Stranded leads with silicon-impregnated mica glass insulation
- Special sizes, wattages, and materials are available upon request.

BENEFITS

- Easy and economical to install
- Designed with first-class materials
- Maximized heat transfer
- Easy to maintain
- Uniform temperatures
- Built solidly
- Oxidation and corrosion resistant
- Durable



SELECTING

WATTCO™ CARTRIDGE HEATER

The following sections will help you select the WATTCO™ cartridge heater that meets the requirements of your application.

NEED ASSISTANCE?

Please call us at 1-800-4WATTCO (1-800-492-8826) for further information or assistance.

FACTORS

Please consider the following factors in order to select the right cartridge heater.

- Operating temperature
- Watt density of the heating element
- Sheath material (corrosive or non corrosive)
 - Temperature of the corrodent
 - Degree of aeration of exposed corrodent
 - Velocity of the corrodent

Please consult the following chart as a reference guide.

APPLICATIONS	SHEATH MATERIAL
Molds Metal dies Platens Hot plates Sealing tools Fluid heating Aerospace Semiconductor	Stainless Steel Incoloy® (available upon request, please consult factory)
Food service and medical equipment Deionized water	Stainless steel
General applications	Incoloy®
Highly corrosive applications	Titanium

Incoloy® is a registered trademark of Inco Alloys International

HOW

TO INSTALL CARTRIDGE HEATER:

- Make a hole in the section that is to be heated (see Figure 2 to find out about proper hole diameter and tolerance).
- Ream a smooth hole for contact and for better heat transfer.
- Extend the hole through the section so that the unit can be driven out if you should need to remove it.
- If making a through hole is impossible, increase the size of the hole without exceeding the tolerances shown in Figure 2.
- Reduce the vibration and flexing of the lead wires to prolong service life.
- Prevent contamination from liquids by protecting the end of the heater.

FIG. 2 - WATT DENSITY VS. FIT TOLERANCE AND WORK TEMPERATURE

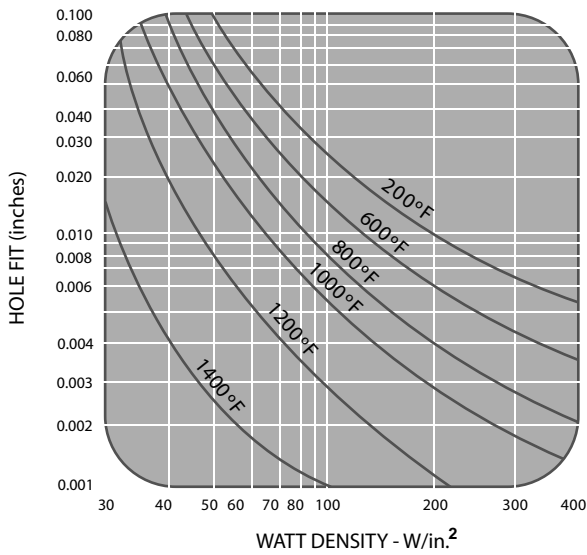
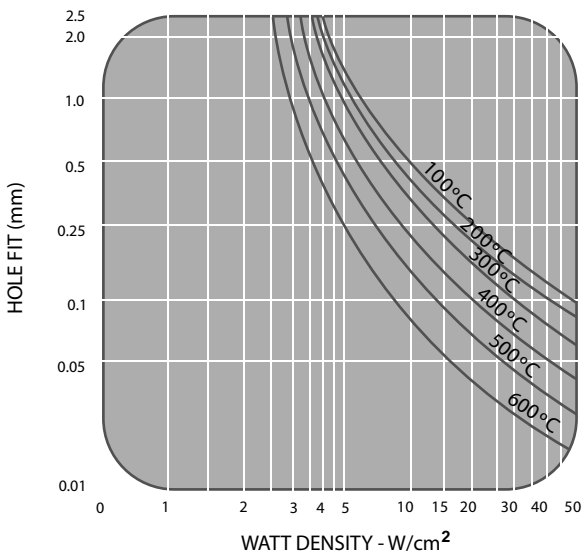


FIG. 3 – SUGGESTED WATT DENSITY FOR HEATING METAL PARTS



WHEN ORDERING, PLEASE SPECIFY: Quantity, catalogue number, tension, wattage, diameter, length of cartridge, length of lead, and extra features.

