

Antifrogen® SOL HT

Premixed heat transfer medium for solar applications with high thermal loads including antifreeze and corrosion inhibiting protection.

Product description

Antifrogen SOL HT is a physiologically harmless, yellowish, clear liquid based on an aqueous solution of higher boiling glycols, which is used as a heat transfer medium in solar heating systems, especially those exposed to high thermal loads. The product is premixed with deionized water to offer a frost resistance of about -23 °C. The corrosion inhibitor formulation is phosphate-, borate- and nitrite free. It meets the requirements of DIN 4757, part 3, for solar heating systems.

At www.antifrogen.com you can find actual informations about all Antifrogen products.

- Based on higher boiling glycols
- Plus anticorrosion additives
- Premixed heat transfer medium
- Permanent usage temperatures: approx. -23 to +200 °C
- Harmless to health
- Applicable in any thermal solar collector

Technical data

Density at 20 °C (DIN 51757)	g/cm ³	approx. 1.082
Refractive index nD at 20 °C (DIN 51423, part 2)		approx. 1.401
pH-value (undiluted, DIN 51369)		approx. 9
Reserve alkalinity (ASTM D 1121)	ml c(HCl) 0.1 M	3 - 4
Boiling point at 1013 mbar (ASTM D 1120)	°C	approx.105
Pour point (DIN 51583)	°C	approx. -28
Kinematic Viscosity at 20 °C (DIN 51562)	mm ² /s	approx. 7.4
Kinematic Viscosity at 80 °C (DIN 51562)	mm ² /s	approx. 1.44
Specific heat at 20 °C	kJ/kg*K	approx. 3.2
Thermal conductivity at 20 °C	W/m*K	approx. 0.36
Specific electrical conductivity at 20 °C	µS/cm	> 1000
Freezing Point (ASTM D 1177)	°C	approx. -23

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Product properties

The technical data below is 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 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 SOL HT was developed especially for use

as a heat transfer medium in solar systems. The product is physiologically harmless.

Frost resistance and usage concentration

The frost resistance of Antifrogen SOL HT is adjusted to a pour point of -28 °C (crystallization point: -23 °C). Trials have shown that this formulation will not cause bursts in system components because slush ice is formed when the product is cooled below the crystallization point.

The frost resistance of the mixture does not change even after many years of use, provided the Antifrogen SOL HT concentration remains constant.

Furthermore phase separation of Antifrogen SOL HT/water mixtures does not occur.

The good corrosion-inhibiting properties of Antifrogen SOL HT decrease as expected with increasing water content.

The frost resistance is of course reduced by mixing

with water, as the curves in the appendix indicate. As already mentioned Antifrogen SOL HT is premixed with deionized water and formulated to give the optimum frost and corrosion resistance. If traces of water still remain in the system after flushing or the user inadvertently dilutes the product, additions of water up to 20 % can be tolerated without any adverse effect on corrosion resistance.

The water used to dilute Antifrogen SOL HT shall contain no more than 100 mg/kg (ppm) chlorides. A wide range of water hardness is acceptable (between 0 and 10° GH). This means, that in addition to fully deionized water, ordinary tap water may be used.

Special antifreeze testers are available for determining frost resistance. For further informations please apply to our Antifrogen-distributors (www.antifrogen.com).

Material compatibilities

Antifrogen SOL HT contains corrosion inhibitors that protect the metals of the solar 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).

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The following table shows the relatively low corrosion of common metals caused by Antifrogen SOL HT with a freezing point of -23 °C compared with a higher boiling glycol/water mixture and mains water.

The values, determined by the above mentioned ASTM method, show the weight loss of metals in g/m² due to corrosion.

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

	Antifrogen SOL HT ^a	higher boiling glycols ^b	weight-loss-limits
Copper	-1.0	-15	10
Soft solder (WL 30)	-1.1	-68	30
Brass (MS 63)	-2.4	-64	10
Steel (CK 22)	±0	-149	10
Cast Iron (GG 25)	±0	-74	10
Cast Aluminium (AlSi6Cu3)	-1.3	-6,7	30

^a Antifrogen SOL HT (undiluted); ^b higher boiling glycols 1:1 water mixture without inhibitors

Glycol/water mixtures without inhibitors should not be used.

