Product Sheet
HEAT TRANSFER FLUIDS

ANTIFROGEN®
KF VP 1974

LOW-VISCOSITY, LOW-TEMPERATURE BRINE FOR THE FOOD SECTOR, ANTIFREEZE AND CORROSION-INHIBITING MEDIUM

CLARIANT INTERNATIONAL LTD
BU INDUSTRIAL & CONSUMER SPECIALTIES

Rothausstrasse 61
4132 Muttenz
Switzerland

CONTACTS

Technical: + 49 (0) 8679 7 4665
Commercial: + 41 61 469 7834

ISSUE
July 2014

Product description

Antifrogen® KF VP 1974 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-, borate and amine-free. The optimization of the corrosion inhibition system was performed without the use of CMR-substances (cancerogenic, mutagenic, reprotoxic).

According to the formulation Antifrogen® KF VP 1974 doesn't contain any restricted substances as described in the EG-guideline 2011/65/EU (**RoHS** = Restriction of Hazardous Substances, Artikel 4 §1): Lead, mercury, hexavalent chromium, polybrominated biphenyl (PBB) respectively polybrominated diphenyl ether (PBDE).

Declaration of Reach-Conformity

Clariant declares that all of its products marketed in the EU, i.e. substances, preparations or sarticles within meaning the Article 3, Section 1-3 of Regulation (EC) 1907/2006 of the European Parliament and the Council of 18.12.2006 (REACH), hereinafter referred to as „substances" are delivered in accordance with all applicable chemical laws, with special references to the Reach Regulations (EC).

- Based on potassium formate
- Including anticorrosion additives
- harmless
- Heat transfer fluid for very low temperatures
- low viscosity and energy efficient
- Minimal usage concentration: 50 % v/v (frost protection : ca. -20 °C)
- Permanent usage temperatures*: approx -50 to +20 °C *
  * short-term defrost temperatures up to +80 ° C are permissible

You can find further information regarding the products on our homepage www.antifrogen.com.

Technical data:

Density at 20 °C (DIN 51757)		g/cm³	approx. 1.343
Refractive index at 20 °C (DIN 51423, part 2)			approx. 1.387
pH-value (undiluted, DIN 51369)			approx. 11
Boiling point at 1013 mbar (ASTM D 1120)		°C	approx. 115
Freezing point (ASTM D 1177)		°C	approx. -53
Pour Point (DIN 51583)		°C	below -60
Kinematic viscosity (DIN 51582)	**at 20 °C** **at -40 °C**	mm²/s	2-3 approx. 9
Surface tension bei 20 °C (ASTM D 1331)		mN/m	approx. 69
Specific heat	**at 20 °C** **at -40 °C**	kJ/kg·K	approx. 2.6 approx. 2.5
Thermal conductivity	**at 20 °C** **at -40 °C**	W/m·K	approx. 0.46 approx. 0.39

Product properties

The certified quality system in accordance with DIN EN ISO 9001 is used in production and quality control. This ensures consistently high product quality.

The technical data below are used to describe the product and is taken from our own measurements or from literature. It does not constitute part of the

delivery specification. The actual product specification may be obtained upon request.

Applications

Antifrogen® KF VP 1974 was developed for use as a heat transfer and refrigerating medium, especially at very low temperatures.

The cooling brine 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 pracitce 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.

The proportion of Antifrogen® KF VP 1974 in a brine should not be less than 50 vol therefore normally - be%. This corresponds to about a -20 ° C frost-proof solution.

The brine should be used only in closed systems to prevent the oxidation of the inhibitors. Bei offenen Kreisläufen ist ein Betrieb als Warmsole nicht erlaubt. Darüber hinaus ist jeder unnötige Lufteinschlag zu vermeiden.

In open circuits, an operation is not allowed as warm brine. Moreover, any unnecessary air entrainment is avoided.

Eine Vermischung mit anderen Kühlsolen, besonders mit Chloridsolen, aber auch mit Glykolsolen (z.B. Antifrogen N oder L), ist nicht zu empfehlen.