TOLERANCES

Please refer to this chart to learn more about the allowed manufacturing tolerances:

MANUFACTURING TOLERANCES	
Resistance tolerance	+ 10% - 5%
Wattage tolerance (at rated tension)	+5%, -10%
Diameter tolerance	±0.002"
Length tolerance	±1/16" or 1.5% of length
Maximum sheath temperature	1400°F

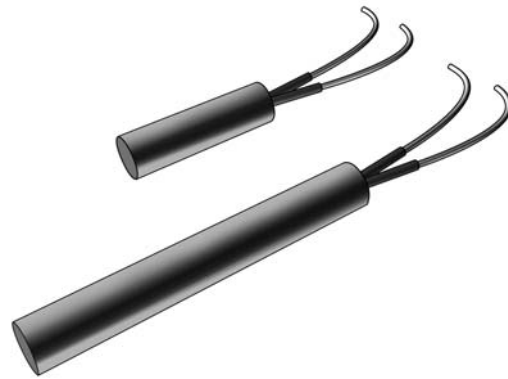


FIG. 4 – DETERMINING THE PROPER FIT

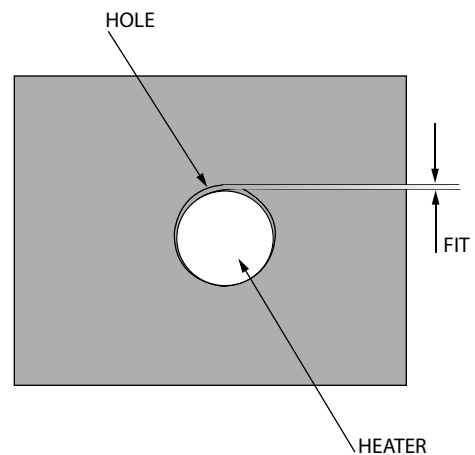




TABLE 1
Standard Watt Density Cartridge Heaters

SHEATH LENGTH		WATTS	WATT DENSITY		CATALOG NUMBER	
in.	mm		W/in. ²	W/cm ²	120V	240V
1/4" HOLE DIAMETER (0.247" SHEATH DIAMETER)						
1	25.4	80	208	32.2	WC20100801	WC20100802
1	25.4	100	260	40.3	WC20101001	WC20101002
1	25.4	150	390	60.5	WC20101501	WC20101502
1 1/4	31.8	225	390	60.5	WC201A2251	WC201A2252
1 1/2	38.1	125	140	21.7	WC201C1251	WC201C1252
1 1/2	38.1	175	228	35.3	WC201C1751	WC201C1752
1 1/2	38.1	250	325	50.4	WC201C2501	WC201C2502
2	50.8	100	87	13.5	WC20201001	WC20201002
2	50.8	150	130	20.2	WC20201501	WC20201502
2	50.8	200	173	26.8	WC20202001	WC20202002
2	50.8	250	215	33.3	WC20202501	WC20202502
2	50.8	300	260	40.3	WC20203001	WC20203002
3	76.2	200	104	16.1	WC20302001	WC20302002
3	76.2	300	156	24.2	WC20303001	WC20303002
4	101.6	300	111	17.2	WC20403001	WC20403002
5	127.0	350	101	15.7	WC20503501	WC20503502
6	152.4	400	94	14.6	WC20604001	WC20604002
3/8" HOLE DIAMETER (0.372" SHEATH DIAMETER)						
1	25.4	55	95	14.7	WC30100551	WC30100552
1	25.4	100	172	26.7	WC30101001	WC30101002
1	25.4	150	259	40.1	WC30101501	WC30101502
1	25.4	200	344	53.3	WC30102001	WC30102002
1 1/4	31.8	125	144	22.3	WC301A1251	WC301A1252
1 1/4	31.8	150	172	26.7	WC301A1501	WC301A1502
