

Temper[®]

Heat transfer fluid



The intelligent solution

temper technology

1. Temper – the product

Temper – a non-toxic and environmentally compatible heat transfer fluid

BENEFITS

- Can be used down to $-55\text{ }^{\circ}\text{C}$
- Outstanding flow, even at low temperatures
- High heat transport performance
- Novel corrosion protection, giving better thermal transfer
- Pre-mixed, i.e ready for use
- No bursting effect on freezing
- Non-toxic, non-flammable, non-explosive
- Readily biodegradable
- Free from phosphates, amines, nitrites and benzoates
- Safe to handle (pH 8–9)
- Approved for use in the food industry and supermarkets

What is Temper?

Temper was developed by Temper Technology AB in the Aspen group. Temper is a synthetic and homogenised solution based on salts. It is colourless to yellowish and contains no amines or nitrites, although it does contain additives, which give it anti-corrosion and lubricating properties.

Temper is supplied ready for use and must not be diluted. Different versions are available, each with a designation that indicates its freezing point:

- Temper $-10\text{ }^{\circ}\text{C}$
- Temper $-15\text{ }^{\circ}\text{C}$
- Temper $-20\text{ }^{\circ}\text{C}$
- Temper $-30\text{ }^{\circ}\text{C}$
- Temper $-40\text{ }^{\circ}\text{C}$
- Temper $-55\text{ }^{\circ}\text{C}$

What can Temper do?

Temper has a high specific heat capacity (eg 3.3 kJ/kg for Temper $-20\text{ }^{\circ}\text{C}$ by $+20\text{ }^{\circ}\text{C}$). It also has outstanding thermal conductivity, especially compared with propylene glycol.

Special additives in Temper provide optimal corrosion protection and lubricating properties.

Because its viscosity is relatively low compared with glycol, pumps and pipe work can be smaller for the same performance. This cuts the cost of purchasing, installing and running the system.

How safe is Temper?

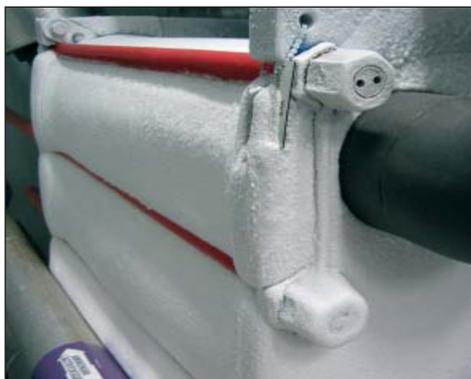
Unlike glycols, Temper is non-toxic and ecologically sound as well as readily biodegradable. In addition, Temper is neither flammable nor explosive. Its WGK rating (Wassergefährdungsklasse, German water hazard class) is 1.

In unopened containers and in closed systems, Temper is stable and will keep practically indefinitely.

On reaching its freezing point, Temper becomes grainy, but its volume does not increase significantly, so that there is no bursting effect.

2. Temper – applications

Secondary refrigerant systems in new installations



How can Temper be used?

Temper can be used wherever a liquid heat transfer medium is required in stationary or mobile installations. Temper offers particular advantages as an alternative to glycol mixtures in the area of indirect cooling (secondary refrigeration) at low temperatures.

- Food industry
- Combined with CO₂ for energy efficient defrost
- Supermarkets
- Ice rinks/artificial ski slopes
- Pharmaceutical industry
- Energy plants

Further applications as a heat transfer fluid at higher temperatures:

- Air conditioning systems
- Heat recovery systems

Temper in new installations

The operational life and reliability of a refrigeration system depend to a large extent on how it is installed, the system's cleanliness before first use, and how the system's components are handled and mounted in relation to each other.

To build a system that works well there are some issues that should be thoroughly considered: Choose the right material, most material can be used such as copper, brass (dezincified), steel, stainless steel, cast iron and certain types of plastic pipes. Minimize oxygen in the system by installing high point air purgers (manual or automatic), and purge the system on a regularly basis. Join the system by welding, brazing or flanges.

Read more at www.temper.se

Before filling, new installations should be cleaned thoroughly, preferable section by section, to avoid contaminants.

The system is then pressure tested with nitrogen or air.