Material compatibilities

Antifrogen® KF VP 1974 contains corrosion inhibitors that protect the metals of the cooling and heating systems, even in combined systems, permanently against corrosion and prevent the formation of boiler scale.

The effectiveness of the inhibitor combinations is checked constantly by the manufacturer by means of the well-known corrosion test method:

ASTM D 1384 (American Society for Testing and Materials). **$CaCl_2$**

The following table shows the relatively low corrosion of common metals caused by an Antifrogen® KF (frost protection = ca. -53 °C) compared to a calcium chloride brine and tap water.

The values, determined by the above mentioned method (ASTM D 1384), show the weight loss of metals in g/m² due to corrosion after 336 h.

Corrosion of metals in g/m², tested with ASTM D 1384 (88 °C / 6 l air/h):

	TW [a]	Antifrogen® KF [b]	$CaCl_2$ [c]	Weight change-limits
Copper	-1.0	-0.5	-11	max. 3.6
Brass (MS 63)	-1.0	-1.8	-36	max. 3.6
Steel (C15)	-76	-1.8	-95	max. 3.6
Cast iron (GG 22)	-192	-3.0	-310	max. 3.5
Cast aluminium (AlSi6Cu3)	-32	+0.4	-135	max. 10.4

[a] Tap water [b] Antifrogen® KF undilut.. [c] Calcium chloride brine

Since soft solder is not resistant to Antifrogen® KF VP 1974, we recommend the use of hard solder joints in assembling systems.

Galvanized lines must not be used because zinc is dissolved.

Formate/Acetate-water mixtures without inhibitors should not be used as this combination shows more corrosiveness than pure water.

Emptied systems should be refilled within a few days. Before filling with an Antifrogen® KF VP 1974/water mixture, the operator must carefully inspect the state of corrosion of the system. If necessary, measures must be taken to ensure perfectly clean metal surfaces. Corroded systems in which slight rust formation is already present cannot subsequently be operated corrosion-free with Antifrogen®, since the metal may be unevenly inhibited and the inhibitor consumed prematurely.

Older systems should therefore be thoroughly inspected and rinsed to ensure they are rust-free before the change is made. Good seals are the only way to ensure perfect functioning of the system and prevent costly leaks.

Das Antifrogen® KF-Wassergemisch sollte vor oder während der Befüllung der Anlage grob vorgemischt werden. The installation of a filter element for protection against solids is recommended.

Bei fortgeschrittenen Korrosionsschäden ist eine professionelle Reinigung vor der Neubefüllung durchzuführen. Besondere Vorsicht ist beim vorherigen Einsatz von chloridreichen Solen angebracht, da Chloridreste stark korrosiv wirken. Nur eine sorgfältige Abdichtung bietet Gewähr für eine einwandfreie Funktion der Anlage.

Hemp and the common compressed asbestos free fiber seals have proved to be suitable materials for this purpose.

According to data published in literature and the results of our own tests and trials, the following plastics and elastomers are suitable for the manufacture of components coming into contact with Antifrogen® KF VP 1974*:

Polyethylene low density, high density	(LDPE, HDPE)
Polypropylene	(PP)
Polytetrafluoroethylene	(PTFE)
Olefin rubber	(EPDM)
Nitril rubber	(NBR)

* The materials have been tested at +80 °C in specific conditions. Please consider the specifications and material compatibilities given by the manufacturer of the elastomers and plastics. We will check not listed materials on compatibility with Antifrogen® KF VP 1974.

Für die Ermittlung der Frostsicherheit empfehlen sich Brix-Refraktometer inkl. Datenschieber, die im Fachhandel für Antifrogen® KF erworben werden können. Die obere Grenze der Anwendungstemperatur bei Abtauvorgängen beträgt für unverdünntes Antifrogen KF +80 °C und sollte aus Korrosionsschutzgründen nicht überschritten werden.

