

## ® Antifrogen KF (VP 1974)

Low-viscosity, low-temperature brine for the food sector, antifreeze and corrosion-inhibiting medium

### Product description

Antifrogen KF is a non-toxic clear liquid, based on an aqueous formiate solution which is used as a low-temperature brine down to -50 °C in industrial and food refrigeration systems. The brine adjusted for maximum achievable protection against freezing is inhibited with non-toxic corrosion inhibitors and is nitrite- and amine-free.

### Notes on use

#### Product properties

The technical data below are used to describe the product. They do not constitute part of the delivery specification. The mandatory product specification will be found in the current technical data sheet.

Technical data Antifrogen KF			
Density at 20 °C (DIN 51757)		g/cm <sup>3</sup>	about 1.354
Refractive index n <sub>D</sub> at 20 °C (DIN 51423, Part 2)			about 1.389
pH-Value undiluted (DIN 51369)			about 11
Boiling point at 1013 mbar		°C	+115
Freezing point (ASTM D 1177)		°C	about -53
Pour point (DIN 51583)		°C	below -60
Kinematic viscosity (DIN 51562)	at 20 °C	mm <sup>2</sup> /s	2-3
	at -40 °C		about 25
Specific heat	at 20 °C	kJ/kgK	about 2.6
	at -40 °C		about 2.5
Thermal conductivity	at 20 °C	W/mK	about 0.46
	at -40 °C		about 0.39
Specific electrical conductivity	at 20 °C	mS/cm	220 - 230

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The effectiveness of the inhibitors added to Antifrogen KF is monitored constantly by means of the ASTM D 1384 corrosion method (American Society for Testing and Materials). The table below shows the relatively low corrosion of the metals

commonly used in refrigeration systems by Antifrogen KF compared to a calcium chloride brine and tap water.

Corrosion of metals in g/m<sup>2</sup>, tested on the basis of ASTM D 1384-97a (336 h/88 °C, 6 l air/h) on the following metals:

Metal	Antifrogen KF (undiluted)	Antifrogen KF (50 % V/V)	Calcium chloride brine 21 % w/s	Tap water (14 °German hard.)
Steel (CK 22)	-1.8	-0.3	-95	-76
Cast iron (GG 25)	-3.0	-2.9	-310	-192
Copper	-0.5	-1.2	-11	-1.0
Brass (MS 63)	-1.8	-2.3	-36	-1.0
Stainl. Steel (1.4541)	-0.3	-0.1	pitting	-0.5
Cast aluminium	+0.4	-0.5	-135	-32

Since soft solder is not resistant to Antifrogen KF, we recommend the use of hard solder joints in assembling

systems. Galvanized lines must not be used because zinc is dissolved.

### Application properties

Antifrogen KF fulfills a dual function as a refrigerating medium. It ensures that the aqueous solution remains liquid at the required brine temperature and protects the metals in the system from corrosion.

The freezing point of the undiluted brine is about -53 °C, and the brine has a strong tendency to supercool. Supersaturated solutions can however be induced to crystallize out by inoculation.

The values shown in the „freezing point“ curve were obtained by this means, and so they provide a reliable guide to the lowest possible temperature in the

refrigeration system. Experience indicates that the brine temperatures obtainable in practice in this way are 8-4 °C higher.

To prevent precipitation, only fully dionized (distilled) water may be used for diluting Antifrogen KF to give the desired protection against freezing (at least -10 °C).

All in the table mentioned materials are protected against corrosion in dilution up to 51 % V/V (= -20 °C). In further dilution with water up to 31 % V/V (= -10 °C) it is recommended to use stainless steel or copper instead of ferrous metals.

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Antifrogen KF should be used only in closed systems to prevent the oxidation of the inhibitors. Antifrogen KF must not be mixed with other brines, especially

with chloride brines but also with glycol brines (e.g. Antifrogen N or L).

### **Other notes on use**

The Antifrogen KF/water mixture should be roughly premixed either before or during filling of the system, too, must be rinsed carefully beforehand with water to remove any rust. Refrigeration systems previously operated with a salt-based cooling brine should be thoroughly flushed with a pickling inhibitor (inhibited acid) to remove all traces of deposits and rust. Particular care is needed with chloride-rich brines because chloride residues are highly corrosive. Only careful sealing ensures trouble-free functioning and prevents losses. Hemp and the common compressed

asbestos fiber seals have proved to be suitable materials for this purpose. Components made of various natural and synthetic rubbers, polyethylene, polypropylene and polytetrafluoroethylene are also resistant. Hydrometers or refractometers are recommended for determining the degree of protection against freezing (for density and refractive index curves see appendices). The upper limit for the operating temperature of undiluted Antifrogen KF in the case of de-icing is +90 °C and should not be exceeded for reasons of corrosion prevention.

