

# Experience Our Value-Added Services that are Second to None

## Casting Alloys

Casting Alloy	Aluminum	Copper	Silicone	Zinc	Lead	Maximum Iron	Tin	Other
Aluminum 319	85.8 - 91.58%	3.0 - 4.0%	5.50 - 6.50%	≤ 1.0%	—	≤ 1.0%	—	≤ 1.7%
Aluminum 356	90.1 - 93.3 %	≤ 0.25%	6.50 - 7.50%	≤ 0.35%	—	≤ 0.60%	—	≤ 1.125%
Bronze	9.0 - 11.0%	≥ 86.0%	—	—	—	0.80 - 1.50%	—	≤ 1%
Yellow Brass	≤ 0.55%	58.0 - 64.0%	≤ 0.05%	32.0 - 40.0%	0.80 - 1.50%	≤ 0.70%	0.50 - 1.50%	≤ 1%

## Material Properties

Material	Classification	Max. Surface Temperature °F (°C)	Density (lb/in <sup>3</sup> )	Coefficient of Linear Thermal Expansion (in/in/°F × 10 <sup>-6</sup> )	Specific Heat Capacity (BTU/lb-°F)	Thermal Conductivity (BTU-in/hr-ft <sup>2</sup> -°F)	Melting Point (°F)
Aluminum 319	Aluminum 319.0	700 (371)	0.101	12.7 @ 68° - 572°F	0.23	754	960 - 1120
Aluminum 356	Aluminum 356.0	750 (399)	0.0968	12.9 @ 68° - 572°F	0.23	1160	1030 - 1140
Bronze	UNS C95300	1350 (732)	0.272	9 @ 68° - 572°F	0.0896	437	1900 - 1913
Yellow Brass	UNS C85700	1200 (649)	0.304	12.2 @ 68° - 500°F	0.0899	582	1660 - 1690

Linear Thermal Expansion Formula:  $\Delta L = L_i \times \alpha \times (T_f - T_i) \times 10^{-6}$

$\Delta L$  = Change in Length

$L_i$  = Initial Length       $\alpha$  = Coefficient of Linear Thermal Expansion

$T_f$  = Final Temperature       $T_i$  = Initial Temperature

### Minimum Casting Thickness vs. Heating Element and/or Cooling Tube Diameters

Casting Thickness	Maximum Available Element Diameter	Maximum Available Cooling Tube Diameter	Maximum Element and Cooling Tube Combination
	Heat Only	Cool Only	Heat and Cool
5/8" (15.9 mm)	.260	1/4	—
3/4" (19.1 mm)	.375	3/8	—
1" (25.4 mm)	.430	1/2	—
1-1/4" (31.8 mm)	.430	1/2	.260 and 3/8
1-3/8" (34.9 mm)	.430	1/2	.315 and 1/2
1-1/2" (38.1 mm)	.430	1/2	.430 and 1/2
1-5/8" (41.3 mm)	.430	1/2	.430 and 1/2
1-3/4" (44.5 mm)	.430	1/2	.430 and 1/2
<b>Finned Casting</b>			
3/4" (19.1 mm)	.375	—	—
7/8" (22.2 mm)	.430	—	—
1" (25.4 mm)	.430	—	—
1-3/4" (44.5 mm)	.430	—	—

### Casting Size & Weight Limitations

	Cylindrical	Platen
Minimum Inside Diameter:	1" (25.4 mm)	—
Maximum Inside Diameter:	48" (1219 mm)	—
Minimum Width:	—	1-1/2" (38.1 mm)
Maximum Width:	—	60" (1524 mm)
Minimum Length:	1-3/4" (44.5 mm)	4" (102 mm)
Maximum Length:	40" (1016 mm)	72" (1829 mm)
Finish:	125 RMS Standard or to customer spec.	
Gap (two-piece cylindrical cast-in band heaters):	1/4" (6.4 mm) top and bottom or to customer specification	
Maximum Weight:	Aluminum— 600 pounds Bronze & Brass— 300 pounds	

**NOTES:** Cylindrical heaters are made with two half-round heaters. Cast-In thermal components can be made in any practical size, weight and geometric shape.

### Heating Element Electrical Specifications

Tubular Heater Diameter	.260"	.315"	.375"	.430"
Maximum Volts	240	277	480	600
Maximum Amps Per Element	15	30	40	40

Maximum Watt Density: Aluminum Alloy—35 W/in<sup>2</sup> on the element  
Bronze or Brass—45 W/in<sup>2</sup> on the element

Resistance Tolerance: +10%, -5%    Wattage Tolerance: +5%, -10%  
Three Phase available depending on casting size.  
Ground Studs can be added to most cast-ins.



**Note:** Tempco-Pak mineral insulated cable heaters can be used in place of tubular heating elements to fit physical constraints not possible with conventional heating elements. See catalog Section 5 for more details.

### Cooling Tube Materials for Castings with Liquid Cooling

Tube Material	Tube OD and Wall Thickness
Stainless Steel (Standard)	1/4" O.D. × .028 wall
Stainless Steel (Standard)	3/8" O.D. × .035 wall
Stainless Steel (Standard)	1/2" O.D. × .049 wall
Stainless Steel (Optional)	5/8" O.D. × .049 wall
Incoloy® 840 (Optional)	1/2" O.D. × .049 wall

Tubing with heavier wall thickness is available upon request.

### Options for Cast-In Thermal Components

#### Casting Surface Treatments

Special surface finishes are required in some applications:

- Electroless Nickel Plating
- Teflon®
- Magnaplate
- Anodizing
- Hard-Coat Anodizing

#### Lab Services

- Computerized Infrared Heating Profiles
- Life Cycle Testing
- X-Rays to confirm heating element location and casting density
- Heating Ramp Rate Testing

Agency C  US Approvals

Cast-In Heater Elements are UL recognized under  
UL File Number E90771.

If you require UL Agency Approval, please specify when ordering.