1 1/2	38.1	30	32	5.0	WC301C0301	WC301C0302
1 1/2	38.1	50	53	8.2	WC301C0501	WC301C0502
1 1/2	38.1	85	68	10.5	WC301C0851	WC301C0852
1 1/2	38.1	100	86	13.3	WC301C1001	WC301C1002
1 1/2	38.1	150	129	20.0	WC301C1501	WC301C1502
1 1/2	38.1	200	173	26.8	WC301C2001	WC301C2002
1 1/2	38.1	250	216	33.5	WC301C2501	WC301C2502
2	50.8	50	29	4.5	WC30200501	WC30200502
2	50.8	75	42	6.5	WC30200751	WC30200752
2	50.8	100	57	8.8	WC30201001	WC30201002
2	50.8	150	86	13.3	WC30201501	WC30201502
2	50.8	200	115	17.8	WC30202001	WC30202002
2	50.8	250	144	22.3	WC30202501	WC30202502
2	50.8	300	172	26.7	WC30203001	WC30203002
2	50.8	400	230	35.7	WC30204001	WC30204002
2 1/2	63.5	500	216	33.5	WC302C5001	WC302C5002
3	76.2	100	34	5.3	WC30301001	WC30301002
3	76.2	150	52	8.1	WC30301501	WC30301502
3	76.2	200	69	10.7	WC30302001	WC30302002
3	76.2	250	86	13.3	WC30302501	WC30302502
3	76.2	300	104	16.1	WC30303001	WC30303002
3	76.2	400	138	21.4	WC30304001	WC30304002
3	76.2	500	173	26.8	WC30305001	WC30305002
3 1/2	88.9	300	87	13.5	WC303C3001	WC303C3002
3 1/2	88.9	500	144	22.3	WC303C5001	WC303C5002
4	101.6	150	37	5.7	WC30401501	WC30401502
4	101.6	250	62	9.6	WC30402501	WC30402502
4	101.6	400	99	15.3	WC30404001	WC30404002
4	101.6	500	123	19.1	WC30405001	WC30405002
4 1/2	114.3	300	65	10.1	WC304C3001	WC304C3002
5	127.0	150	29	4.5	WC30501501	WC30501502
5	127.0	200	39	6.0	WC30502001	WC30502002
5	127.0	500	96	14.9	WC30505001	WC30505002
5	127.0	750	144	22.3	WC30507501	WC30507502
6	152.4	200	31	4.8	WC30602001	WC30602002

WHEN ORDERING, PLEASE SPECIFY: Quantity, catalogue number, tension, wattage, diameter, length of cartridge, length of lead, and extra features.