### **Service and monitoring**

The Antifrogen KF concentration should be checked once a year. It is also advisable to check the degree of protection against freezing when Antifrogen KF or water has been replenished. A sample should also be

taken for checking the serviceability and corrosion inhibition. This service is offered by Clariant GmbH, Gendorf Plant, Division Functional Chemicals R&D, D-84504 Burgkirchen, Tel. +49-8679-7-2272.

### **Safety, toxicology and ecology**

Antifrogen KF has neither a flash point nor a fire point.

The results of ecotoxicological studies demonstrate the good biodegradability and toxicological safety of Antifrogen KF.

Further Information will be found in the current EC safety data sheet.

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**Dispatch and storage**

Antifrogen KF is delivered in road tankers, rail tank wagons and non-returnable drums (250 kg). The product has good storage stability.

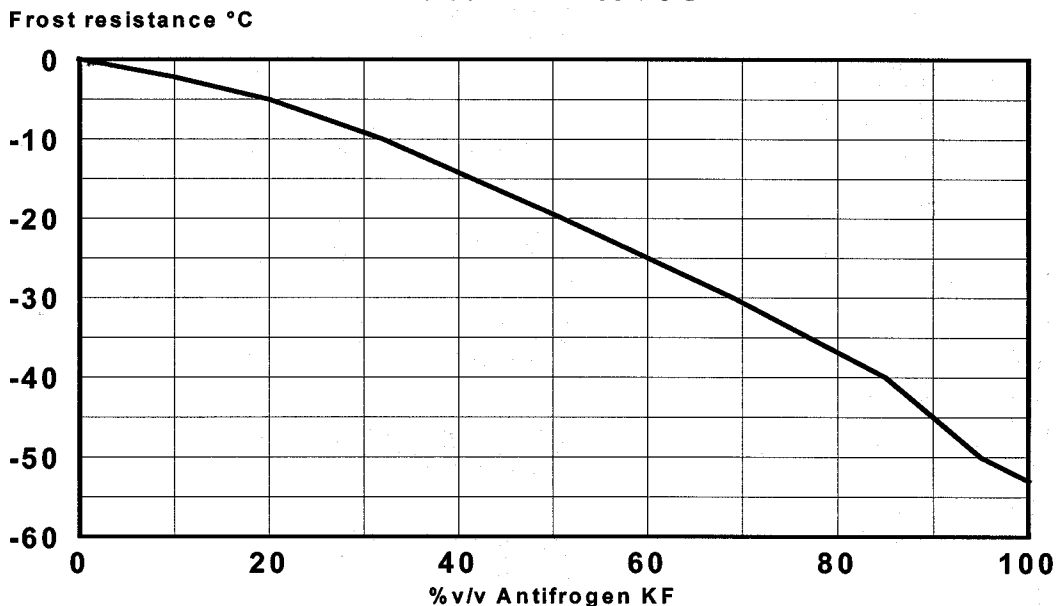
Remarks: Very slight turbidity with brown precipitations can occasionally be observed dependent

on the quality of raw materials. However, this has no negative effect on the product performance.

**Appendix**

The following diagrams give information on the most important physical properties of Antifrogen KF/water mixtures.

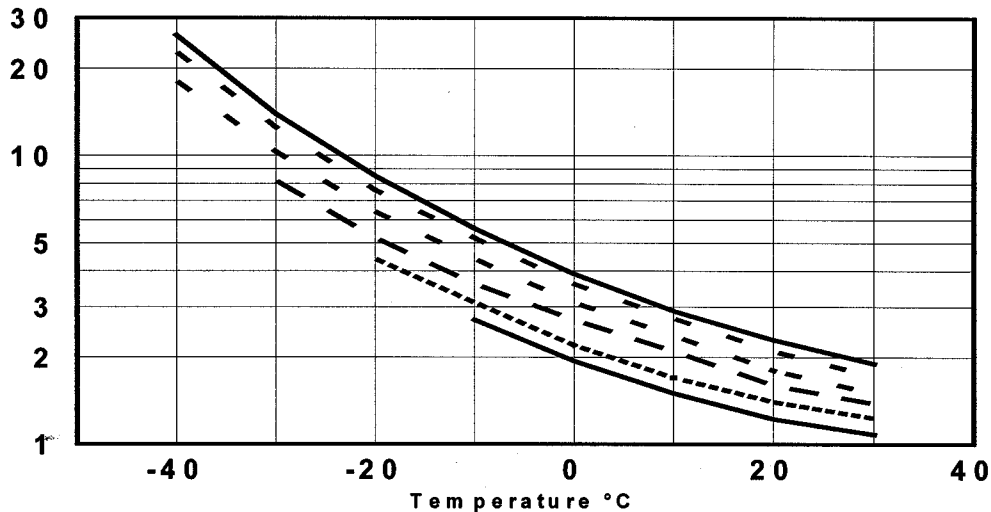
**Frost resistance (ASTM D 1177) of Antifrogen KF-water mixtures**