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

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

Butyl rubber	(IIR)
Fluorcarbon elastomers, e.g. ®Viton (Du Pont)	(FPM)
Natural rubber up to 80 °C	(NR)
Nitrile rubber, e.g. ®Perbunan (Bayer)	(NBR)
Olefin rubber, e.g. ®Buna AP (Bayer)	(EPDM)
Polychlorbutadiene elastomers, e.g. ® Neopren	(CR)
Silicon rubber, e.g. ®Elastosil (Wacker)	(Si)
Styrene butadiene rubber up to 100 °C	(SBR)
Polyacetal, e.g. ®Hostaform (Ticona)	(POM)
Polybutene, e.g. ®Rhiatherm (Simona)	(PB)
Polyester resins	(UP)
Polypropylene, e.g. ®Hostalen PPH 2222	(PP)
Polyvinylidenedifluorid	(PVDF)
Polytetrafluoroethylene, e.g. ®Hostaflon	(PTFE)
flex. Polyolefine, e.g. ®Bauder Thermoplan T-SV (for flat roofs)	(FPO)

*The materials have been tested at boiling temperature in specific conditions. Please consider the specifications and material compatibilities given by the manufacturer of the elastomers and plastics. In the table not listed materials we like to check them for compatibility.

Phenol-formaldehyde resins, plasticized PVC and polyurethane elastomers are not resistant.

Experience has shown that EPDM elastomer seals are suitable for these systems.

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For threaded pipe connections, in which hemp is used as a seal, coating with Fermit or Fermitol or Loctite has proved successful. Leaks may occasionally occur when polytetrafluorethylene (PTFE) sealing tapes are used.

Circulating pumps should be selected with special regard to their suitability for operation with antifreeze

agents. Pump components made, for example, of materials based on phenolic resins do not meet this requirement. However, the circulating pumps normally used in heating installations have been found to be resistant.

Heat resistance

Antifrogen SOL HT was developed because of the increased use of vacuum collectors, which have a high standstill temperature of over +200 °C. The usual heat transfer media, based on ethylene or propylene glycol, tend to evaporate in such systems at high temperature owing to the low boiling point of these glycols. They leave partially insoluble, salt-like residues that can lead to operating problems if the collector is frequently idle and can result in failure of the system. The new product consists predominantly

of higher boiling, physiologically harmless glycols with a boiling point of over +270 °C at 1013 mbar. Due to the boiling point of the glycols the above-mentioned effect will be avoided.

Nevertheless, operating temperatures of more than +200 °C should be avoided. In the case of not-closed systems or the insert of oxygen (e.g. via valves) the maximum usage concentration is lower. At high temperature loads a decoloration of the fluid can occur, which has no effect on the properties of the product.

Notes for use in solar heating systems

Antifrogen SOL HT is an ideal heat transfer medium for highly stressed solar heating systems, particularly those with vacuum collectors. The materials normally used in solar heating systems, such as copper, stainless steel and aluminum, are protected from corrosive attack for many years by special corrosion inhibitors. To ensure optimum protection, the following advice should be followed:

1. The systems should conform to the requirements of DIN 4757 and must be designed as closed circuits. The membrane pressure surge compensators must conform with DIN 4807.
2. Before filling, the systems should be flushed out with water and pipe joints, valves and circulating pumps should be pressure-tested for leaks.
3. Hard-soldered joints are preferable to soft-soldered. Traces of flux (chloride- free) must be removed by pumping through with hot water.
4. If at all possible, galvanized components should not be used in the system because zinc is not resistant to the product and tends to start dissolving, which can lead to formation of sludge. Dirt traps and filters can help here.
5. After pressure testing, which also affords an opportunity to determine the capacity of the system from the amount of water used (water meter), the system should be drained and then filled immediately with Antifrogen SOL HT. Air

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pockets (gas pockets) are to eliminate immediately.

- 6. Long-term no-load operation of the system should be avoided because this can adversely affect the stability of the heat transfer medium and considerably reduce its service life.

- 7. In the event of leaks, top up with Antifrogen SOL HT. Avoid mixing it with other products. If accidentally water is used to top up the system, the concentration (= frost resistance) of the heat transfer medium should be checked with a hydrometer.

Service and monitoring

It has been found that Antifrogen SOL HT can be used in installations for many years. However, the Antifrogen SOL HT concentration (= frost resistance) should be checked annually. As required, the performance of the heat transfer medium and level of corrosion inhibition can also be checked by us. If a 250 ml sample is provided, this service can be undertaken by our distributors or Clariant Produkte (Deutschland) GmbH, Werk Gendorf, BU ICS, Heat Transfer Fluids, D-84508 Burgkirchen, Germany,

phone: +49-8679-72272, (see also: www.antifrogen.com).

