PRODUCT / APPLICATION INFORMATION

The Impact on Design When Operating or Maintain Pipe Temperature Approaches the T-Rating

In areas with explosive atmospheres, the heat tracing design must be done such that the heat tracer sheath temperature does not exceed the T-Rating while energized. The heat tracer sheath temperature is a function of power output (watt density), tracer circumference, overall U-value, and the pipe temperature.

$$T_{sheath} = \frac{W}{UC} + T_{pipe}$$

While maximum sheath temperatures for T-rating are often done and based on a run-away uncontrolled pipe temperature (stabilized design), the interest in this discussion is for the case where there is a relatively high maintain temperature specified and a controlled design method is used. As the specified maintain temperature approaches the T-Rating the allowable watt density for the tracer decreases resulting in a design with multiple tracers. This impacts the cost of the tracing system and in some instances results in a design that is impractical. On some occasions when the customer specifications were reviewed in light of this issue, it was found that the T-rating was arbitrarily assigned. It was then raised to the represent the actual gases and explosive conditions that were present. Then a more cost-effective design was possible. Similarly on a second review the process engineers were able to lower the required pipe maintain temperature which in turn allowed for a more practical or cost-effective design.

To be able to assess the situation up front before significant design effort, the following graphs are provided. These show the number of tracers required based on the heat loss and temperature difference between the specified T-rating and pipe maintain temperature. As stated above, as the pipe maintain temperature approaches the T-rating, the number of tracers needed dramatically increases.

Most of these higher temperature maintenance applications involve MI cable. As a result the data provided, is based on MI cable with a diameter of 4.1 mm (0.016 in). Since the overall heat transfer coefficient is temperature dependent, correlations are shown for four different pipe maintain temperatures: 10ºC, 50ºC, 180ºC, and 300ºC. For a case where the maintain temperature is not one of these four, use simple interpolation or the graph with the next lower maintain temperature.

Note that an AIT may be specified instead of a T-rating. If that is the case use T_{AIT} instead of T_{RATING} in calculating the temperature difference for the X-axis.

Here is an example case:

Given
T maintain = 180ºC
Heat loss = 50 W/m
T-rating of T3 (200ºC)

Assessment
T-rating – T maintain is 20ºC
From the graph showing a maintain of 180ºC, seven or more heat tracers are needed.

The T-rating is changed from T3 to T2
With the new specified T-rating of T2 (300ºC) the temperature difference is now 120ºC. The design can be done with two heat tracers.

For high temperature maintenance applications in classified area, the graphs will assist in making a first cut assessment for:

(1) Number of MI tracers needed,

(2) Impact on the design if the AIT or T-rating is changed,and

(3) Possible reduction in tracers if the maintain temperature is lowered.

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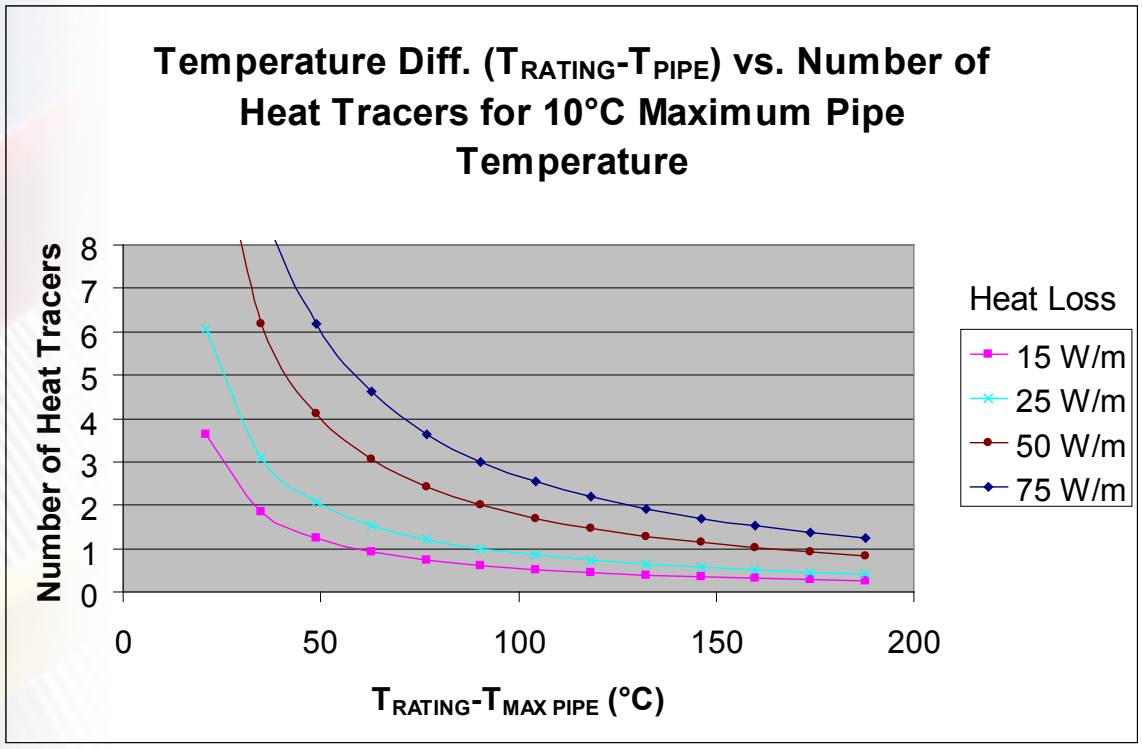

