

## FROST PROTECTION FWF-K ANTI-FREEZE CONCENTRATE/FWF-F READY-MIXED ANTI-FREEZE AGENT



**FWF-K anti-freeze concentrate and FWF-F ready-mixed anti-freeze agent are environmentally friendly long-term anti-freeze agents on a mono propylene glycol basis. They prevent frost in thermal solar systems and are used as heat transport fluids.** Special corrosion inhibitors protect the metal and plastic materials normally used in the construction of such systems, including copper and aluminium, from corrosion as well as the development of coatings and depositions. This helps to maintain the efficiency of the systems. The fluid is food-safe and does not corrode the standard sealing materials used in heating systems.

### Important information

- It should be ensured that the circulation pump used is suitable for operation with anti-freeze agents.
- Before filling with water, the system has to be flushed and pressure tested to make sure that all the connections are leak-tight.
- The system has to be filled with anti-freeze agent immediately after pressure testing. Do not allow any air to enter!
- Galvanised system components should be avoided, because zinc is not resistant to glycols.
- Experience has shown that the anti-freeze agent can be stored and used over a period of several years. The concentration (frost resistance) should nevertheless be checked every year.
- Do not top up with water in case of fluid loss. Only use the correct concentration of anti-freeze agent and water to top up the system.
- The corrosion properties of our solar fluid can be checked using the pH value. The pH value should be > 7.5. Measurement is conducted using pH measuring strips. The solar fluid should be replaced if a lower value is determined.
- The optimum usage temperature is between -30 °C and 170 °C. In case of persistent temperatures over 170 °C, we recommend the installation of compensation vessels to allow the heat transport fluid to flow out of the collectors.
- The heat transport fluid is subject to a gradual chemical change at temperatures above 200 °C, which can threaten the operating safety of the system.
- According to the Ordinance of Hazardous Substances (Gefahrstoffverordnung, GefStoffV), anti-freeze agents are not subject to labelling requirements (see safety data sheet).
- The notes provided in the product information and the safety data sheet regarding use are based on technical experience. The statements are not binding promises of specific properties. The suitability of the product for a particular use has to be tested beforehand.
- The product information does not release the customer from the obligation to perform an incoming goods inspection according to the Commercial Code 377/378 (Handelsgesetzbuch, HGB 377/378).

### Water requirements

In case of no-flow temperatures above 200 °C, only desalinated or demineralised water should be used as filling water. If only drinking water is available, the following water hardness upper limits should be observed:

0–10 dGH: Permissible without restriction

> 10 dGH: Soften or mix water to obtain values under 10 dGH

### Specifications

Type		FWF-K anti-freeze concentrate	FWF-F ready-mixed anti-freeze agent
<b>Product data</b>			
	Appearance	Clear, slightly yellow liquid	Blue dyed liquid
	Odour	Virtually odourless	
	Basis	1,2-Propandiol; Mono propylene glycol	
	Flash point (°C)	> 100 (ASTM-D 51758)	
	Boiling point (°C)	> 150 (ASTM-D 1120)	> 103 (ASTM-D 1120)
	Density (20 °C)	1.040–1.050 g/cm <sup>3</sup> (DIN 51757)	1.035–1.045 g/cm <sup>3</sup> (DIN 51757)
	Frost protection	See dilution table	Up to -28 °C
	Thermal conductivity (20 °C)	Approx. 0.22 W/m*K	Approx. 0.40 W/m*K
	pH value (20 °C)	7.5–8.5 (ASTM-D 1287) 1:1 with neutr. water	Approx. 8.0 (ASTM-D 1287)
	Viscosity (20 °C)	65–75 mm <sup>2</sup> /s	Approx. 5.8 mm <sup>2</sup> /s
	Inhibited	Free of nitrites, secondary amines, phosphates and borates	
	Miscibility with other propylene glycol based anti-freeze agents	✓	Only limited

# SOLAR ACCESSORIES

## FROST PROTECTION FWF-K ANTI-FREEZE CONCENTRATE/FWF-F READY-MIXED ANTI-FREEZE AGENT

Corrosion and material loss rates (g/m<sup>2</sup>)  
(according to ASTM D 1384)