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, Toxicology and Ecology

Flash point (DIN 51758)	°C > 105 (not detectable)
Ignition temperature (DIN 51794)	°C > 420
Temperature class (DIN/VDE 0165)	T2

Antifrogen SOL HT has neither a flash point, nor an ignition point.

The product is based on non-toxic glycols (higher polyalkylene glycols). The corrosion inhibitor formulation is phosphate-, borate- and nitrite free and

consists essentially of physiologically harmless additives.

The results of ecotoxicological studies confirm the good biodegradability and toxicological inertness of Antifrogen SOL HT. In concentrations up to 1000 mg/l, Antifrogen SOL HT shows no acute harmful effects on fish and bacteria. Antifrogen SOL HT is readily biodegradable.

Spent Antifrogen SOL HT can be disposed off in a special waste incineration unit in accordance with local regulations.

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

Transport and storage

VbF (German regulations - on flammable liquids)

®= registered trademark

Antifrogen® SOL HT

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

Antifrogen SOL HT is supplied by our Antifrogen-distributors in road tankers, intermediate bulk

containers (IBC, 1050 kg), non-returnable corrugated drums (220 kg) and divers' small containers. Further informations about our Antifrogen-distributors you can find on our homepage www.antifrogen.com.

Antifrogen SOL HT has a storage stability of two years. Since zinc is not resistant to Antifrogen SOL HT, this should be borne in mind when the product is transferred to other containers.

Antifrogen L

While Antifrogen N is based on monoethylene glycol, Antifrogen L contains as the base product the toxicologically harmless 1,2-propylene glycol, which is approved, for example, by the FDA (Food and Drug Administration) in the USA for use as a food additive. Antifrogen L should therefore be given preference to Antifrogen N in all instances where the product is intended to be used in the food and drinks sector or where the possibility of the heat transfer medium entering process water or hot water cannot be excluded. A special data sheet on this product is available.

Antifrogen KF

Antifrogen KF is a non-toxic clear liquid, based on an aqueous formiate solution which is used as a low-temperature brine down to -55 °C in industrial and food refrigeration systems. The brine has a low viscosity at low temperatures.

Antifrogen N

Antifrogen N is a clear liquid, tinted pale yellow, for use as a heat transfer medium in closed hot water heating systems, heat pumps and as 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 Homepage