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TABLE 1

Standard Watt Density Cartridge Heaters

...continued

SHEATH LENGTH		WATTS	WATT DENSITY		CATALOG NUMBER	
in.	mm		W/in. ²	W/cm ²	120V	240V
3/8" HOLE DIAMETER (0.372" SHEATH DIAMETER)						
6	152.4	250	39	6.0	WC30602501	WC30602502
6	152.4	400	63	9.8	WC30604001	WC30604002
6	152.4	600	94	14.6	WC30606001	WC30606002
6	152.4	750	117	18.1	WC30607501	WC30607502
6	152.4	1000	157	24.3	WC306010001	WC306010002
7	177.8	250	33	5.1	WC30702501	WC30702502
7	177.8	600	80	12.4	WC30706001	WC30706002
7	177.8	1000	133	20.6	WC307010001	WC307010002
8	203.2	300	34	5.3	WC30803001	WC30803002
8	203.2	500	58	9.0	WC30805001	WC30805002
8	203.2	1000	115	17.8	WC308010001	WC308010002
10	254.0	600	54	8.4	WC3106001	WC3106002
10	254.0	1000	91	14.1	WC31010001	WC31010002
12	304.8	400	30	4.7	WC3124001	WC3124002
12	304.8	600	45	7.0	WC3126001	WC3126002
12	304.8	1000	75	11.6	WC31210001	WC31210002
1/2" HOLE DIAMETER (0.497" SHEATH DIAMETER)						
1	25.4	50	65	10.1	WC50100501	WC50100502
1	25.4	150	193	29.9	WC50101501	WC50101502
1 1/4	31.8	125	107	16.6	WC501A1201	WC501A1202
1 1/4	31.8	200	172	26.6	WC501A2001	WC501A2002
1 1/2	38.1	150	97	15.0	WC501C1501	WC501C1502
1 1/2	38.1	200	128	19.8	WC501C2001	WC501C2002
2	50.8	200	86	13.3	WC50202001	WC50202002
2	50.8	250	108	16.7	WC50202501	WC50202502
2	50.8	300	128	19.8	WC50203001	WC50203002
2	50.8	400	171	26.5	WC50204001	WC50204002
2 1/4	57.2	75	28	4.3	WC502A0751	WC502A0752
2 1/4	57.2	125	46	7.1	WC502A1251	WC502A1252
2 1/4	57.2	250	92	14.3	WC502A2501	WC502A2502
2 1/4	57.2	400	147	22.8	WC502A4001	WC502A4002
2 3/8	60.3	100	34	5.3	WC502B1001	WC502B1002
2 3/8	60.3	250	86	13.3	WC502B2501	WC502B2502
2 1/2	63.5	100	32	5.0	WC502C1001	WC502C1002
2 1/2	63.5	300	96	14.9	WC502C3001	WC502C3002
2 1/2	63.5	400	128	19.8	WC502C4001	WC502C4002
2 1/2	63.5	500	161	25.0	WC502C5001	WC502C5002
3	76.2	125	32	5.0	WC50301251	WC50301252
3	76.2	250	64	9.9	WC50302501	WC50302502
3	76.2	400	104	16.1	WC50304001	WC50304002
3	76.2	500	129	20.0	WC50305001	WC50305002
3	76.2	600	154	23.9	WC50306001	WC50306002
3	76.2	750	193	29.9	WC50307501	WC50307502
3 1/2	88.9	250	54	8.4	WC503C2501	WC503C2502
3 1/2	88.9	500	107	16.6	WC503C5001	WC503C5002
4	101.6	150	28	4.3	WC50401501	WC50401502
4	101.6	250	46	7.1	WC50402501	WC50402502
4	101.6	350	65	10.1	WC50403501	WC50403502
4	101.6	400	74	11.5	WC50404001	WC50404002
4	101.6	500	92	14.3	WC50405001	WC50405002
4	101.6	750	138	21.4	WC50407501	WC50407502
4	101.6	1000	184	28.5	WC504010001	WC504010002
5	127.0	250	38	5.9	WC50502501	WC50502502
5	127.0	350	50	7.8	WC50503501	WC50503502
5	127.0	400	58	9.0	WC50504001	WC50504002
5	127.0	500	72	11.2	WC50505001	WC50505002

WHEN ORDERING, PLEASE SPECIFY: Quantity, catalogue number, tension, wattage, diameter, length of cartridge, length of lead, and extra features.



