

® Antifrogen L

Cooling brine for the food industry
Antifreeze and corrosion inhibitor for refrigeration, solar heating and heat pump systems, approved fire extinguishing agent

Product description

Antifrogen L is a clear liquid, tinted light blue, for use as a cooling brine and heat transfer medium in solar heating and heat pump systems and in the food industry, e.g. in breweries, dairies, ice-cream factories, cold stores and fish processing factories.

The product is inhibited without the use of nitrites, amines and phosphates.

- Based on 1,2-propylene glycol and anticorrosion additives
- Minimal usage concentration: 25 % v/v (-10°C)
- Permanent usage temperatures: approx. -25 to +150°C
- Suitability of plastics/elastomers → page 3/4

Technical data

Density at 20 °C (DIN 51757)	g/cm ³	about 1.055
Refractive index n _D at 20 °C (DIN 51423, Part 2)		about 1.436
pH value (1:2 mixture with water) (DIN 51369)		7 – 9
Reserve alkalinity (ASTM D 1121)	ml c (HCl) 0,1 m	min. 12
Boiling point at 1013 mbar (ASTM D 1120)	°C	about 170
Pour point (DIN 51583)	°C	about -50
Kinematic viscosity at 20 °C (DIN 51582)	mm ² /s	about. 72
Surface tension at 20 °C (1:2 mixture with water) (ASTM D 1331)	mN/m	47
Specific heat at 20 °C	kJ/kg·K	2.5
Thermal conductivity at 20 °C	W/m·K	0.21
Specific electrical conductivity at 20 °C (1:2 mixture with water)	µS/cm	about 2800

Notes on user

Product properties

The technical data below is used to describe the product. It does not constitute part of the delivery specification. The mandatory product specification will be found in the current technical data sheet.

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

Application properties

Antifrogen L fulfills a dual function as a heat transfer medium. It ensures that the aqueous solution remains liquid at the required brine temperature and protects any metal components in the refrigeration system from corrosion.

Frost resistance (see graph, page 14) is determined by the Antifrogen L content of the aqueous solution.

The frost resistant curve in the appendix shows that below a frost resistance of -20 °C solidified Antifrogen L/water mixtures will not cause bursts under central European conditions. In installing the system, only chloride-free soldering agents should be used. Propylene glycol, which has relatively low toxicity, provides the basic resistance to freezing. As a result of its high boiling point (about 187 °C), there is no evaporation loss. **Phase separation of Antifrogen L/water does not occur when such mixtures are used as a heat transfer medium.**

The critical heat transfer coefficient of the Antifrogen L/water mixtures commonly used are only slightly different from the coefficient of tap water alone when heat is transferred to the atmosphere via radiators. In such cases, the quantity of heat that can be transferred with an Antifrogen L/water mixture is practically the same as for water alone and so the heat exchange surfaces do not need to be modified. In liquid/liquid heat transfer, on the other hand, the quantity of heat that can be transferred decreases as the content of Antifrogen L increases, so that the heat exchange

surface has to be increased according to the altered k values. Since Antifrogen L/water mixtures have a higher viscosity and density, a higher pressure drop must be expected in pipelines etc.; graphs of the relative heat transfer coefficient and relative pressure drop – in comparison with pure water – are particularly useful for calculation purposes. These graphs and other physical data are to be found in the appendix.

The effectiveness of the inhibitors present in Antifrogen L is constantly checked. Normally the wellknown corrosion test method ASTM D 1384 (American Society for Testing and Materials) is used.

1,2-propylene glycol/water mixtures cannot be used without inhibitors because they are more corrosive than water alone.

The following table shows the relatively low corrosion of metals commonly used in refrigeration systems caused by an Antifrogen L/water mixture at -15 °C as compared with a calcium chloride brine giving the same antifreeze effect. The values, determined by the ASTM D 1384 method, show the weight loss of the metals in g/m² due to corrosion.

Corrosion of metals in g/m², tested in accordance with ASTM D 1384 (336 hours/88 °C, 6 l air/h)

	Antifrogen L / water mixture 1:2	1,2-propylene glycol / water mixture 1:2 without additives	Mains water (14° dH) without additives	Calcium-chloride brine 21 % (w/w)
Steel (CK 22)	< -0.5	-225	-76	-95
Cast iron (GG 25)	< -1.0	-92	-192	-310
Copper	< -0.5	-1.2	-1,0	-11
Brass (MS 63)	-0.8	-2.5	-1,0	-36
Special steel (1.4541)	< -0.3	n.d.	-0.5	cannot be used (pitting)
Aluminium (99,5)	-1.9	n.d.	-5	-660
Cast Aluminium (AlSi ₆ Cu ₃)	-2.4	-68	-32	-135
Soft solder (WL 30)	-2,3	-136	-11	-443

*German hardness; EH = 1.25 GH

Red bronze, hard silver and hard copper solder are also resistant to Antifrogen L/water mixtures.

It is advisable, if at all possible, not to use the product in galvanized pipelines, since all glycol/water mixtures can dissolve zinc.

Antifrogen L should always be diluted with water.

The water used to dilute Antifrogen L should contain no more than 100 mg/kg chlorides. This should be borne in mind particularly if systems contain components made of aluminium or aluminium alloys. A wide range of water hardness is acceptable (between 0 and 25 ° GH). This means that, in addition to tap water, fully deionized water may be used.

The good corrosion-inhibiting properties of Antifrogen L/water mixtures decrease as expected with increasing water content. The Antifrogen L concentration of a cooling brine or heat transfer medium should therefore be at least 25 % by volume. Such a solution is resistant to freezing down to -10 °C.

