

SELECTING COOLING TUBES FOR **CAST-IN HEATERS**



TEMPCO

CHOOSING THE RIGHT COOLING TUBE

Tempco offers many different options when it comes to cooling tubes for cast-in heaters. While there are some standard options, one size and material does not fit all. So, what option fits the application best?

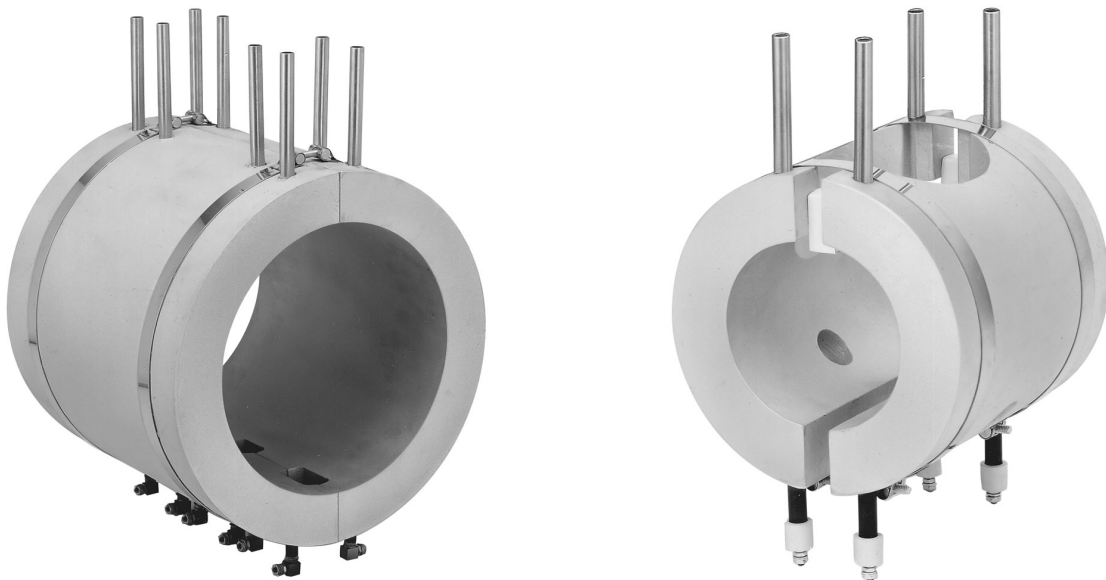
One consideration is the type of environment will the casting be used. Our standard material, 304 stainless steel, can be used in a wide variety of applications, but what if the casting will be operating in a chemically aggressive environment? Some applications will expose the cooling tubes to high levels of acid or chloride. Compared to 304 stainless steel, 316 stainless steel or incoloy material tubing will offer a much higher corrosion resistance making it an ideal choice in applications such as chemical and food processing.

Temperature also needs to be considered. The recommended maximum operating temperature of the casting is 700°F for aluminum 319 and 750°F for aluminum 356, so 304 or 316 stainless steel and incoloy tubing will be suitable. For bronze castings, the recommended maximum operating temperature is 1350°F. Higher temperatures will cause high amounts of thermal stress due to both thermal expansion and contraction, as well as an increased rate of corrosion. In these applications, an incoloy cooling tube will have much better resistance to thermal stress and oxidation.

Once the material has been selected, the operating pressure of the cooling fluid is critical to selecting the size of the cooling tube. Even encased in aluminum or bronze castings, the internal cooling tube can be subject to failure if the continuous operating pressure is too high. Barlow's Formula, shown below, can be used to determine the appropriate diameter and wall thickness for the application.

$$\text{Maximum Working Pressure (psig)} = \frac{2 \times \text{Material Strength (psi at Room Temp.)} \times \text{Wall Thickness of Tube (in)}}{\text{OD of Tube (in)} \times \text{SF (Safety Factor of 1.5 to 10, typically 4)}}$$

One must also consider the different types of cooling tube construction when thinking about temperature and pressure. The Tempco standard is welded and drawn, which is a durable and cost-effective construction method. In applications with higher temperatures and pressures, seamless tubing should be used as it offers more uniform strength and is more resistant to thermal stress.



Examples of single set of cooling tubes (Right) dual set of cooling tubes (Left) on a cast-in band heater

While in some cases there may be some special circumstances or unique material requirements, these main parameters will help define what cooling tube is right for each application.