TABLE 1
Standard Watt Density Cartridge Heaters

...continued

SHEATH LENGTH		WATTS	WATT DENSITY		CATALOG NUMBER	
in.	mm		W/in. ²	W/cm ²	120V	240V
1/2" HOLE DIAMETER (0.497" SHEATH DIAMETER)						
5	127.0	750	108	16.7	WC50507501	WC50507502
5	127.0	1000	143	22.2	WC505010001	WC505010002
5 1/2	139.7	500	64	9.9	WC505C5001	WC505C5002
5 1/2	139.7	750	97	15.0	WC505C7501	WC505C7502
6	152.4	300	35	5.4	WC50603001	WC50603002
6	152.4	500	59	9.1	WC50605001	WC50605002
6	152.4	750	88	13.6	WC50607501	WC50607502
6	152.4	1000	117	18.1	WC506010001	WC506010002
6 1/2	165.1	1000	108	16.7	WC506C10001	WC506C10002
7	177.8	500	50	7.8	WC50705001	WC50705002
7	177.8	1000	99	15.3	WC507010001	WC507010002
8	203.2	300	26	4.0	WC50803001	WC50803002
8	203.2	500	43	6.7	WC50805001	WC50805002
8	203.2	1000	86	13.3	WC508010001	WC508010002
8	203.2	1500	129	20.0	WC508015001	WC508015002
8	203.2	2000	172	26.7	WC508020001	WC508020002
9	228.6	500	38	5.9	WC50905001	WC50905002
9	228.6	1000	76	11.8	WC509010001	WC509010002
10	254.0	500	34	5.3	WC51005001	WC51005002
10	254.0	1000	68	10.5	WC510010001	WC510010002
10	254.0	1500	102	15.8	WC510015001	WC510015002
10	254.0	2000	136	21.1	WC510020001	WC510020002
12	304.8	550	30	4.7	WC51205001	WC51205002
12	304.8	1000	56	8.7	WC512010001	WC512010002
12	304.8	1500	84	13.0	WC512015001	WC512015002
12	304.8	2000	112	17.4	WC512020001	WC512020002
14	355.6	2300	110	17.1	WC514023001	WC514023002
18	457.2	1700	62	9.6	WC518017001	WC518017002
5/8" HOLE DIAMETER (0.622" SHEATH DIAMETER)						
1 1/4	31.8	50	34	5.3	WC601A0501	WC601A0502
1 1/4	31.8	200	137	21.2	WC601A2001	WC601A2002
1 1/4	31.8	250	171	26.5	WC601A2501	WC601A2502
2	50.8	100	34	5.3	WC60201001	WC60201002
2	50.8	200	68	10.5	WC60202001	WC60202002
2 1/4	57.2	100	29	4.9	WC602A1001	WC602A1002
2 1/4	57.2	350	103	16.0	WC602A3501	WC602A3502
2 3/8	60.3	280	77	11.9	WC602B2801	WC602B2802
3	76.2	150	31	4.8	WC60301501	WC60301502
3	76.2	250	51	7.9	WC60302501	WC60302502
3	76.2	500	102	15.8	WC60305001	WC60305002
3	76.2	750	154	23.9	WC60307501	WC60307502
3 3/4	95.3	525	82	12.7	WC603E5251	WC603E5252
4	101.6	250	37	5.7	WC60402501	WC60402502
4	101.6	400	58	9.0	WC60404001	WC60404002
4	101.6	500	73	11.3	WC60405001	WC60405002
4	101.6	600	88	13.6	WC60406001	WC60406002
4	101.6	750	110	17.1	WC60407501	WC60407502
4	101.6	1000	146	22.6	WC604010001	WC604010002
5	127.0	250	28	4.3	WC60502501	WC60502502
5	127.0	500	57	8.8	WC60505001	WC60505002
5	127.0	750	86	13.3	WC60507501	WC60507502
5	127.0	1000	114	17.7	WC605010001	WC605010002
5 1/8	139.7	285	32	5.0	WC605A2851	WC605A2852
6	152.4	300	28	4.3	WC60603001	WC60603002
6	152.4	500	47	7.3	WC60605001	WC60605002
6	152.4	1000	93	14.4	WC606010001	WC606010002
6	152.4	1500	140	21.7	WC606015001	WC606015002

WHEN ORDERING, PLEASE SPECIFY: Quantity, catalogue number, tension, wattage, diameter, length of cartridge, length of lead, and extra features.