The following advice should be observed when using Antifrogen L in heating and refrigeration systems and in solar heating and heat pump systems:

Emptied systems should be refilled within a few days. Before filling with an Antifrogen/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. The Antifrogen L/water mixture should be roughly premixed either before or during filling of the system. When choosing a circulating pump, care should be taken to ensure that it is suitable for operation with antifreezes. Pump components made from phenolic-resin-based materials, for example, do not meet this requirement. Refrigeration systems previously operated with a salt-based cooling brine must be thoroughly flushed with a pickling inhibitor and then with water to remove traces of salt and rust particles.

If chloride-rich brines have been used previously, flushing must be carried out with particular care because any residues in the system tend to impair the corrosion-inhibiting effect of Antifrogen L.

When a refrigeration system previously operated with a salt-based cooling brine or a heating system previously filled with water is charged with Antifrogen L, the low surface tension and associated rust-removing action of this product may cause any existing corrosion damage to show up as leaks.

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.

After leakage, systems with Antifrogen L/water mixtures should only be topped up with Antifrogen L of the same concentration. Mixing with different products should be avoided, as it can lead to incompatibilities. In exceptional cases, the expert opinion of the responsible R&D department in the Functional Chemicals Division at Clariant should be contacted.

Compressed asbestos fiber ("IT") seals have proved to be suitable for these systems.

Graphite cords can be used as gland seals. For threaded pipe connections in which hemp is used as a seal, coating with ®Fermitol (Nissen & Volk) has proved successful. Without hemp, ®Loctite 511 or 577 is useful.

Tests and many years of practical experience have shown that the materials used for pressure surge compensators e.g. ®Flexcon (Flamco) are not affected by Antifrogen L/water mixtures.

According to data published in the 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 L/water mixtures of normal concentration:

Butyl rubber	(IIR)
Fluorocarbon elastomers, e.g. ®Viton (DuPont)	(FPM)
Natural rubber up to 80 °C	(NR)
Nitrile rubber e.g. ®Perbunan (Bayer)	(NBR)
Olefine rubber, e.g. ®Buna AP (Bayer)	(EPDM)
Polyacetale, e.g. ®Hostaform (Ticona)	(POM)

Polyamide	(PA)
Polybutene, e.g. ®Rhiatherm (Simona)	(PB)
Polychlorbutadiene elastomers, e.g. ®Neopren (Du Pont)	(CR)
Polyester resins	(UP)
Polyethylene, crosslinked, e.g. ®Rautherm (Rehau) ®Polytherm (Hewing)	(CPE)
Polyethylene low-density, high-density	(LDPE, HDPE)
Polypropylene, e.g. ®Hostalen PPH 2222 (Targor)	(PP)
Polytetrafluorethylene, e.g. ®Hostaflon (Dyneon)	(PTFE)
Polyvinyl chloride, unplasticized	(uPVC)
Styrene/butadiene rubber up to 100 °C	(SBR)
Silicone rubber, e.g. ®Elastosil (Wacker)	(Si)
Acrylnitrile butadiene styrole	(ABS)

Polyurethane elastomers, plasticized PVC and phenol-formaldehyde resins are not resistant.

Practical experience has shown frost resistance over the following temperature ranges to be adequate:

Hot water heating system	-10 bis -20 °C
Earth-buried collectors combined with heat pumps	-10 bis -15 °C
Other external circuits combined with heat pumps	-20 bis -25 °C
Refrigeration systems	-10 bis -30 °C

Special testers are available for determining the frost resistance. Test instruments which operate on the principle of density measurement by hydrometer or those which determine the cooling limit by refractometry are also suitable.

For solar heating applications, especially those which are exposed to high thermal stress (vacuum tube collectors with a no-load operating temperature of up to +260 °C), a special heat transfer medium based on non-toxic, high-boiling alkylene glycols is available,

known as **Antifrogen SOL**. Please request a separate data sheet for this product. In heat pumps Antifrogen L is used as the heat transfer medium in external circuits; the Antifrogen L/water mixture transfers heat to the internal circuit of the heat pump. To prevent corrosion, the Antifrogen L concentration should not be less than 25 % by volume. Antifrogen L/water mixtures are suitable for use as frostproof fire extinguishing agents for sprinklers in frost-prone areas, e.g. in cold stores or in outdoor areas.

Systems which have been operated only temporarily with Antifrogen L (e.g. for frostproofing during winter construction) must be rinsed out thoroughly with water several times before being refilled, since product residues may attack metals more severely because of the inadequate inhibitor concentration.

Servicing and monitoring

It has been found that Antifrogen L can be used in installations for many years. However the Antifrogen L concentration in the installation should be checked annually. This check is also advisable when the installation is topped up with liquid.

Dealers have Antifrogen L antifreeze testers for this purpose.

The performance of the Antifrogen L/water mixture should also be checked at intervals of approx. two years. If a 250 ml sample is provided, a dealer can also perform this service. For major industrial installations, these tests can also be undertaken by Clariant Produkte (Deutschland) GmbH, Werk Gendorf, Division Functional Chemicals R&D, D-84504 Burgkirchen, phone ++49 8679 722 72.

The data in our service report relate solely to the sample sent to us. Guidance on further use of 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

Maximum allowable workplace concentration ¹⁾ (MAK-Wert, TRGS 900, 1992)		not stipulated
Acute oral toxicity LD ₅₀ (rat)	mg/kg	> 15000
Flash point (DIN 51758)	°C	about 106
Ignition temperature (DIN 51794)	°C	about 446
Temperature class (DIN/VDE 0165)		T2
German regulations on dangerous substances (GefStoffV)		does not require a hazard warning label
German chemical act (ChemG)		existing commercial chemical substance (components included in EINECS)
Water hazard class (WGK)		1

¹⁾ Published by the "Kommission zur Prüfung gesundheitsschädlicher Arbeitsstoffe der Deutschen Forschungsgemeinschaft "
(MAK-Werte 1992)

Antifrogen L may be described as relatively harmless according to the usual classification systems.

