

Watt Density & Sheath Selection

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Watt density and sheath material are the two most critical factors affecting element life. Watt density (watts per square inch of heater surface area) determines heater operating temperature for a given set of conditions. The sheath material must be suitable for the corrosive conditions and the extreme temperatures of the application.

Watt density is calculated as follows:

$$\text{Watt Density} = \frac{\text{Element Wattage}}{3.14 \times \text{Element Diameter} \times \text{Heated Length}}$$

Element diameter and heated length are expressed in inches.

Heating Air and Other Gases – Charts A through C give maximum sheath temperatures for a range of watt densities and velocities. This data is based upon air at atmospheric pressure and a 75° F inlet air temperature. For higher inlet temperatures, the sheath temperature will increase accordingly. Contaminants in the air, while normally not affecting the sheath temperature, may require a more highly corrosion-resistant sheath and/or fin material. For heating compressed air and other gases, consult the factory or your local INDEECO representative for watt density and sheath recommendations.

Chart B

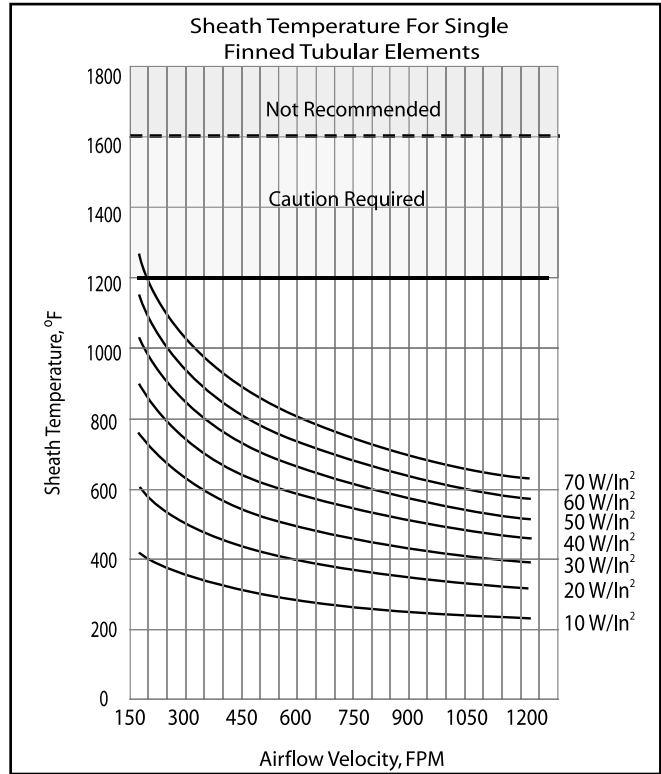


Chart A

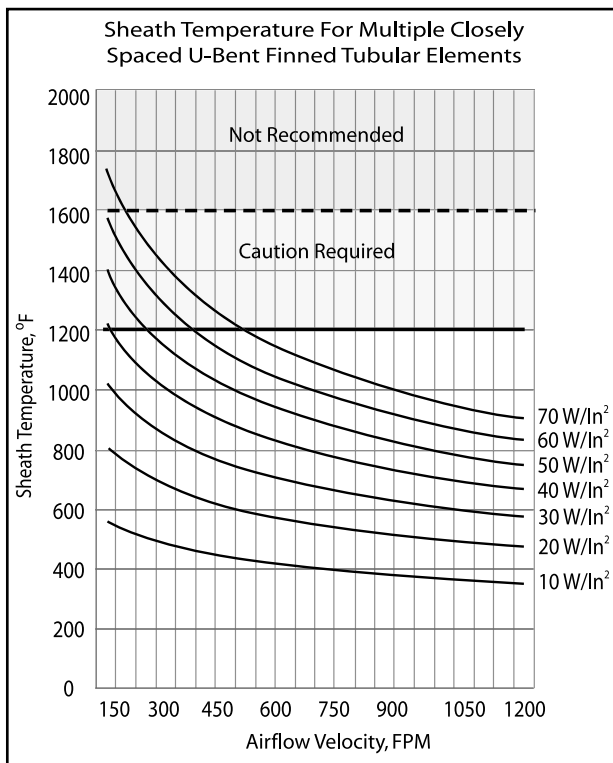
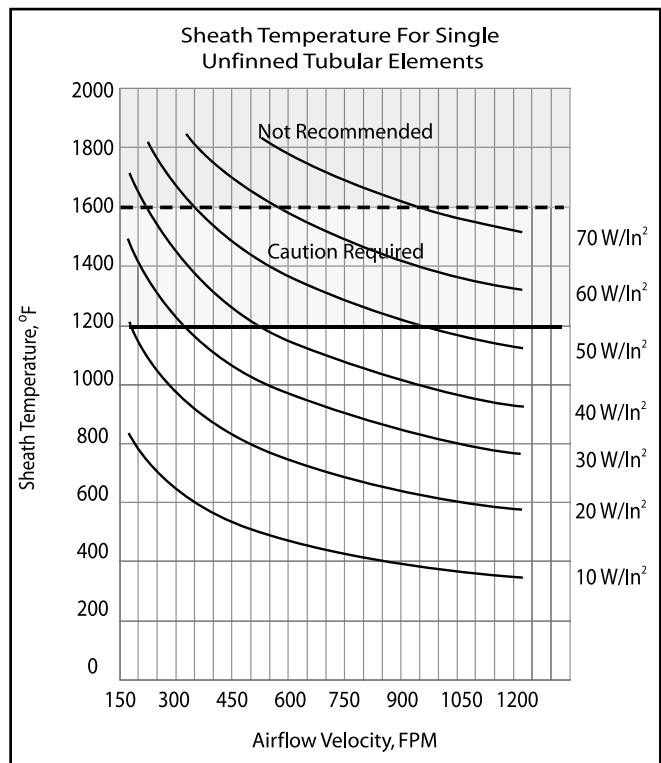


Chart C



Watt Density & Sheath Selection