CARTRIDGE HEATERS

component parts



TABLE 1

Standard Watt Density Cartridge Heaters

...continued

SHEATH LENGTH in.	mm	WATTS	WATT DENSITY		CATALOG NUMBER	
			W/in. ²	W/cm ²	120V	240V
5/8" HOLE DIAMETER (0.622" SHEATH DIAMETER)						
7	177.8	500	39	6.0	WC60705001	WC60705002
7	177.8	1000	79	12.2	WC607010001	WC607010002
7	177.8	1500	118	18.3	WC607015001	WC607015002
8	203.2	500	34	5.3	WC60805001	WC60805002
8	203.2	850	58	9.0	WC60808501	WC60808502
8	203.2	1000	68	10.5	WC608010001	WC608010002
8	203.2	1500	102	15.8	WC608015001	WC608015002
10	254.0	500	27	4.2	WC61005001	WC61005002
10	254.0	1000	54	8.4	WC610010001	WC610010002
10	254.0	1500	81	12.6	WC610015001	WC610015002
10	254.0	2000	108	16.7	WC610020001	WC610020002
12	304.8	500	22	3.4	WC61205001	WC61205002
12	304.8	1000	45	7.0	WC612010001	WC612010002
12	304.8	1500	67	10.4	WC612015001	WC612015002
14	355.6	3700	140	21.7	WC614037001	WC614037002
15	381.0	2400	84	13.0	WC615024001	WC615024002
16	406.4	4500	148	22.9	WC616045001	WC616045002
18	457.2	1500	44	6.8	WC618015001	WC618015002
18	457.2	3000	87	13.5	WC618030001	WC618030002
18	457.2	4700	137	21.2	WC618047001	WC618047002
20	508.0	4700	123	19.1	WC620047001	WC620047002
36	914.4	3000	43	6.7	WC636030001	WC636030002
3/4" HOLE DIAMETER (0.747" SHEATH DIAMETER)						
2 1/4	57.2	200	49	7.6	WC702A2001	WC702A2002
3	76.2	250	43	6.7	WC70302501	WC70302502
3	76.2	500	85	13.2	WC70305001	WC70305002
4	101.6	500	61	9.5	WC70405001	WC70405002
4	101.6	1000	122	18.9	WC704010001	WC704010002
5	127.0	300	28	4.3	WC70503001	WC70503002
5	127.0	500	47	7.3	WC70505001	WC70505002
5	127.0	1000	95	14.7	WC705010001	WC705010002
6	152.4	500	39	6.0	WC70605001	WC70605002
6	152.4	1000	78	12.1	WC706010001	WC706010002
6	152.4	1500	116	18.0	WC706015001	WC706015002
6	152.4	2000	155	24.0	WC706020001	WC706020002
7	177.8	500	33	5.1	WC70705001	WC70705002
7	177.8	1000	66	10.2	WC707010001	WC707010002
8	203.2	500	28	4.3	WC70805001	WC70805002
8	203.2	1000	57	8.8	WC708010001	WC708010002
8	203.2	2000	114	17.7	WC708020001	WC708020002
10	254.0	1000	45	7.0	WC710010001	WC710010002
10	254.0	2000	90	14.0	WC710020001	WC710020002
12	304.8	1000	37	5.7	WC712010001	WC712010002
12	304.8	2000	74	11.5	WC712020001	WC712020002
12	304.8	4000	148	22.9	WC712040001	WC712040002
15	381.0	1500	44	6.8	WC715015001	WC715015002
16	406.4	1800	49	7.6	WC716018001	WC716018002
18	457.2	2000	49	7.6	WC718020001	WC718020002
20	508.0	1150	25	3.9	WC720011501	WC720011502
20	508.0	2250	49	7.6	WC720022501	WC720022502
20	508.0	5000	115	17.8	WC720050001	WC720050002
24	609.6	1375	25	3.9	WC724013751	WC724013752
24	609.6	2750	50	7.8	WC724027501	WC724027502
36	914.4	2500	30	4.7	WC736025001	WC736025002