The base product of Antifrogen L, 1,2 propylene glycol, is a permitted additive as a solvent and extractant under the German food additives trade regulations of 10.7.1984 (BG Bl. (Federal Law Gazette) I p. 897), appendix 2, list 9. In the USA, propylene glycol is permitted as a generally harmless food additive according to section 184.1666 of the Federal Register dated 1.4.1985.

1,2-propylene glycol 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 L with water.**

Spent Antifrogen L/water mixtures can be disposed of in a special waste incineration plant in accordance with local regulations.

According to the 2nd general administrative regulation relating to the German waste management act of 10.4.1990, reuse is preferable to disposal.

In concentration up to 100 mg/l, Antifrogen L/water mixtures show no acute harmful effects on fish and bacteria. They are readily biodegradable.

Antifrogen L/water mixtures can therefore be taken to a biological treatment plant for biodegradation, after consultation with the operator, provided the relevant legal provisions on water and waste allow this.

Antifrogen L/water mixtures have neither a flash point nor a fire point.

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

Transport and storage

VbF ²⁾	-
GGVE/RID	non-regulated
GGVS/ADR	non-regulated
ADNR	non-regulated
IMDG code	non-regulated
UN number	-
IATA-DGR	non-regulated

²⁾ German regulations on flammable liquids

Antifrogen L is supplied in road tankers, intermediate bulk containers (IBC, 1000 kg) and non-returnable corrugated drums (220 kg). Smaller canisters are available from our dealers. Antifrogen has a good storage stability. Since zinc is not resistant to Antifrogen L, this should be borne in mind when the product is transferred to other containers.

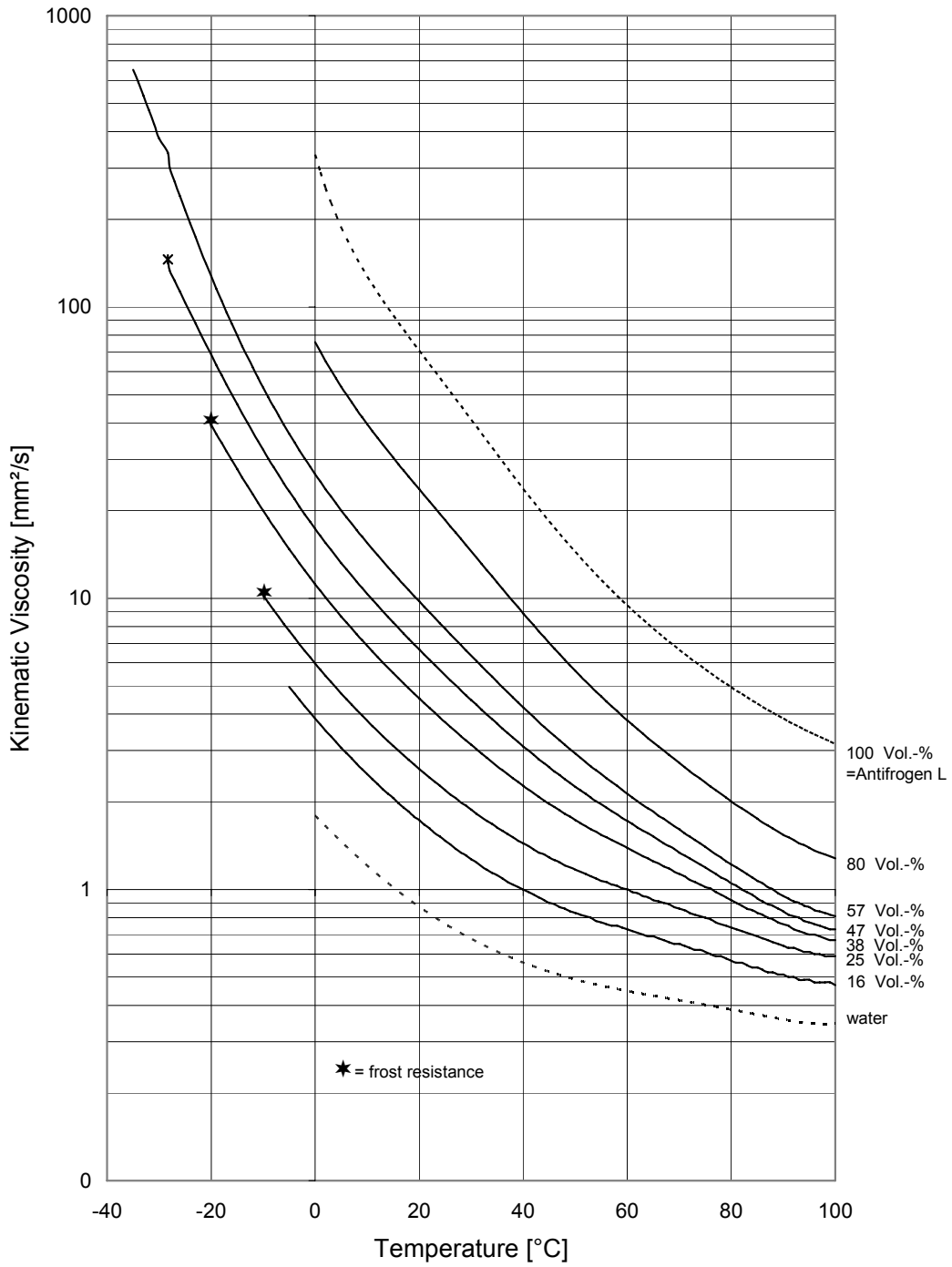
Antifrogen KF

For applications in the low-temperature range (-20 to -50 °C), we supply Antifrogen KF, a toxicologically harmless cooling brine based on formates. Because of its low viscosity at low temperatures, Antifrogen KF is particularly suitable for the food sector. A special data sheet on this product is available on request.