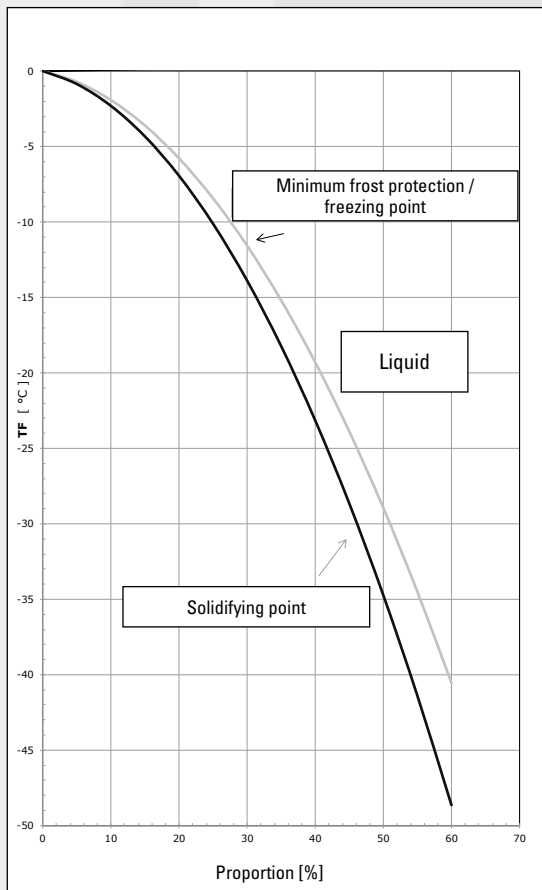
Aluminium	-0.3
Soft solder	1.6
Brass	0.8
Copper	0.8
Steel	-0.1
Grey cast iron	0.9

### FWF-K anti-freeze concentrate dilution table

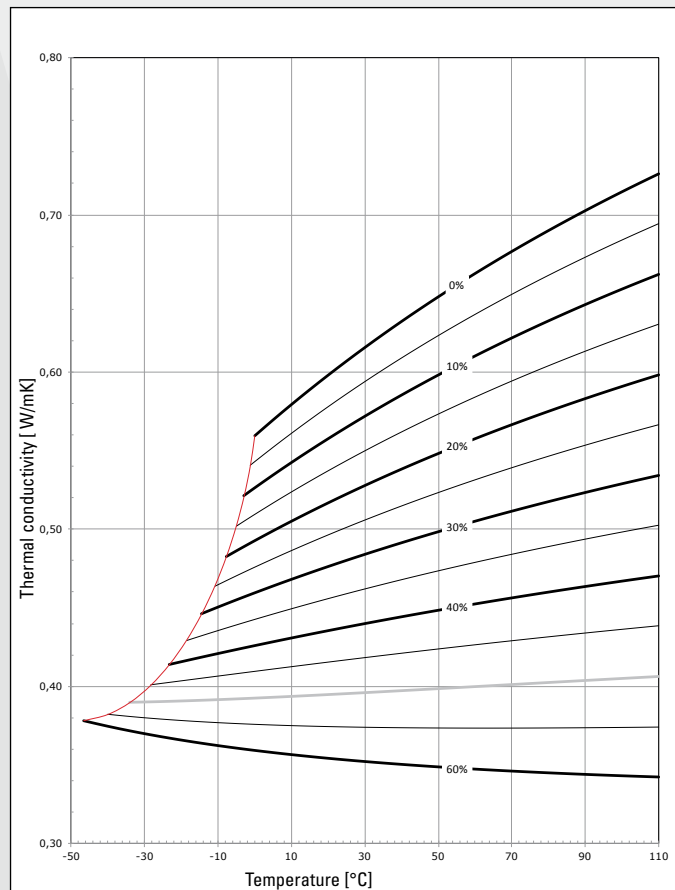
FWF-K anti-freeze concentrate	Water	Frost protection
35 vol %	65 vol %	-15 °C
40 vol %	60 vol %	-19 °C
50 vol %	50 vol %	-28 °C

Notes: FWF-K anti-freeze concentrate is fully miscible with water. In the delivery condition, a frost protection of up to -42°C is provided without segregation. The ready-mix contains a concentration of 42% FWF-K and 58% water! **To ensure corrosion resistance, the minimum concentration of FWF-K should not be less than 35%.**