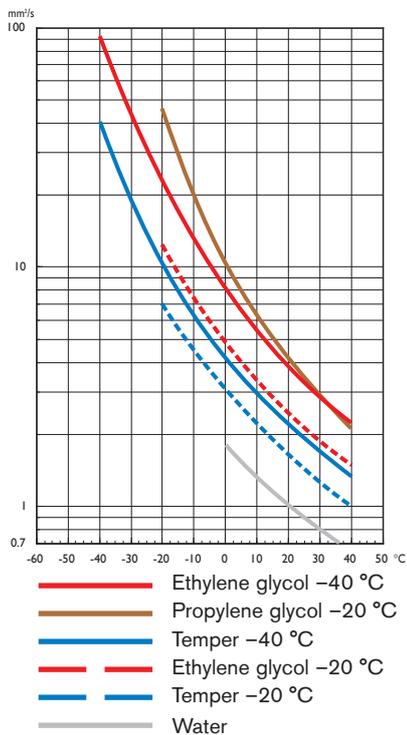
The installation is then filled from the lowest point and all air is carefully vented off.

Temper in existing installations

When changing from another type of heat transfer fluid to Temper, a thorough review and overhaul of the system is essential. This is required in order to ensure that the components to be incorporated are compatible with Temper and that the system is cleaned in the correct way. For more information about this, please contact Temper Technology.

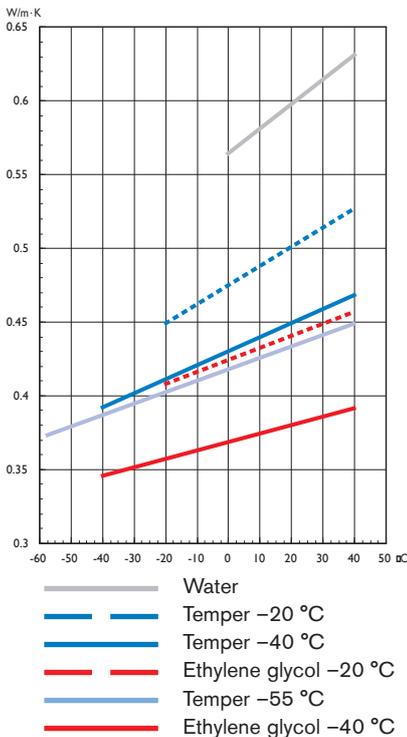
3. Using Temper properly

Planning, installation and operation



Kinematic viscosity

When a fixed body is transported through a fluid it is not only the dynamic viscosity that determines the resistance it meets. More energy is used to push a heavy fluid away than a light fluid. The concept of kinematic viscosity takes this factor in consideration.



Heat conduction capacity

Good heat conducting capacity is desirable for the medium in cooling or heating equipment, among other things because it reduces the temperature difference between the fluid and the wall of the pipe.

Correct installation for safe use

To make the best possible use of Temper and to ensure problem-free operation of the system for a long time, a number of important points must be borne in mind during planning, installation and operation. Detailed technical data sheets can be requested directly from Temper Technology or obtained over the Internet www.temper.se.

Fundamentals

Secondary refrigeration systems

Temper should only be used in sealed systems, since oxygen from the air increases the tendency of metal parts in the system to oxidise. In addition, the water evaporates from open systems. This inevitably alters the composition/concentration of Temper and might lead to a thickening of the solution and to the formation of crystals. Air purger equipment must be installed in the system.

Pipe work and valves

Commonly used materials such as copper, brass, steel, stainless steel, cast iron and plastics (ABS, PE), approved for the planned temperature, may be used for pipe work and valves. Galvanised steel, zinc and soft solder are not suitable.

Filters

We recommend the use of filters with a mesh size of 0.6 to 0.8 mm, so that any dirt or corrosion products picked up by the heat transfer fluid are trapped.

Pumps

When choosing pumps, you should inform the manufacturer that Temper will be used. Make sure that the correct material is used for the seals. Because of the way Temper works, small amounts of Temper will appear at the shaft seal. Traces of salt crystals must be regularly washed off the seal surfaces with water. Alternatively, pumps without seals may be used.

Seal materials/gaskets

We recommend EPDM rubber or similar, provided that they can withstand the temperatures of the application. Traditional sealing with flax/paste (such as Uni-Pack, Locher) may also be used, check with your supplier.

Our specialist advisors are at your service for further technical support relating to the use of Temper.

4. Temper corrosion protection

An innovative concept using novel inhibitors

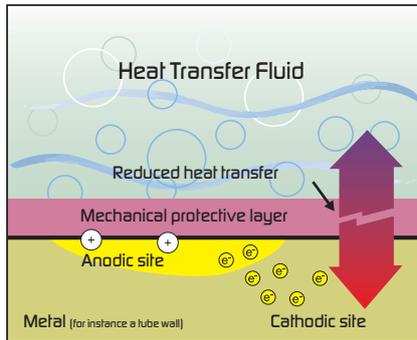


Figure 1

Conventional corrosion protection

Corrosion arises because of differences of electric potential between different metals (galvanic corrosion, compare the galvanic series).