Heating Liquids – Recommended watt densities and sheath materials for heating several common fluids are listed in Table II.

This information should be used only as a guide. INDEECO cannot be responsible for heater failures due to corrosion or excessive temperatures in the application.

Heating Metals – Table III gives recommended watt densities and sheath selection for elements that are clamped or inserted. Allowable watt densities will vary with such factors as element fit in a machined opening and metal thickness.

Watt Density & Sheath Materials

Table II

Material	Maximum Fluid Temperature °F	Sheath Material	W/Sq. In.
Asphalt	300	Steel	5-9
Caustic Soda (50%)	180	304 SS	15
Dowtherm A	100	Steel	55-60
	200	Steel	40-50
	300	Steel	20-35
	500	Steel	3-5
Ethylene Glycol	200	Steel	30-40
Fuel Oil, #5 & #6	200	Steel	5-12
Lube Oil, SAE 10-30	250	Steel	15-20
Lube Oil, SAE 40-50	160	Steel	5-12
Oakites	210	Steel	30-40
Therminol 66	500	Steel	25-30
	600	Steel	20-25
	650	Steel	10-15
Water-Potable	100	Copper	75
	212	Incoloy	50-75
Water-Deionized	100	304 SS	75
	212	304 SS	50-75

For a comprehensive list of sheath materials compatible with fluids under a variety of conditions, refer to INDEECO Immersion Heater Catalog C70.

Table III

Application	Maximum Metal Temperature °F	Recommended Watt Density W/Sq. In.	Recommended Sheath Material
Clamped to Flat Metal Surface	200	20	Steel
	200	30	304 SS
	400	20	304 SS
Inserted into Machined Grooves or Holes	200	25	Steel
	200	35	304 SS
	400	25	304 SS
	600	20	304 SS
	600	25	Incoloy
	800	15	Incoloy