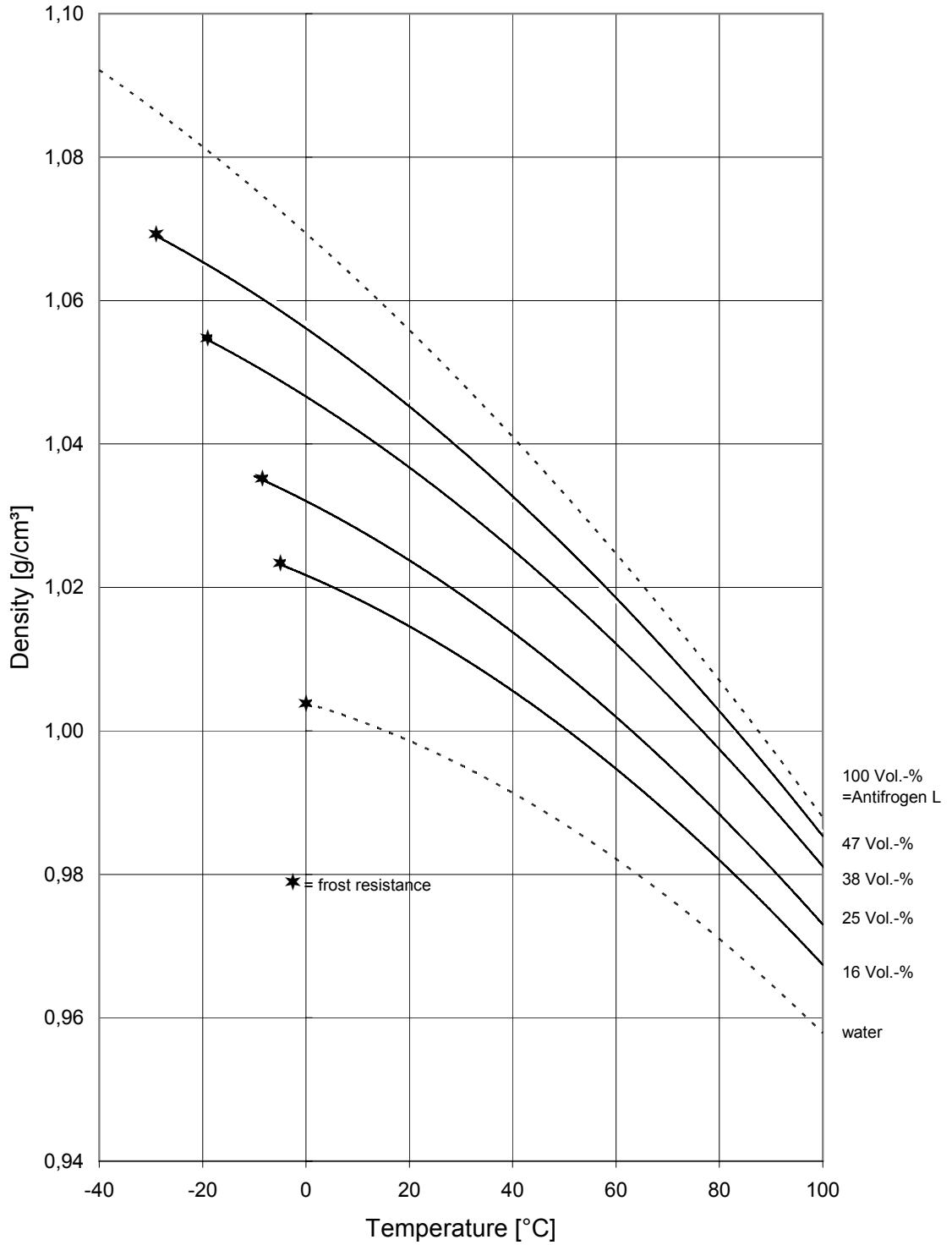
Appendix

The following graphs show the most important physical properties of Antifrogen L/water mixtures.

