

## Fluid Properties Explained 3 – Minimum Operating Temperature

There really is no standard definition for the recommended operating temperature range for heat transfer fluids. The Minimum Recommended Temperature is a perfect example. Sometimes the “Minimum Pumpable Temperature” (@ 2000 cps) and the “Pour Point” are given as the minimum temperature. Ignore both of them – the fluid is way too viscous at those temperatures to be pumped with anything short of a piston pump (and when was the last time anybody used one of those on a thermal fluid system?)

There are actually two aspects to the low-temperature limit:

1. How cold a start-up will the fluid handle? All fluids get more viscous with decreasing temperature. High viscosity reduces the heat transfer rate as well as the pumpability, both of which influence how fast the system can be brought up to temperature. If you anticipate extremely cold weather around your installation, you may want to specify a gear pump, which will move almost any viscosity. Centrifugal pumps are much more widely used so it makes more sense to use their limitations as a general guideline for cold start-ups. A properly specified centrifugal pump (correct horsepower and impeller size for normal operation) can handle a maximum viscosity of about 400 cps. So unless you heat-trace the lines, the lowest start-up temperature of a fluid is where the fluid viscosity is in the 300 to 400 cps range
2. If the fluid will be used for cooling as well as heating, what is the lowest fluid temperature that the fluid can handle? In the heat transfer world, it is a long way from the cold start-up temperature to the minimum viscosity where a fluid will actually transfer heat. Just like the maximum film temperature of the fluid (more on that next time), the fluid film coefficient at the surface of the heat exchanger will determine how well the fluid works. For most equipment, the maximum design viscosity is around 20 cps. So this sets the lowest operating temperature.

We'll deal with the maximum recommended operating temperature next time.