### Viscosity of Antifrogen KF-water mixtures

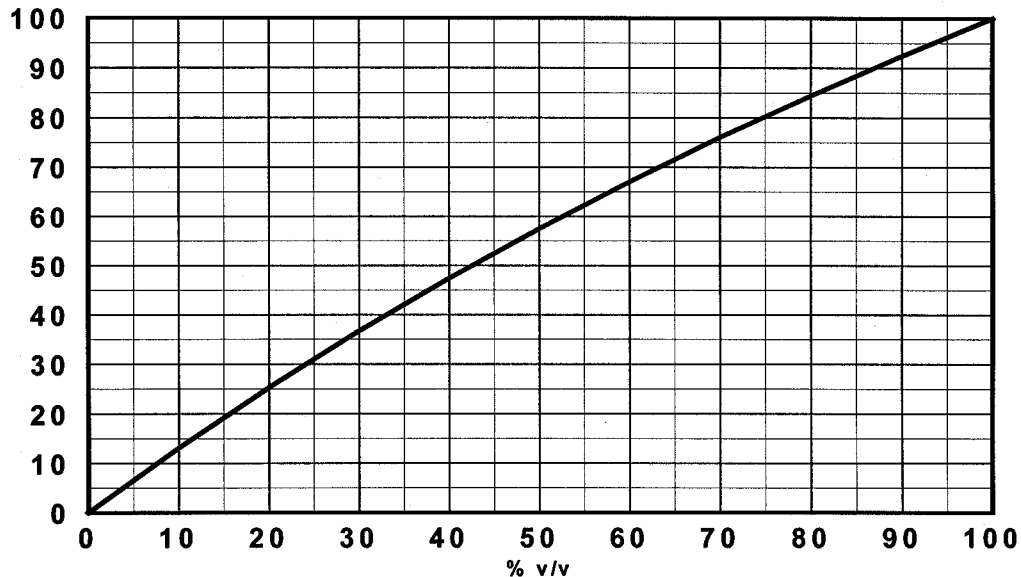
100 % v/v   95 % v/v   85 % v/v   69 % v/v   51 % v/v   32 % v/v

Viscosity  $\text{mm}^2/\text{s}$



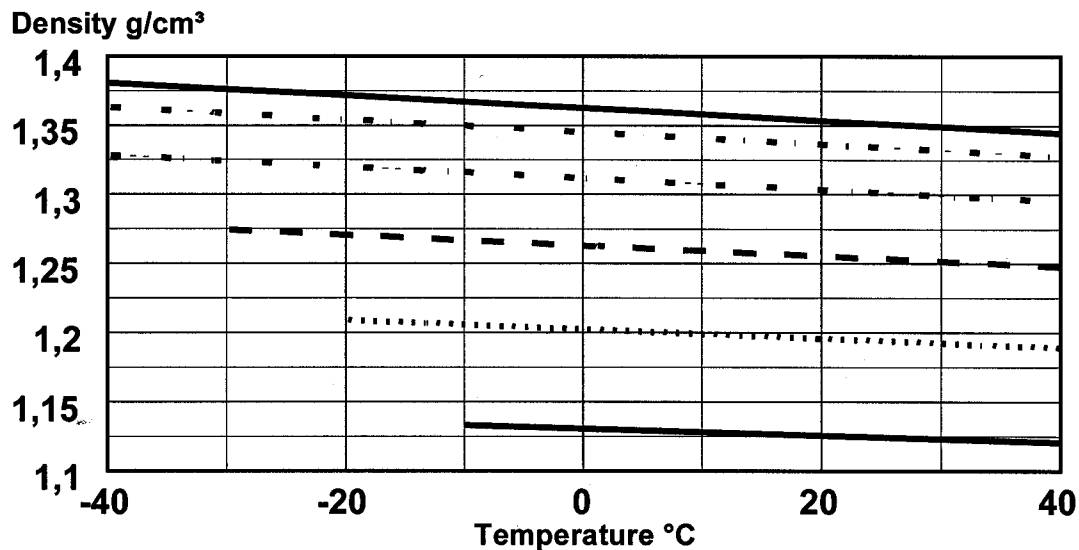
### Conversion of % v/v in % m/m Antifrogen KF