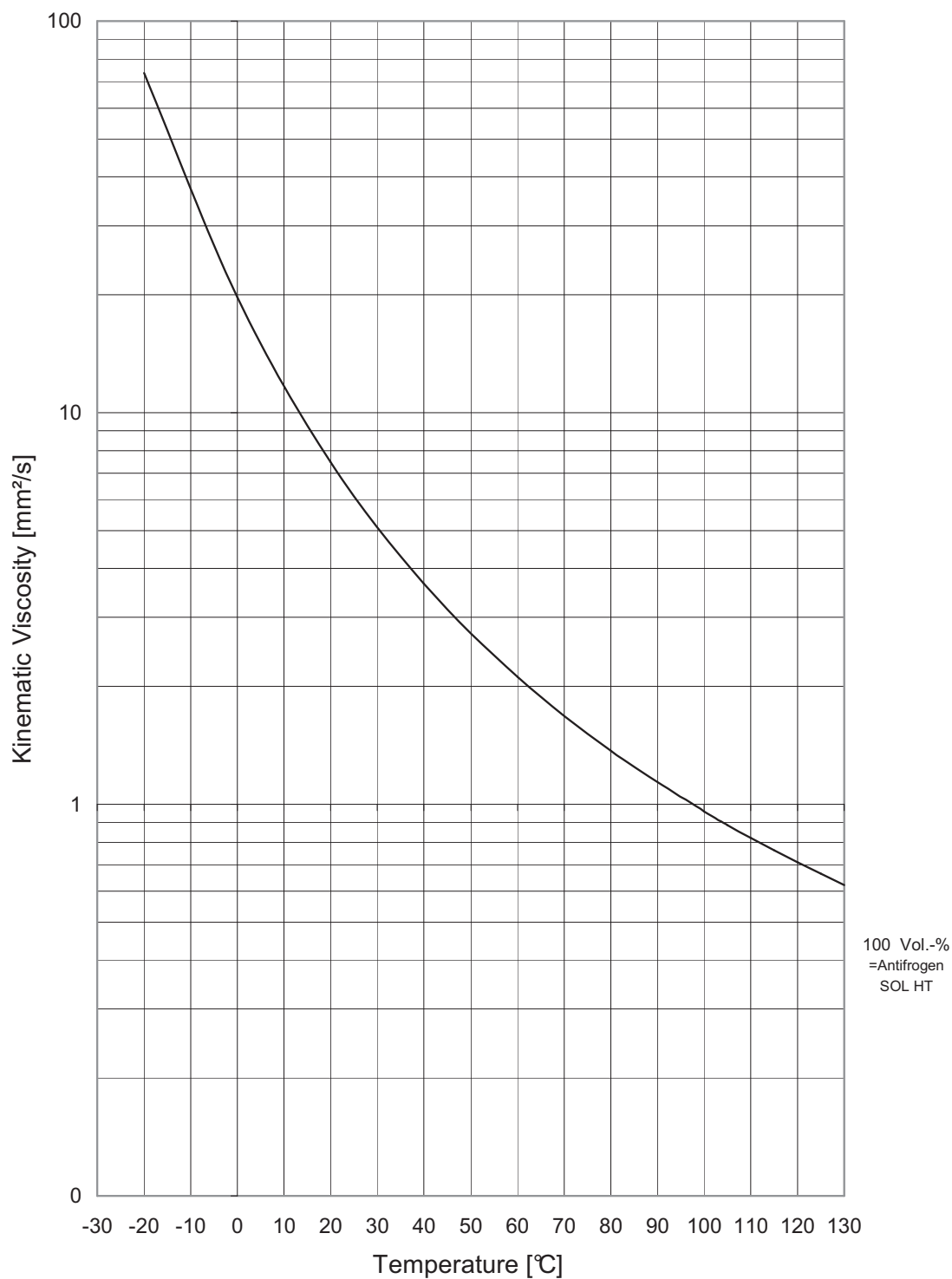
Please visit us at www.antifrogen.com, where you can find newest informations on our product range. Additionally, a technical calculation program with all relevant physical data and the technical leaflets can be downloaded there.

Appendix

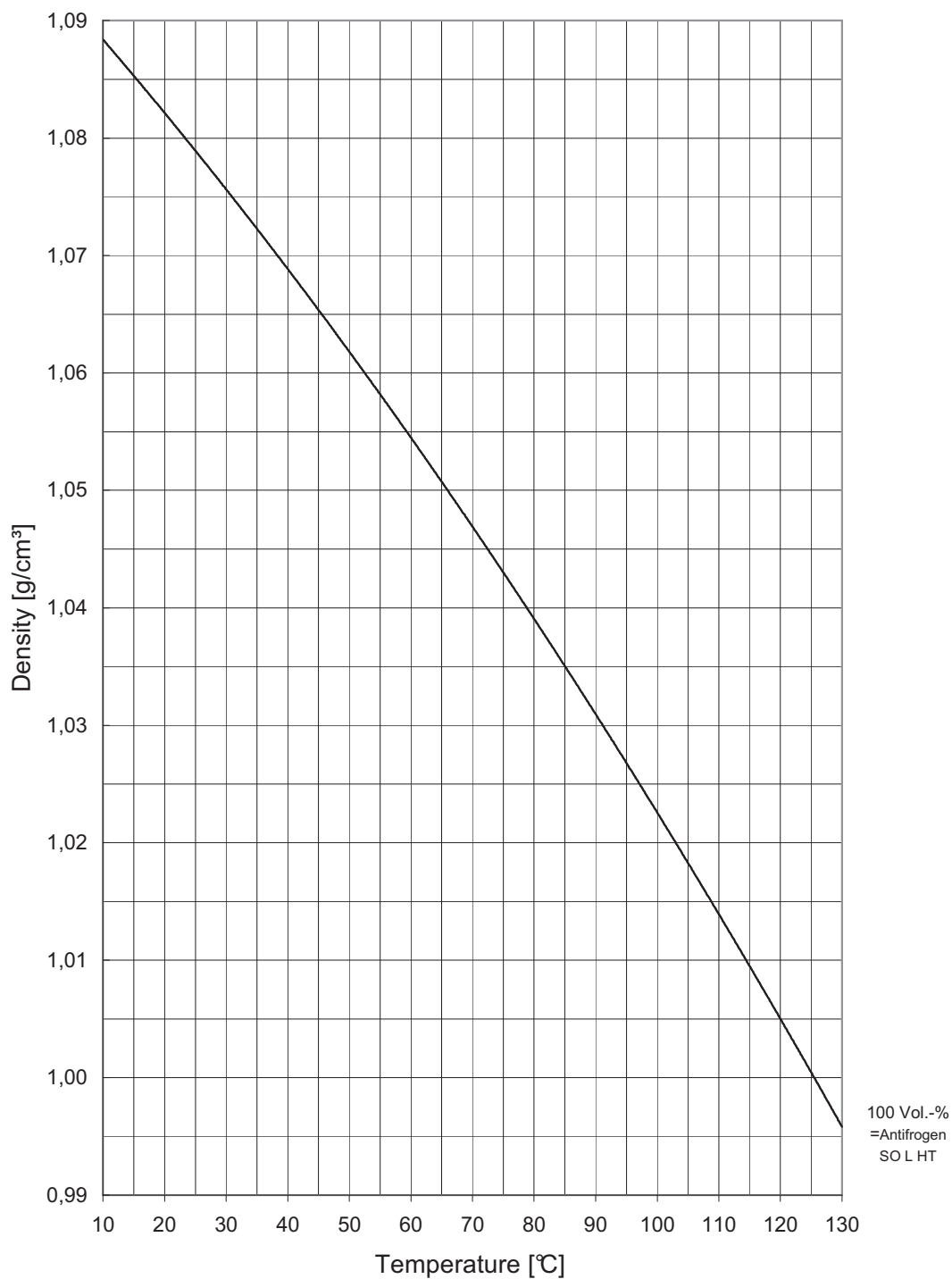
The following graphs show the most important physical properties of Antifrogen SOL HT. Due to the calculation software, which has been used to gain the related curves, small variances of the physical values are possible.