Kinematic Viscosity
of Antifrogen L-water mixtures of different concentrations

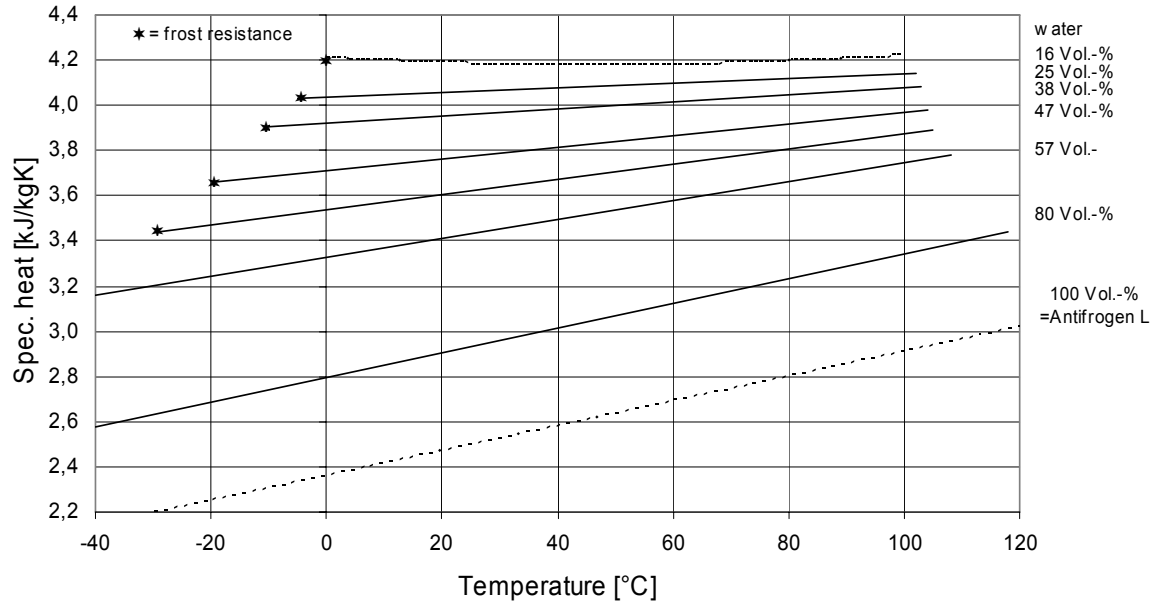


Density
of Antifrogen N-water mixtures of different concentrations



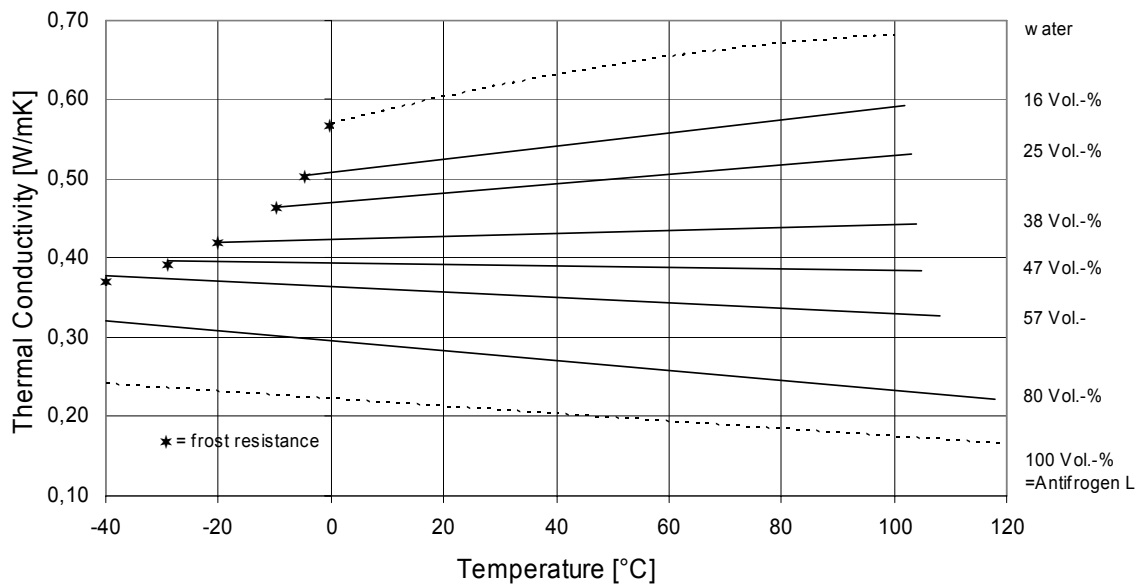
Specific Heat

of Antifrogen L-water mixtures of different concentrations