% m/m

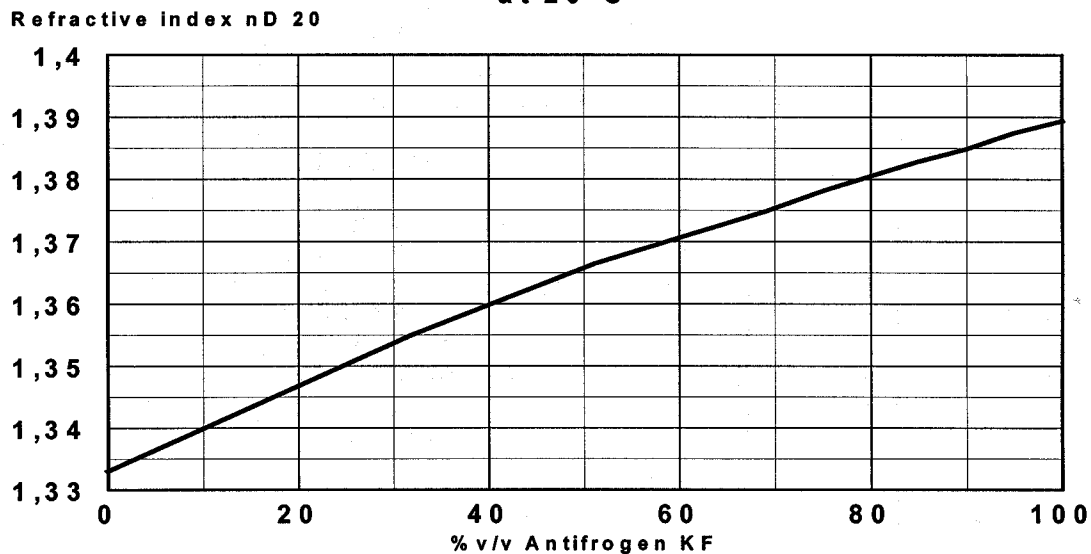


### Density of Antifrogen KF-water mixtures

100 %v/v    95 %v/v    85 %v/v    69 %v/v    51 %v/v    32%v/v



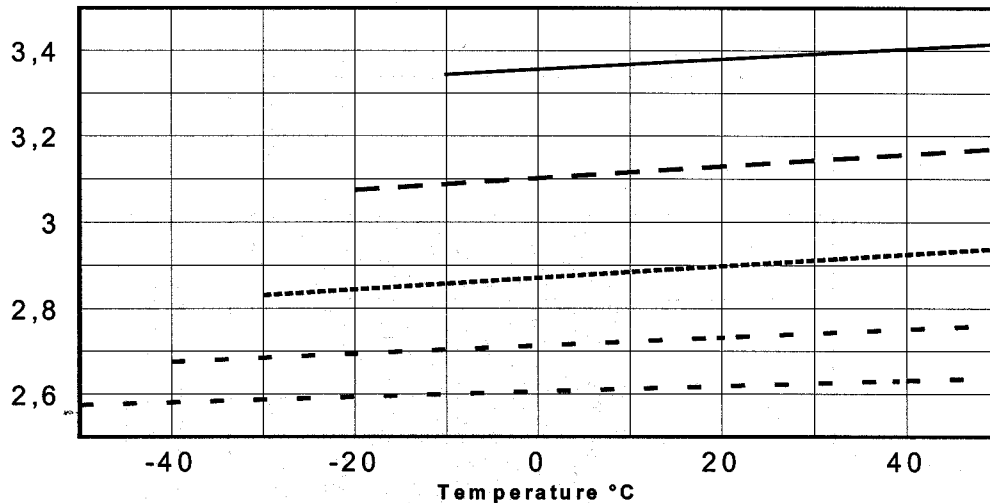
### Refractive index of Antifrogen KF-water mixtures at 20 °C