Frost protection curve of concentrate/water mixture

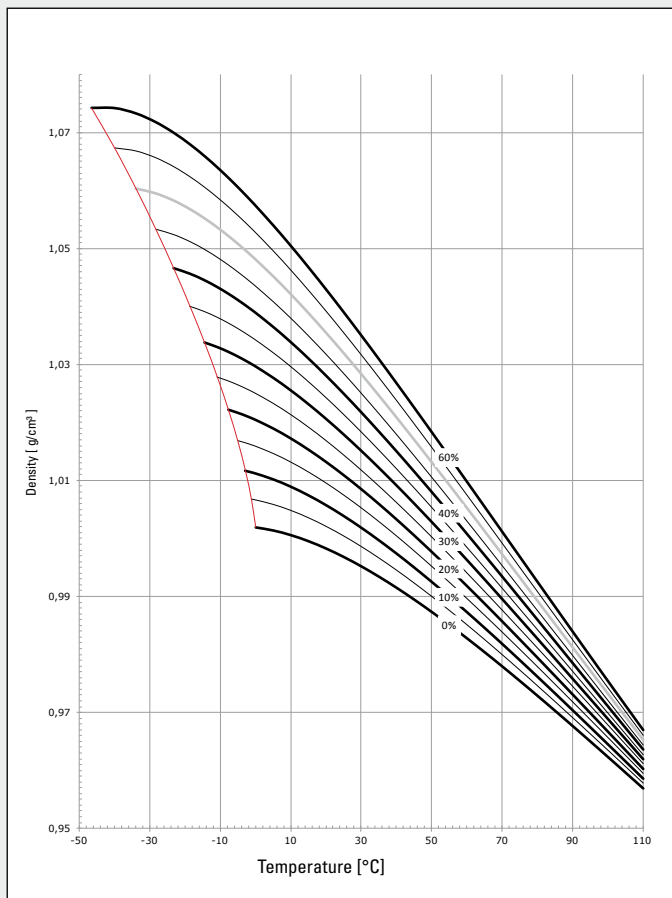


Thermal conductivity of concentrate/water mixture

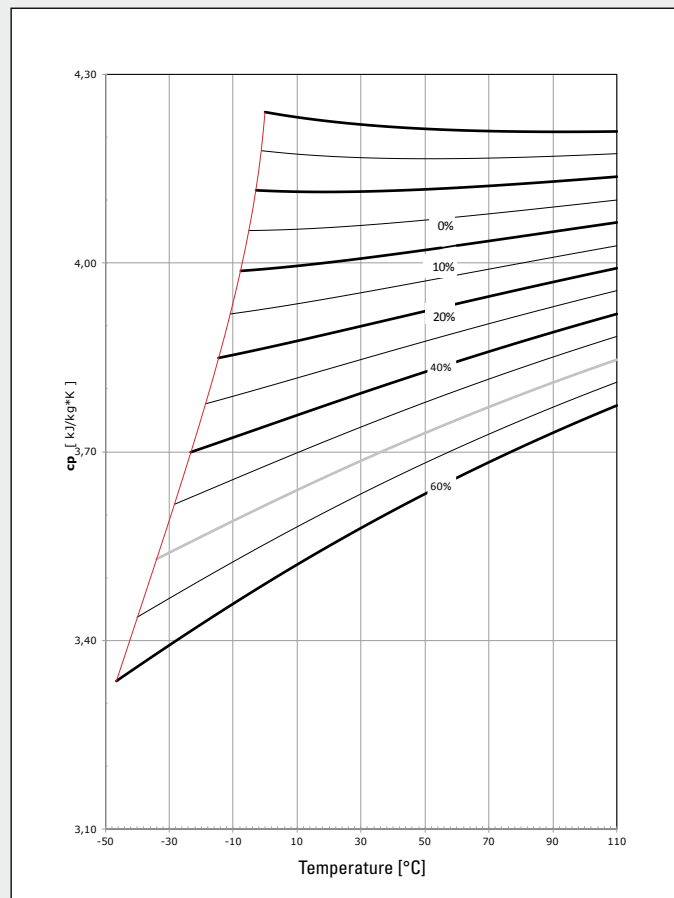


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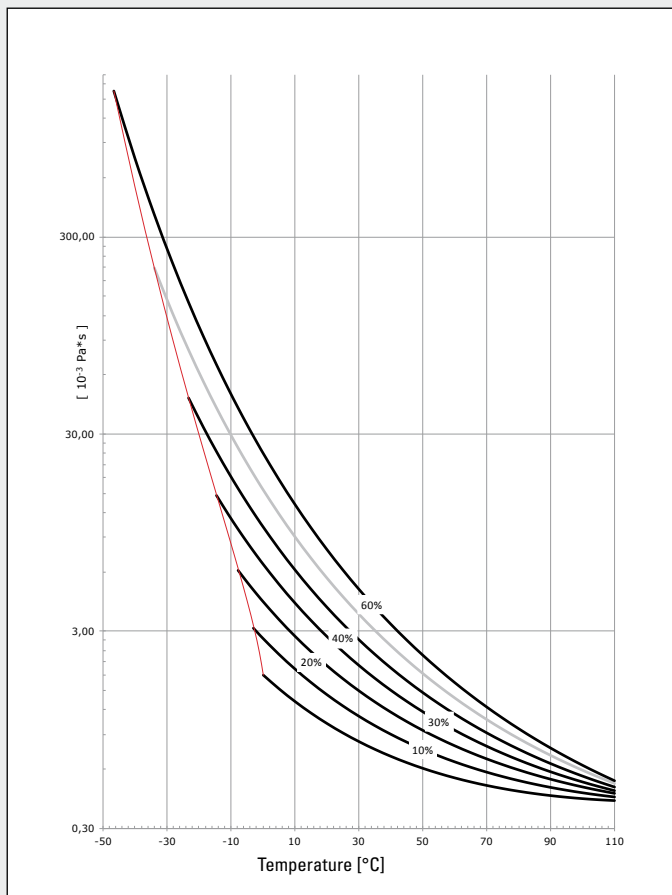
**Specific density of concentrate/water mixture**