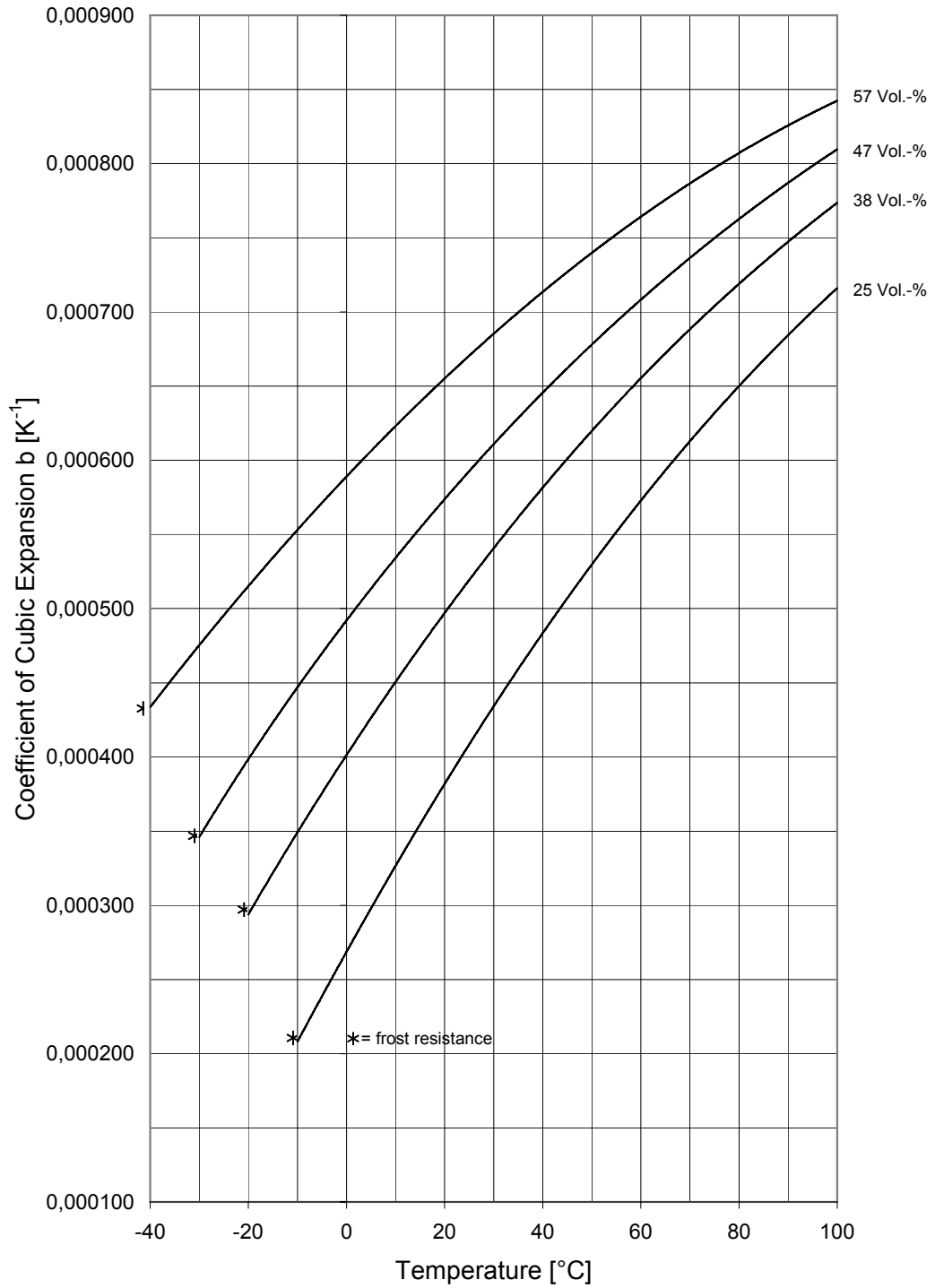
Thermal Conductivity

of Antifrogen L-water mixtures of different concentrations



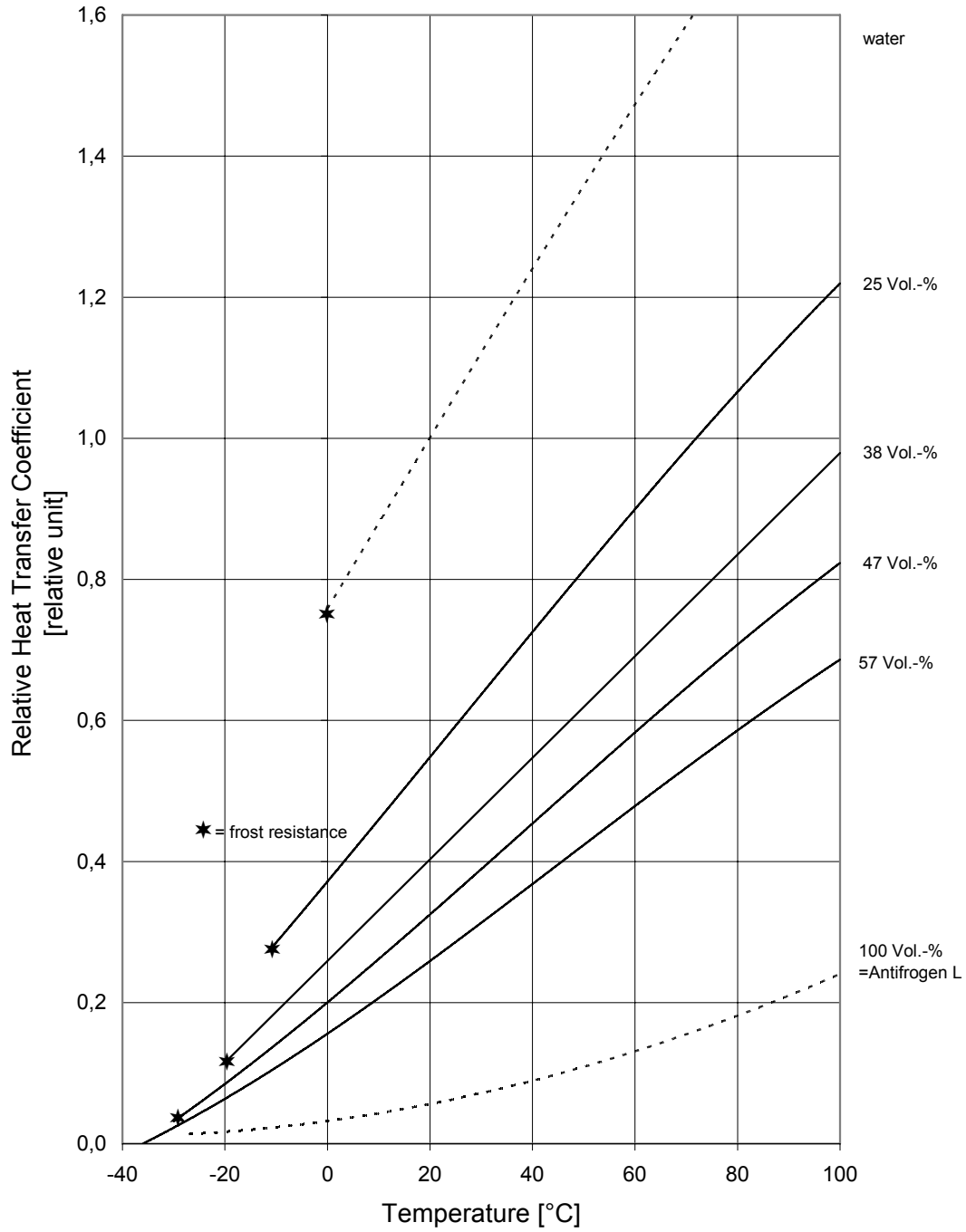
Coefficient of Cubic Expansion

of Heat Transfer Fluid P-water mixtures of different concentrations