Normally, corrosion inhibitors are added to the heat transfer fluid (glycol for example) to give protection against corrosion of pipes and valves etc. These inhibitors form a uniform mechanical protective film on the inside of all components. This protective film prevents corrosion by preventing the transport of electrons (see figure 1).

However, there are various drawbacks with this method:

- The protective film prevents optimal heat transfer.
- The protective film can easily be damaged by mechanical action, making it ineffective.
- If the inhibitors that form a protective film are degraded or damaged at some sites, new heat transfer fluid must be added. This creates a new, additional protective film throughout the entire system, even where the existing film is intact. This further reduces heat transfer.
- To assess the condition of the corrosion protection in the system, it would be necessary to check the adequacy of the mechanical protective film in every part of the system. This is to some extent impossible and would in any case be timeconsuming and costly.

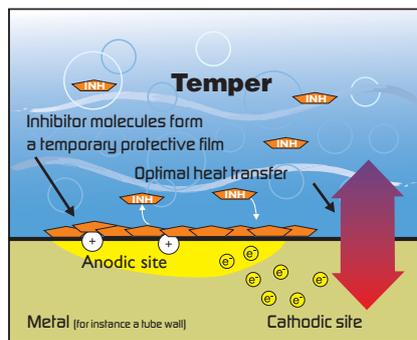


Figure 2

Temper corrosion protection

In the initial phase of corrosion, electronic potential displacements occur, without metal atoms being dissolved from the surface.

Temper contains special corrosion inhibitors which do not form a general mechanical protective film, but which instead act only where electronic potential differences arise. The molecules of the inhibitor accumulate at the corrosion-prone site, where they form an extremely thin local layer. This layer locally eliminates the risk of corrosion, with practically no effect on heat transfer. The Temper corrosion inhibitor is not consumed: Once the electric potential difference is equalized, the inhibitor molecules are released and are free to accumulate at any other site where there is an electric potential displacement (see figure 2).

With Temper, it is very easy to assess the corrosion condition of a system by determining the number of "free" inhibitor molecules. If the number of free inhibitor molecules falls below a given value (which might even happen when filling a system with Temper for the first time, for example because corrosion products are already present) optimal corrosion protection can be restored by adding pure inhibitor. If necessary the density (freezing point) can also be adjusted.



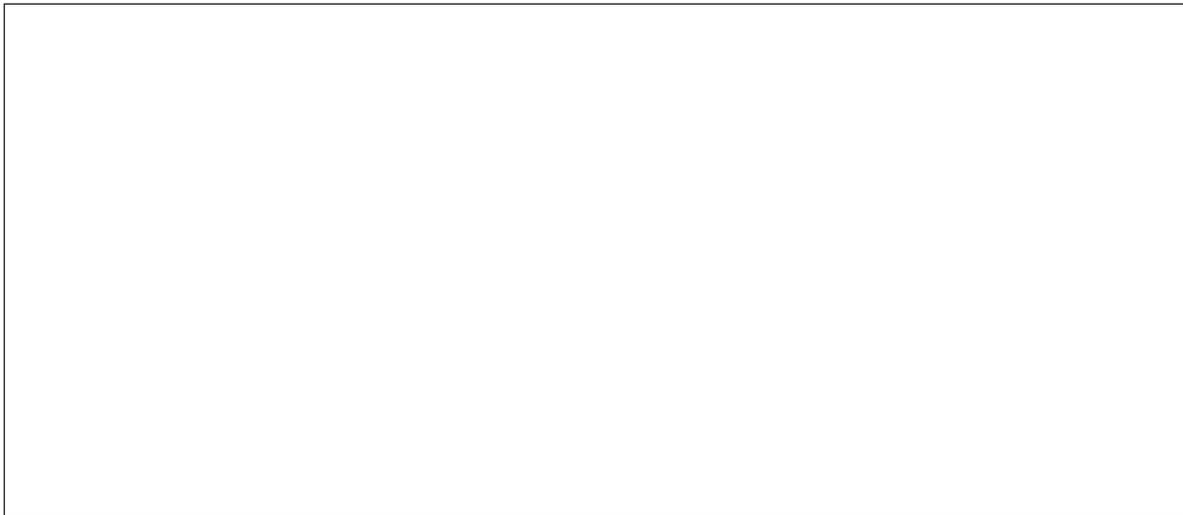
Business concept

Temper Technology offers technically and environmentally highly developed products on a global market. Increased customer value is achieved through high levels of availability, service, technical support and extensive training. Sales for applications within refrigeration, heating, antifreeze and fire protection take place via selected local distributors.

Temper Technology – a niche company

The world market is dominated by a small number of multinational corporations. Temper Technology is a niche company and is maintaining a firm position thanks to its unique innovations and strong commitment to the environment.

For further information and details, please contact Temper Technology or visit us at www.temper.se



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