Service and monitoring

According to our experience Antifrogen® KF VP 1974 can be used in installations for many years. However, the Antifrogen® KF VP 1974 concentration in the installation should be checked annually. This check is also advisable when the installation is topped up with liquid. Distributors have Antifrogen® KF VP 1974 antifreeze testers for this purpose.

The performance of the Antifrogen® KF VP 1974/water mixture should also be checked at intervals of one to two years. If a 250 ml sample is provided, the distributors can also perform this service.

For major industrial installations these tests can also be undertaken directly by Clariant Produkte (Deutschland) GmbH, Werk Gendorf, BU ICS / TA, D-84508 Burgkirchen, Germany, phone +49(0) 86 79/7-22 72, (www.antifrogen.com, see Technical service).

The data in our service report relate solely to the sample sent to us. Guidance on further use for the product tested assumes that the system is in proper condition and properly operated. We would expressly point out that, particularly where corrosion or scale is already present in the system, interactions with the product may occur with unpredictable consequences. We accept no liability whatsoever for any damage resulting from the improper condition or operation of the system.

Safety and Handling:

Potassium formate, the product on which Antifrogen® KF VP 1974 is based, is classified in water hazard class **WGK 1 (slightly water-polluting)** according to the list of water-polluting substances (VwVwS from 17.05.1999). **This also applies to mixtures of Antifrogen® KF VP 1974 with water.**

Flammpunkt (DIN 51758, closed cup)	> 110 °C
Ignition temperature (DIN 51794)	>550 °C
Temperature class (DIN/VDE	T2

0165)

Antifrogen® KF VP 1974/water mixtures have neither a flash point nor a fire point.

Spent Antifrogen® KF VP 1974/water mixtures can be disposed off in accordance with local regulations. According to the 2nd general administrative regulation relating to the German waste management act of 10.04.1990, reuse is preferable to disposal.

The results of ecotoxicological studies demonstrate the good biodegradability and toxicological safety of Antifrogen® KF VP 1974.

Further information will be found in the current EG safety data sheet.

Transport and storage:

VbF	-
GGVE/RID	non-regulated
GGVS/ADR	non-regulated
ADNR	non-regulated
IMDG-Code	non-regulated
UN-Nummer	-
IATA-DGR	non-regulated

Antifrogen® KF VP 1974 is supplied by our Antifrogen® distributors in road tankers. The product shows a good storability.

Further information about our Antifrogen® distributors you can find on our homepage www.antifrogen.com.

Antifrogen® KF VP 1974 has a storage stability of two years, if stored in closed original packaging. Since zinc is not resistant to Antifrogen® KF VP 1974, this should be considered when the product is transferred to other containers.

Further information to our products

ANTIFROGEN® N

Antifrogen® N is a tinted yellow liquid, for use as a heat transfer medium in closed hot water heating systems, heat pumps and as a cooling brine in industrial refrigeration equipment. Antifrogen® N is not suitable for the use

in food or pharmaceutical applications. Alternatively, the use of Antifrogen® L is recommended.

Antifrogen® L

Antifrogen® L is a blue tinted, clear liquid, which is used as a heat transfer medium in heat recovery systems and in the food and pharmaceutical sector or where the possibility of the heat transfer medium entering process water or hot water cannot be excluded. For this applications a " Toxicological Risk Evaluation on Adverse Human Health Effects for Users from Oral Uptake of Foodstuff contaminated with Antifrogen® L" is available (www.antifrogen.com, see downloads/certificates)

Antifrogen® L contains as the base product the toxicologically harmless 1,2-propylene glycol, which is approved by the FDA (Food and Drug Administration, acc. § 184.1666 of the Federal Register from 1.4.1985), Propylene glycol is registered as a generally harmless food additive) in the USA. Additionally, the 1,2-Propylene glycol is approved as solvent and extracting agent according Lebensmittel-Zusatzstoffverkehrsordnung vom 10.7.1984 (BG B1.I S. 897), Anlage 2, Liste 9. Also, Antifrogen® L is approved as an officially fire extinguishing agent (VdS-Certificate, www.antifrogen.com, see downloads/certificates).

