Central Heating
NEW ZEALAND

The Effects of Propylene Glycol on Pump Performance

Recently we have seen a large increase in the number of customers adding glycol to their heating systems to provide frost protection. We have been specifying this, usually at a rate of around 25%, which will provide frost protection down to -11°C.

The issue with this is that the glycol/water solution has a large impact on the pump power required for any given circuit. This is due to two significant differences in the physical properties of a glycol/water mixture compared to a pure water fluid (which is usually used for pump/pipe calculations).

1. Propylene glycol has a lower specific heat capacity than water. To deliver any given quantity of heat (kW), we consequently require a higher flow rate than is required when using only water.

2. Propylene glycol/water mixtures have higher viscosity and density than 100% water solutions and will therefore cause higher pressure drops in the system.

These two factors combined can produce increases in a system's required pump pressure of around 25-35% compared to the same system when only pumping water.

To show this more clearly we have calculated the pump power required for a typical heat pump system with three different heat transfer fluids. The system is based on a nominal heat pump flow rate of 2.4m^3/h (Bran 0041 or similar) which will be connected directly to a 12-way Watts manifold via 20m of 32mm Multitubo pipe with 100m long 16mm loops. The pressure drop for this system has been calculated with the following results:

- 100% Water = 84.9 kPa
- 10% propylene glycol and 90% water (freezing point = -4°C) = 100.94 kPa
- 20% propylene glycol and 80% water (freezing point = -9°C) = 114.01 kPa

As shown above, the concentration of glycol added to a system can have significant impact on the pumping power required.

When specifying glycol as antifreeze for a system, we must factor in the effect this will have on the pressure drop and ensure that excessive glycol is not added. A concentration of 10% propylene glycol, which provides frost protection down to -4°C, should be suitable for most applications.