WHEN ORDERING, PLEASE SPECIFY: Quantity, catalogue number, tension, wattage, diameter, length of cartridge, length of lead, and extra features.

EXTRA FEATURES AND MODIFICATIONS

EXTRA FEATURES	MODIFICATIONS
TENSIONS AND WATTAGES	WATTCO™ cartridge heaters can be custom build to suit other tensions and wattages upon request. Connecting series cartridges on line tensions of more than 300V is not recommended. Please call us at 1-800-4WATTCO (1-800-492-8826) for further details or assistance.
LENGTHS	WATTCO™ cartridge heaters can be specially configured to any length, up to 100 inches. With longer lengths, special equipment will be necessary for accurate drilling and reaming holes.
SHEATH MATERIALS	WATTCO™ standard cartridge heaters are made from grade 321 stainless steel. Should you need special requirements, please call us at 1-800-492-8826.
MOISTURE-RESISTANCE	WATTCO™ cartridge heaters are supplied with welded end cap that acts as a gas tight seal. The alternative options for lead wire construction are: <ul style="list-style-type: none"> • Silicon potting • Teflon seals • Teflon leads Please call us at 1-800-4WATTCO (1-800-492-8826) for assistance.
LEAD WIRE LENGTH	WATTCO™ cartridge heaters are supplied with standard 10" long fiberglass insulated nickel leads. Longer leads or spliced leads to stock units are available upon request.
PROTECTIVE LEAD COVERS	WATTCO™ provides cable or stainless steel braided sleeving for additional mechanical protection over the lead wires.
THERMOCOUPLE	Built-in J or K thermocouples are available for any WATTCO™ cartridge heater.
GROUND WIRE	For special code requirements, request that an additional ground wire be fixed to the sheath.
THREADED BUSHING	For immersed applications, request welded single-ended and double-ended stainless steel bushings. Please call us at 1-800-4WATTCO (1-800-492-8826) for density information.

WHEN ORDERING, PLEASE SPECIFY: Quantity, catalogue number, and extra features.

THREADED BUSHING (FIG. 1-2)

For liquid immersion heating applications under 750°F, use brass.
For applications over 750°F, use stainless steel.

CART. DIA.	A DIM. mm	B DIM. mm	STD. TAPER PIPE THD.
1/4"	11.9	15.2	1/8" NPT
3/8"	15.7	17.2	1/4" NPT
1/2"	17.2	21.7	3/8" NPT
5/8"	22.5	24.2	1/2" NPT
3/4"	26.8	26.5	3/4" NPT
1 19/64"	44.5	34.9	1 1/4" NPT

CART. DIA.	A DIM. mm	B DIM. mm	C DIM. mm	STD. TAPER PIPE THD.
1/4"	11.9	24.8	9.6	1/8" NPT
3/8"	15.7	27.6	10.4	1/4" NPT
1/2"	17.2	35.6	13.9	3/8" NPT
5/8"	22.1	38.2	16	1/2" NPT
3/4"	26.8	43.2	16.7	3/4" NPT
1 19/64"	44.5	60.3	25.4	1 1/4" NPT



FIG. 1

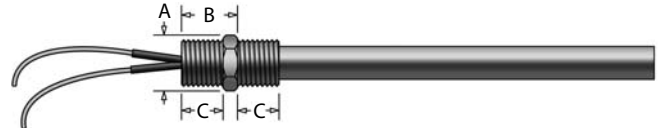


FIG. 2