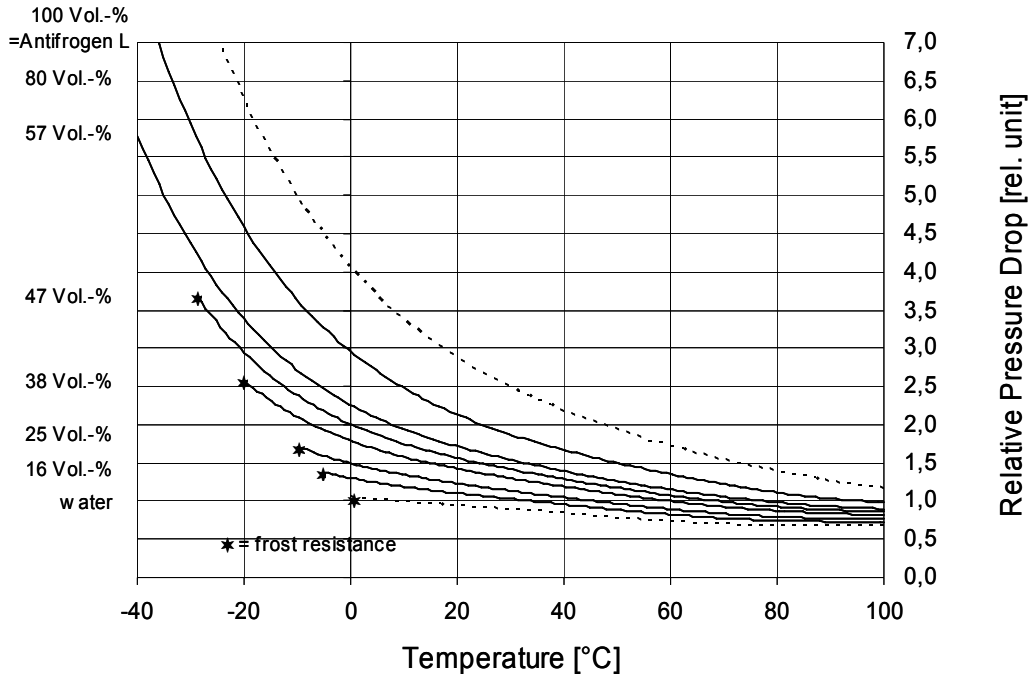
Relative Heat Transfer Coefficient

of Antifrogen L-water mixtures in comparison with water (+20°C) in turbulent flow



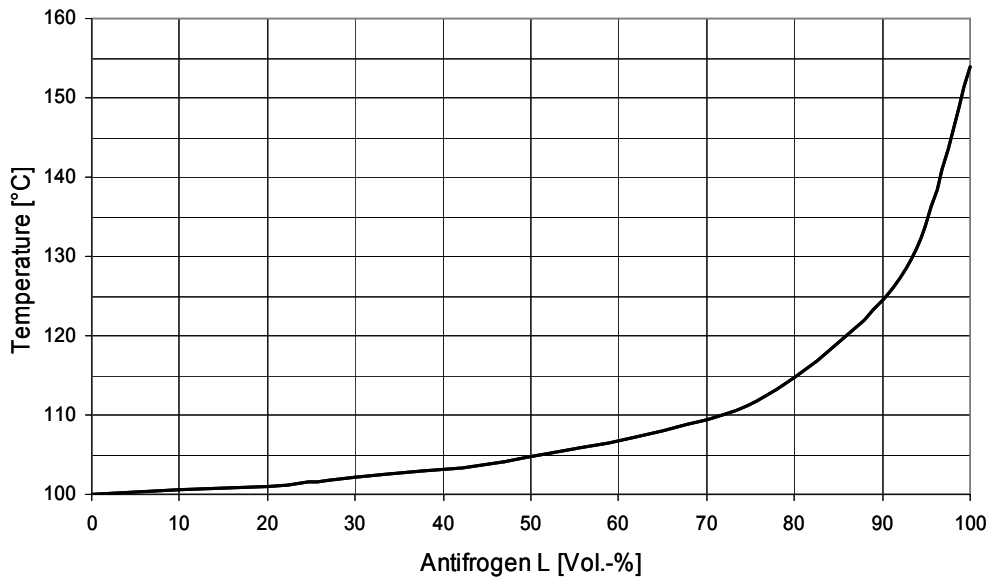
Relative Pressure Drop

of Antifrogen L-water mixtures in comparison with water (+10°C) in turbulent flow