ANTIFROGEN® SOL HT

Antifrogen® SOL HT is a physiologically harmless, yellowish, clear liquid based on an aqueous solution higher boiling glycols, which is used as a heat transfer medium in solar heating, especially those exposed to high thermal loads. The product is premixed with deionized water to give a frost resistance of about -23 °C.

Antifrogen® SOL Clean

Antifrogen® SOL Clean is a physiologically harmless, colorless, clear liquid based on glycol ethers with characteristic odor. Antifrogen® SOL Clean is used as a cleaning agent in solar systems.

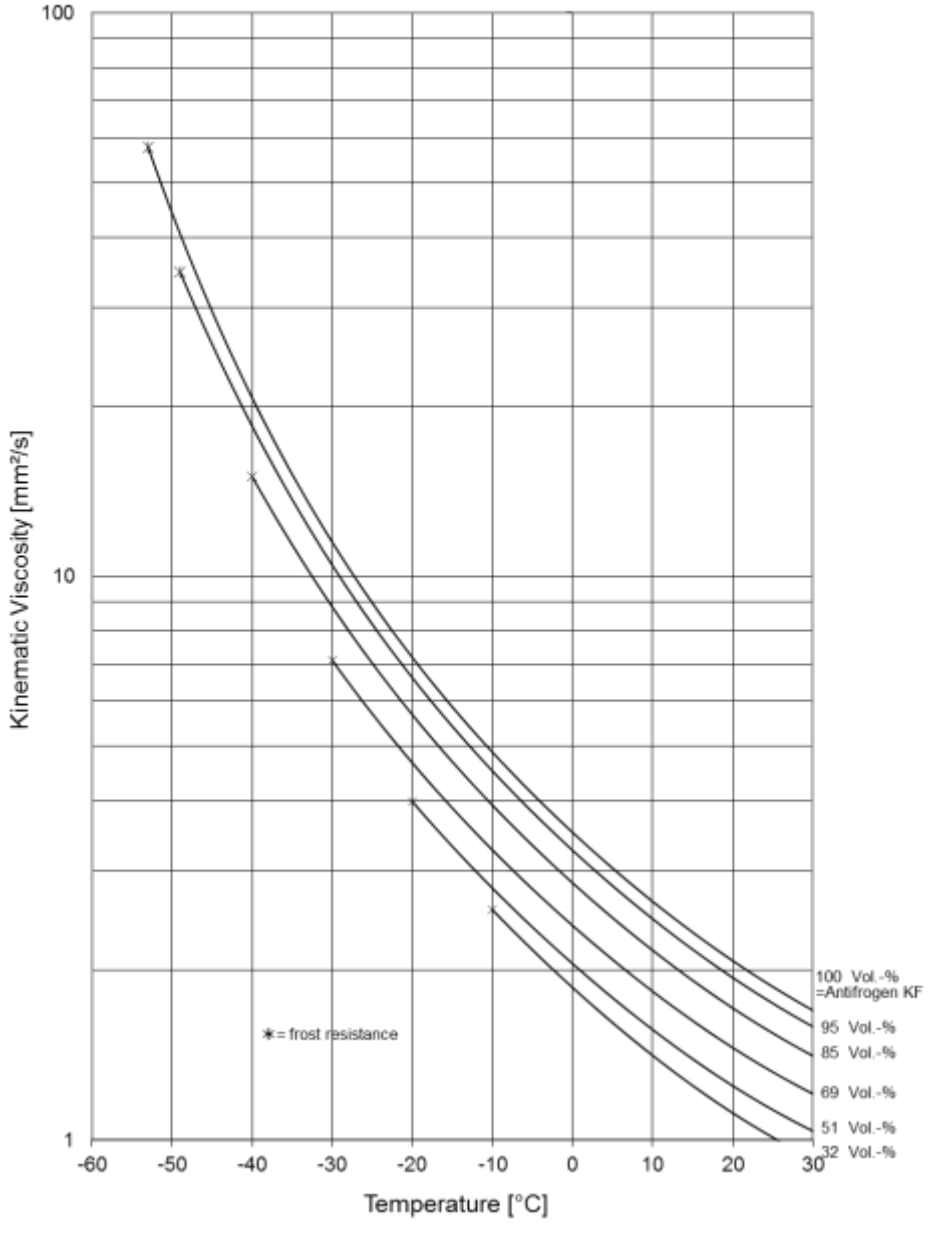
Antifrogen Homepage

Please visit us at www.antifrogen.com, where you can find newest informations on our product range. Additionally, a technical calculation program with all relevant physical data can be used and the technical leaflets can be downloaded there.

