

## Pure Aluminum Heated Parts Reduce Silicon and Heavy Metal Contamination and Offer Increased Operating Temperatures

The need for maintaining an ultra pure environment has led to the development of pure aluminum cast-in heated parts. Watlow now has the capability to cast complex heated shapes in 99.7 percent pure aluminum that limits process contamination and offers increased operating temperatures up to 450°C (842°F).

Pure aluminum cast-in heated parts provide higher maximum operating temperatures over the more typical aluminum casting alloys. This equates to a 25 percent increase in process temperatures, resulting in an additional 90-130°C operating range. Thermal conductivity is also improved more than A356 alloy.

Designed and engineered to customer specifications, Watlow's low-pressure casting technique and CNC machining ensure consistent quality heated parts. Many types of tubing can be cast-in to produce a circulation heater or add cooling capability for heat/cool applications.

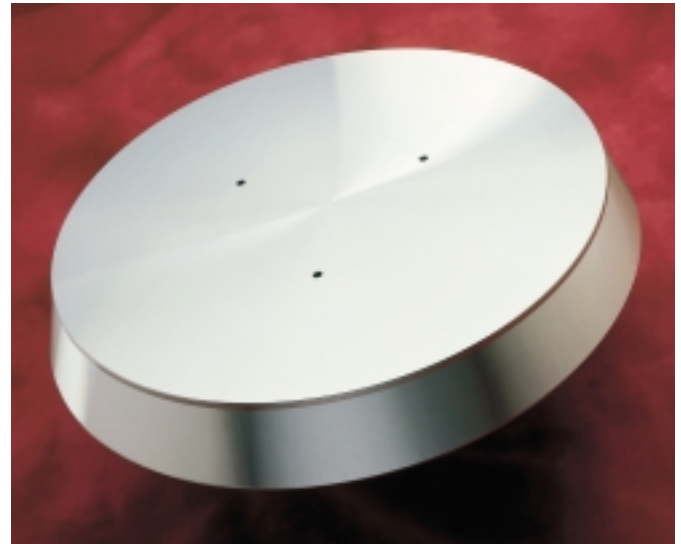
With a modern and innovative aluminum foundry on site, and over 75 years of experience in manufacturing heaters, Watlow has refined the technique to allow pure aluminum alloys to be cast with the same precision as more typical aluminum alloys.

Watlow's custom designs are backed by strong engineering support, expert heater knowledge, metallurgical expertise in foundry practice and precision machining using CAD/CAM/CAE and CNC manufacturing techniques.

Pure aluminum cast-in heated parts are produced at Watlow's ISO 9001 registered facility in Batavia, Illinois.

### Applications

- Semiconductor processing
- Foodservice equipment
- Packaging equipment
- Life science/medical equipment



### Features and Benefits

#### 99.7% pure aluminum

- Reduced risk of process contamination
- Allows increased operating temperatures

#### Low porosity

- Longer heater life
- Improved temperature uniformity
- Fewer defects in machined surfaces

#### Excellent temperature uniformity

- Provides better process yields



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BAT-PAL-60



## Properties and Characteristics of Aluminum Alloys

AA#	Thermal Properties				Mechanical Properties			
	Solidus Temperature °C (°F)		Thermal Conductivity W/m-K (BTU/ft*h*°F)		Tensile MPa (ksi)		Yield MPa (ksi)	
<b>Casting Alloys</b>								
319	515	(960)	109	(63)	235	(34)	130	(19)
356	555	(1035)	159	(92)	207	(30)	165	(24)
170.1	646	(1195)	234	(135)	76	(11)	28	(4)
<b>Wrought Alloys</b>								
1100	643	(1190)	222	(128)	90	(13)	34	(5)
5052	607	(1125)	91	(110)	193	(28)	90	(13)
5086	585	(1085)	127	(73.4)	60	(38)	115	(17)
6061	582	(1080)	180	(104)	310	(45)	276	(40)

## Chemical Compositions Comparisons of Common Aluminum Alloys (maximum limits)

AA#	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Sn	Ti	Other	% Al
<b>Casting Alloys</b>												
319	6.50	1.00	4.00	0.50	0.01	-	0.35	1.00	-	0.25	0.50	85.9
356	7.50	0.60	0.25	0.35	0.45	-	-	0.35	-	0.25	0.15	90.1
170.1	0.05	0.09	0.07	-	0.01	-	-	-	-	0.03	0.10	99.7
<b>Wrought Alloys</b>												
1100	1.0	-	0.05/0.20	0.05	-	-	-	0.10	-	-	0.15	99.0
5052	0.25	0.40	0.10	0.10	2.2/2.8	0.15/0.35	-	0.10	-	-	0.15	96.2
5086	0.40	0.50	-	0.2/0.7	3.5/4.5	-	-	0.25	-	0.15	0.15	94.1
6061	0.4/0.8	0.70	0.15/0.4	0.15	0.8/1.2	0.04/0.35	-	0.25	-	0.15	0.15	96.5

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