

**TECHNICAL UPDATE - TU-4005**

**SUBJECT: Safety Factors in electric traced bundle design**

A recent customer call brought to light a question that many have asked lately. What safety factor do we use when designing traced bundles.

Our rule of thumb has been to design the bundle with 10% to 15% more heater power than is required to maintain the process temperature requested by the customer at the lowest stated ambient temperature. Now, the question is "Is that enough?"

There are a number of common reasons to increase the safety factor.

Reason #1: The voltage source at the customer's site is not what he thinks it is.

This is one of the most common reasons to increase the safety factor. We have had a number of instances where the customer thought he had 240 VAC, but it turned out to be 220 or 210 VAC. We can design for the effect of this drop if we know about it. The power output of the heater varies with the **square** of the change in voltage, so a 8% drop in voltage results in a 16% drop in power output.

Reason #2: The temperature that the customer thought he needed to maintain is not the temperature he must maintain.

If the customer is unsure of the required maintenance temperature, we can increase the safety factor to forestall future problems. A note of caution, this may increase the size or cost of the bundle.

Reason #3: The gas inlet temperature is less than the requested maintenance temperature.

This seems more common as of late. The customer is inletting at 150°F and wants to maintain a gas temperature of 200°F. This is not an application for traced bundles except in very limited instances. In those limited applications a 25% to 50% safety factor is used to guard against unknowns in the final installation.

Reason #4: The bundle length is approaching the maximum circuit length of the heating element.

There is a power drop along the length of the heating element due to the resistance of the copper bus wires. At the maximum circuit length this resistance results in a power loss of about 10% of the output of the heater. In this case, the safety factor is increased to 15% to 20% to compensate.

The "rule of thumb" is in force for most designs. Any increase in the safety factor requires good communication between the end user and the designer.