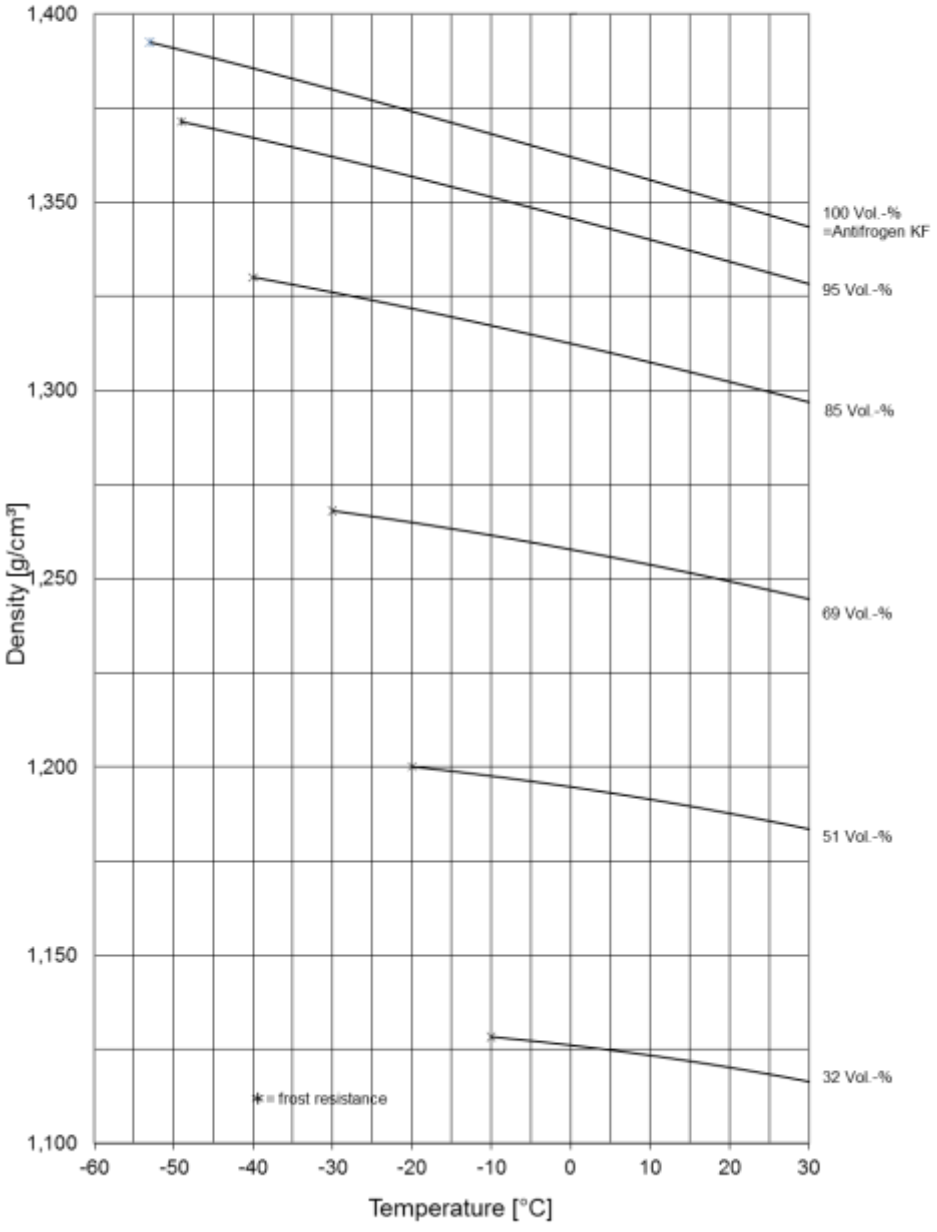
Appendix

The following graphs show the most important physical properties of Antifrogen® VP 1974/water mixtures. Due to the calculation software, which has been used to gain the related curves, small variances of the physical values are possible.

