

Fluid Properties Explained 4 – Maximum Fluid Temperature

“I’m going to be operating the system at (your process temperature here) °F. How long will the fluid last?”

Every heat transfer fluid product bulletin shows a maximum recommended operating temperature and/or a maximum recommended film temperature. Many manufacturers simply set the maximum operating temperature by subtracting 50°F from the maximum recommended film temperature.

Other suppliers, hoping for an advantage, reduce that difference to 20°F, effectively expanding the fluid’s upper range. The main problem with both approaches is that they ignore the effect that the type of heater has on the actual film temperature.

Heat moves from the heat source (heater tube, electric element or steam coil) through a thin, relatively stagnant film of fluid into the moving fluid. If the temperature of this fluid film exceeds the maximum recommended film temperature, the bonds holding the molecules together start to break apart and the fluid will degrade. But every heater has two film temperatures—the average and the maximum.

The average film temperature is estimated by dividing the average heat flux (BTU/hr-ft²) by the fluid film coefficient (BTU/hr-ft²-°F) and then adding that number to the operating temperature. The tricky part is estimating the maximum film temperature. If the heater has a uniform heat flux (e.g. steam coils, electric element, or fluegas heat recovery) the maximum film temperature will closely track the average.

However, almost all fired heaters have a radiant section (the section where the coils face the flame) which can have a much higher heat flux. This can result in localized film temperatures well in excess of the heater average. Depending on the fired-heater design, temperature differences between bulk and film temperatures can be as high as 100°F. So if the required operating temperature is within 60-75°F below the stated maximum film temperature of the heat transfer fluid, be aware that fluid life might be shortened.

Next time we’ll cover another commonly reported heat transfer fluid property.