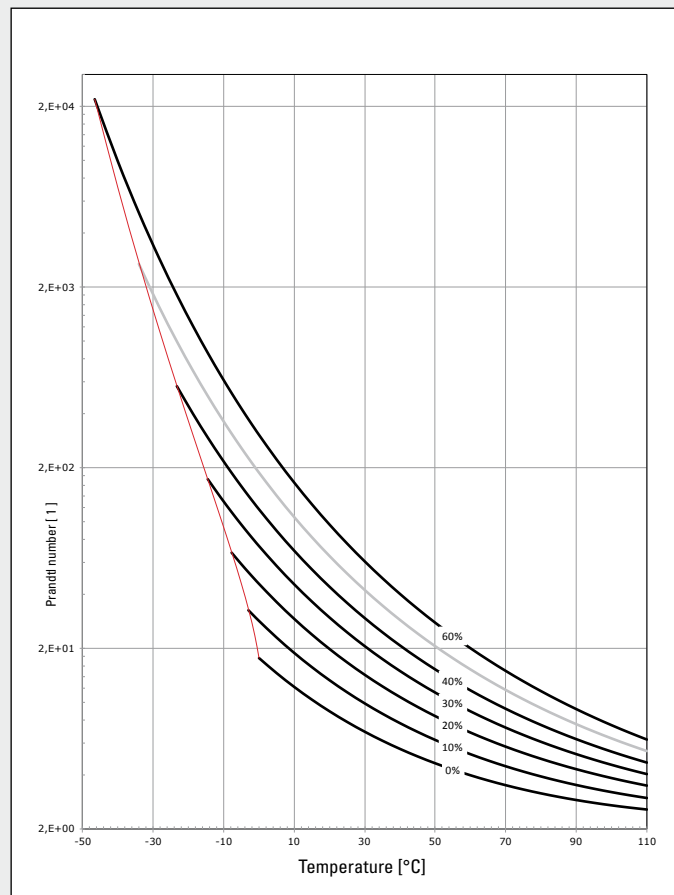
**Specific heat capacity of concentrate/water mixture**



**Dynamic viscosity of FWF-K concentrate/water mixture**



**Prandtl number of FWF-K concentrate/water mixture**



# SOLAR ACCESSORIES

## FROST PROTECTION FWF-VSF EVAPORATION-PROOF, READY TO USE, READY-MIXED



### Frost protection FWF-VSF evaporation-proof, ready-mixed to -24 °C

are environmentally friendly long-term anti-freeze agents on a mono propylene glycol basis. They prevent frost in thermal solar systems and are used as heat transport fluids. Special corrosion inhibitors protect the metal and plastic materials normally used in the construction of such systems, including copper and aluminium, from corrosion as well as the development of coatings and depositions. This helps to maintain the efficiency of the systems. The fluid is food-safe and does not corrode the standard sealing materials used in heating systems. The anti-freeze fluid was specially designed for use as a heat transport medium in solar systems with high no-flow temperatures. To ensure that it maintains its special characteristics, the anti-freeze fluid may not be mixed with other heat transport media or diluted with water.

### Specifications

Type		FWF-VSF evaporation-proof, ready-to-use
Product data	Appearance	Green dyed liquid
	Odour	Virtually odourless
	Operating temperature	-24 °C to 230 °C
	Basis	Di-propylene glycol
	Boiling point (ASTM D 1120)	>102°C
	Frost protection	-24°C
	Density at 20 °C	1.02–1.04 g/cm <sup>3</sup> (DIN 5157)
	Viscosity at 20 °C	15 mm <sup>2</sup> /s
	Thermal conductivity at 20 °C	Approx. 0.4 W/mK
	Miscibility	To ensure that it maintains its special characteristics, FWF-VSF may not be diluted or mixed with other heat transport media or water. Only FWF-VSF may be used to top up fluid losses!
Seal compatibility	Does not corrode the standard sealing materials used in heating systems	
Inhibited	Free of nitrites, secondary amines, phosphates and borates	