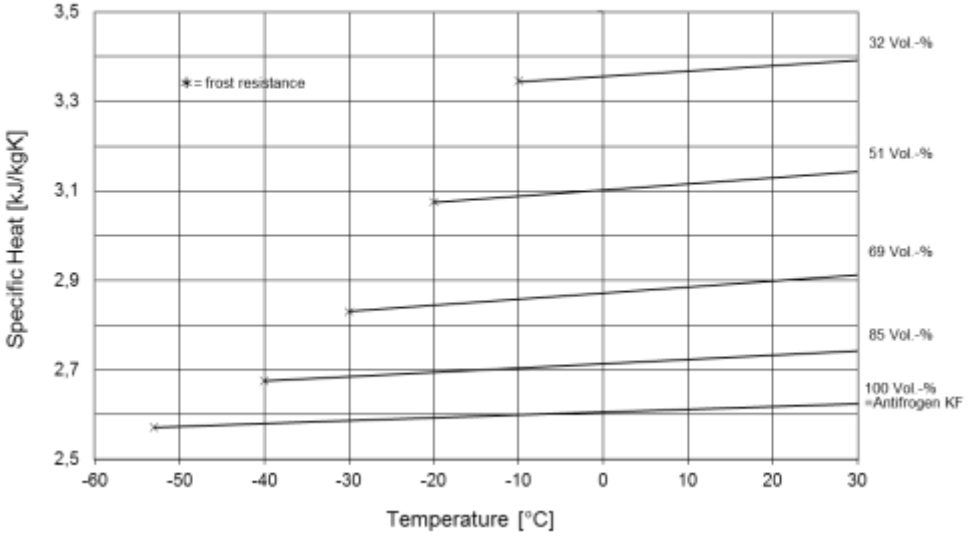
Kinematic Viscosity
of Antifrogen KF-water mixtures of different concentrations



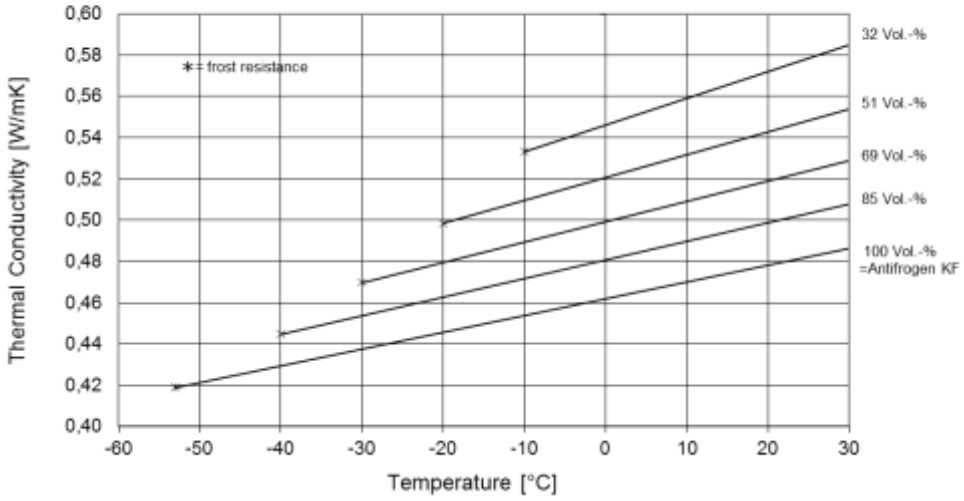
Density
of Antifrogen KF-water mixtures of different concentrations