### Specific heat of Antifrogen KF-water mixtures

32 Vol.% 51 Vol.% 69 Vol.% 85 Vol.% 100 Vol.%

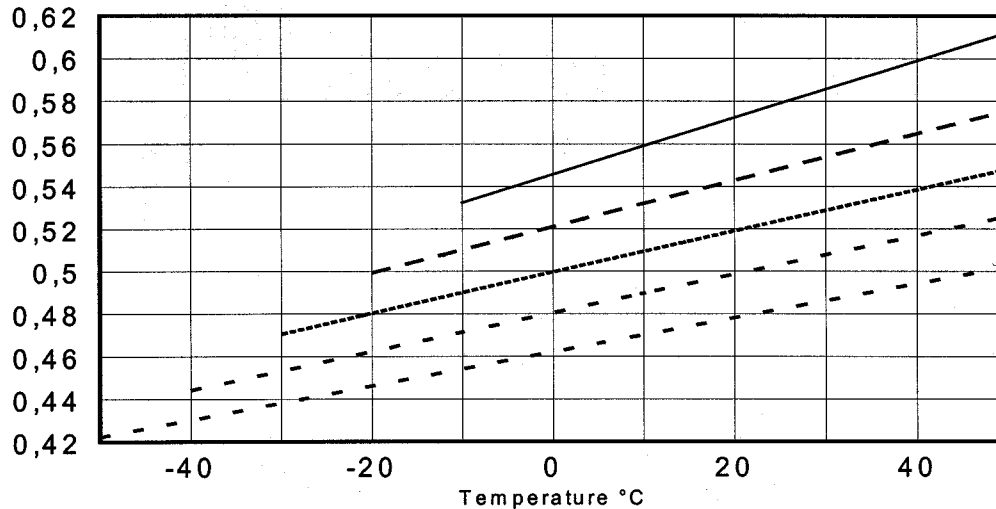
$\text{kJ/kg.K}$



### Thermal conductivity of Antifrogen KF-water mixtures

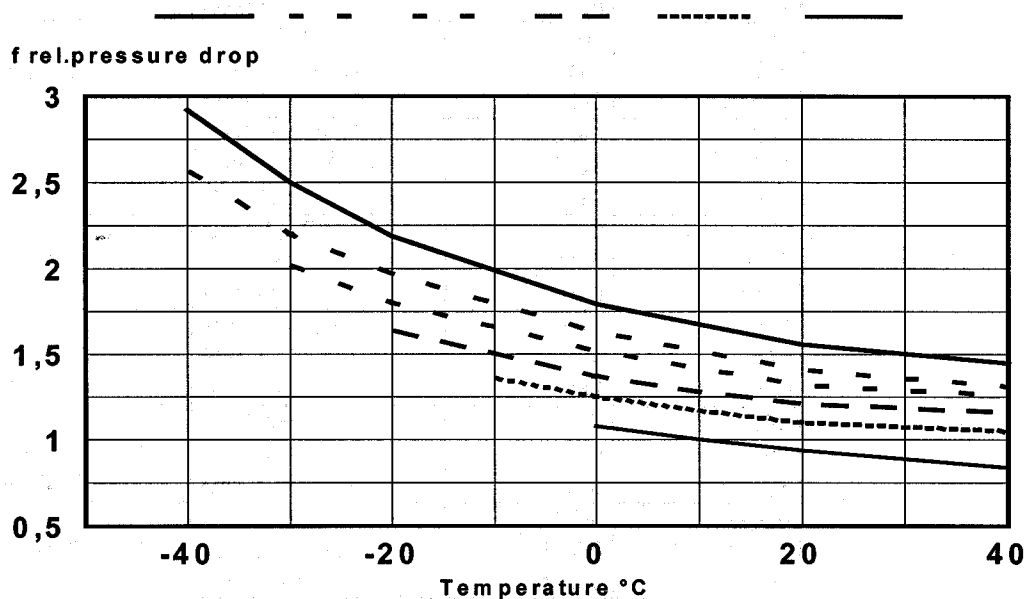
32% V/V 51% V/V 69% V/V 85% V/V 100% V/V

$\text{W/mK}$



**Relative pressure drop of Antifrogen KF-water mixtures**

in comparison with water +10°C in turbulent flow  
 100 % v/v 85 % v/v 69 % v/v 51 % v/v 32 % v/v 0 % (Water)



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