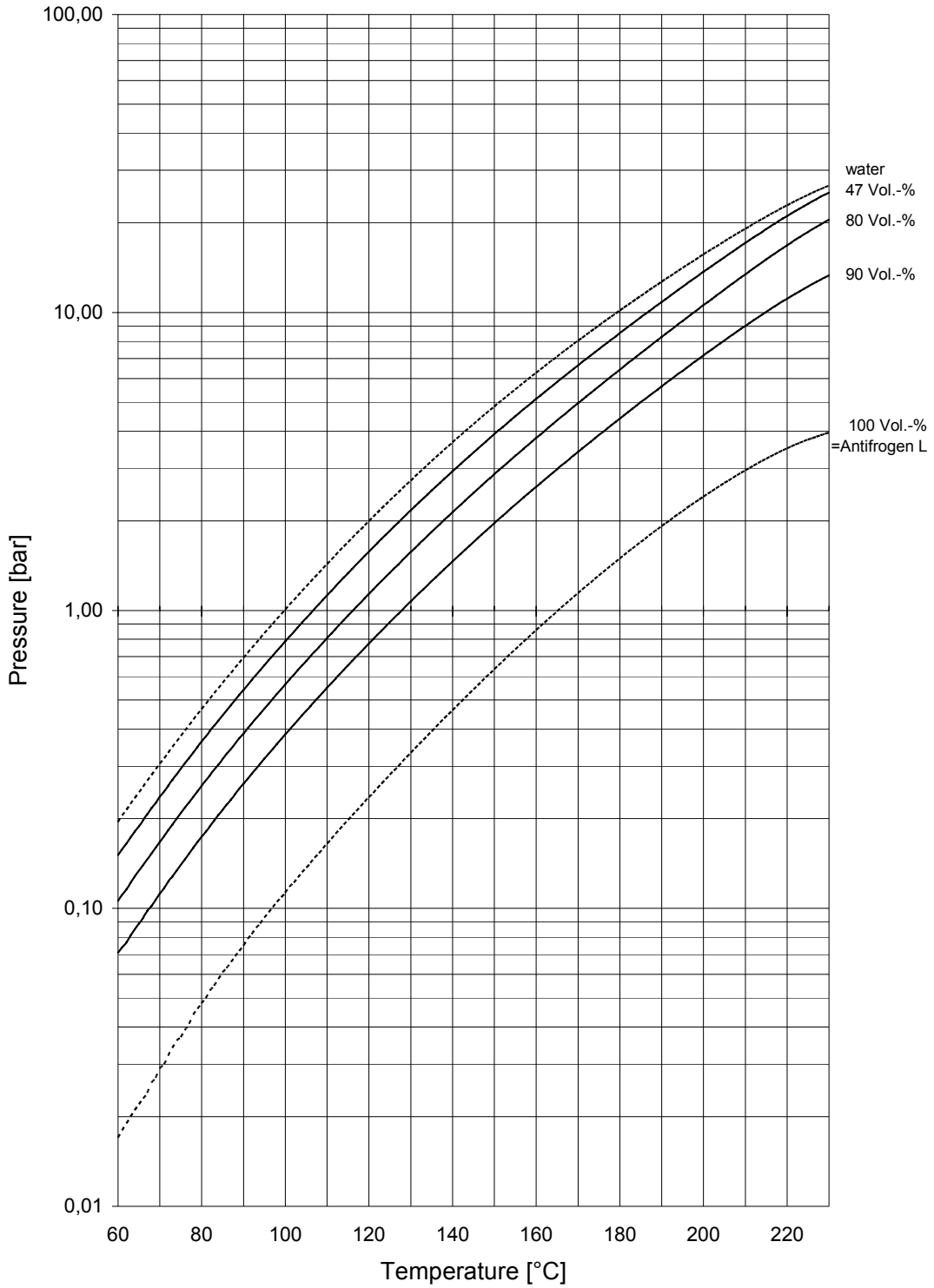


Boiling Points

of Antifrogen L-water mixtures of different concentrations in accordance with ASTM D 1120 at 1013 hPa (mbar)

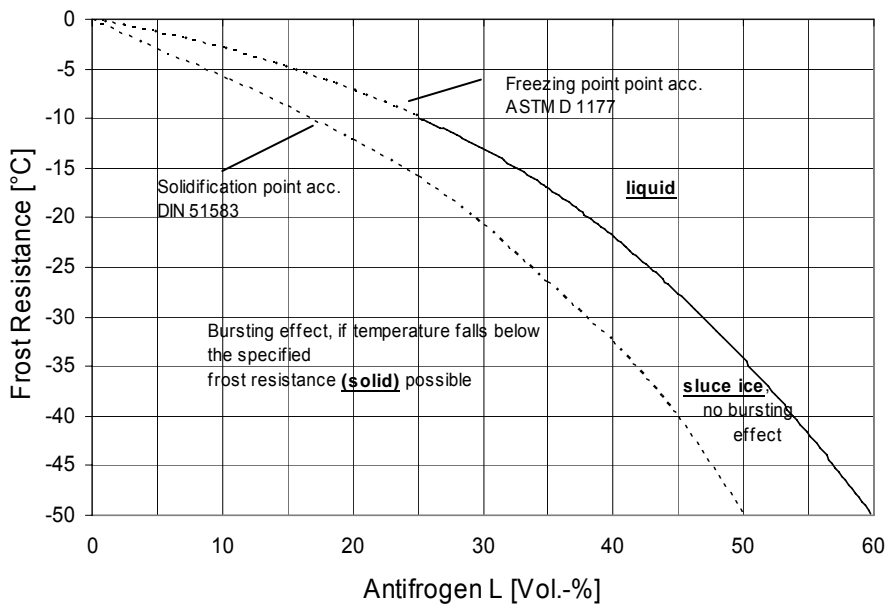


Vapor Pressure
for Antifrogen L-water mixtures as a function of temperature



Frost Resistance

of Antifrogen L-water mixtures (crystallization point in accordance with ASTM D 1177)



Antifrogen L as fire extinguishing agent

Antifrogen L ist he first glycol based antifreeze which is approved by the VdS (Verband der Schadensversicherer = german assurance association; **VdS approval no. G 4040093**) for the use as a fire extinguishing agent.

Since that, **Antifrogen L/water mixtures up to 38 % v/v** (represents a freezing point of -20 °C) are approved for the use as a fire extinguishing medium in sprinkler systems for fighting class A fires.

The use of higher concentrated Antifrogen L/water mixtures is not recommended since the glycol base of the product could be of any contribution to the fire! Higher concentrates are not approved by the VdS as fire extinguishing agent!

The antifreeze can be used to fill up the pipe network of sprinkler systems. However, it must be proved that pure water comes out of the sprinklers after max. 4 minutes after triggering – even at the hydraulically adversed sprinkler head. Additionally, it must be ensured that no impermissible pressures occur in the

This information is based on our present state of know-ledge and is intended to provide general notes on our products and their uses. It should not therefore be construed as guaranteeing specific properties application.

Any existing industrial property rights must be observed. The quality of our products is guaranteed under our General Conditions of Sale.

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system which could possibly be created by any variations in temperature.

Antifrogen L/water mixtures in sprinkler systems are **not allowed for the use in galvanized pipes or in connection with other zinc containing components:** In a worst case scenario, the sprinkler head could be clogged by dissolved zinc residues.

For the use of Antifrogen L/water mixtures in sprinkler systems, the **Clariant product service** for determining physical/chemical properties and the freezing point must be used once a year. A copy of the test results must be forwarded to VdS – Technische Prüfstelle (VdS Technical Department).

For the use in fire extinguishing systems with more than 20 sprinklers, coordination with the VdS is necessary.

Compatibility with several metals, elastomers and plastics can be seen in the corresponding tables (page 3 and 4). Pre-diluted Antifrogen L/water mixtures are available in 25, 32, 35 and 38 % v/v concentrations.

All mentioned mixtures can be used in the sprinkler systems from 0 to 16 bar pressure.