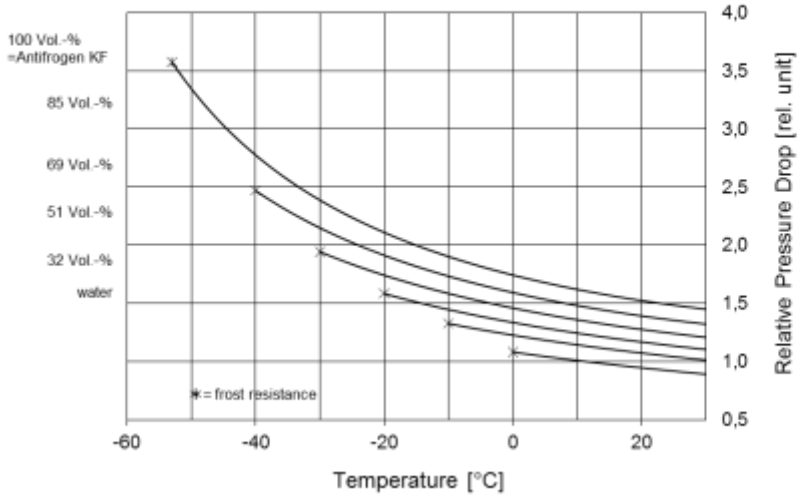
Specific Heat
of Antifrogen KF-water mixtures of different concentrations



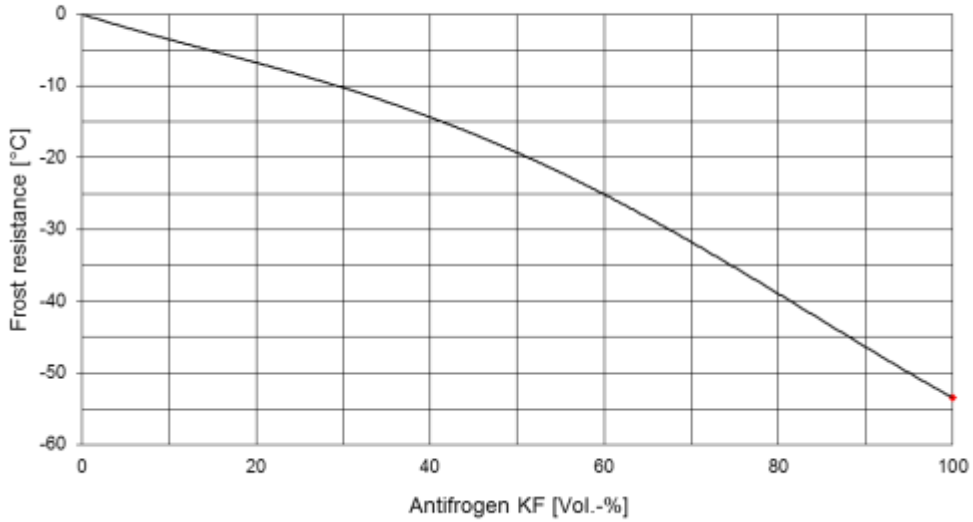
Thermal Conductivity
of Antifrogen KF-water mixtures of different concentrations



Relative Pressure Drop
of Antifrogen KF-water mixtures in comparison with water (+10°C) in turbulent flow



Frost resistance
of Antifrogen KF-water mixtures (crystallization point in accordance with ASTM D 1177)



Brechzahlen von Antifrogen KF-Wassermischungen