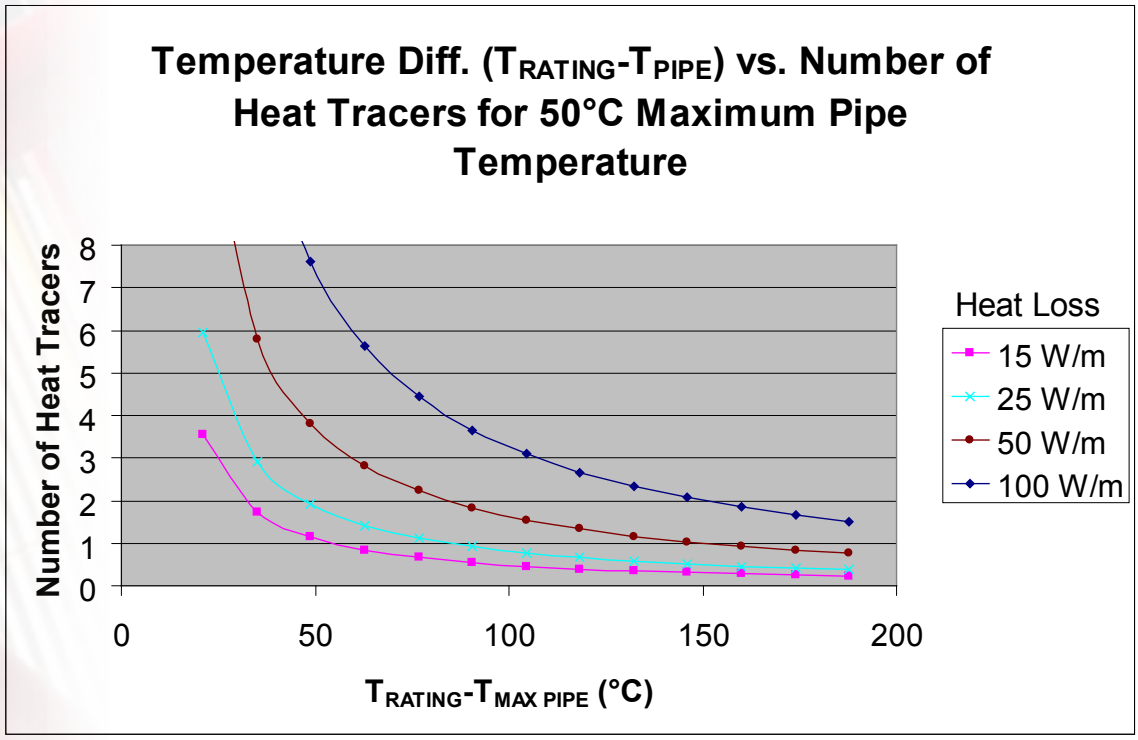

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