Antifrogen[®] SOL HT

Kinematic Viscosity
of Antifrogen SOL HT

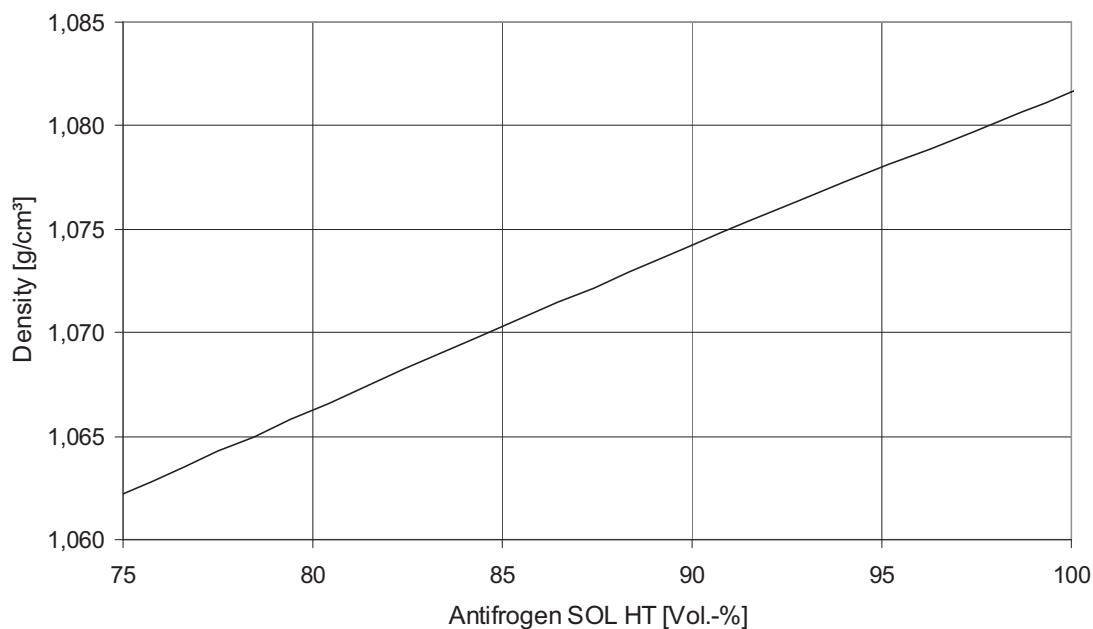


Density
of Antifrogen SOL HT

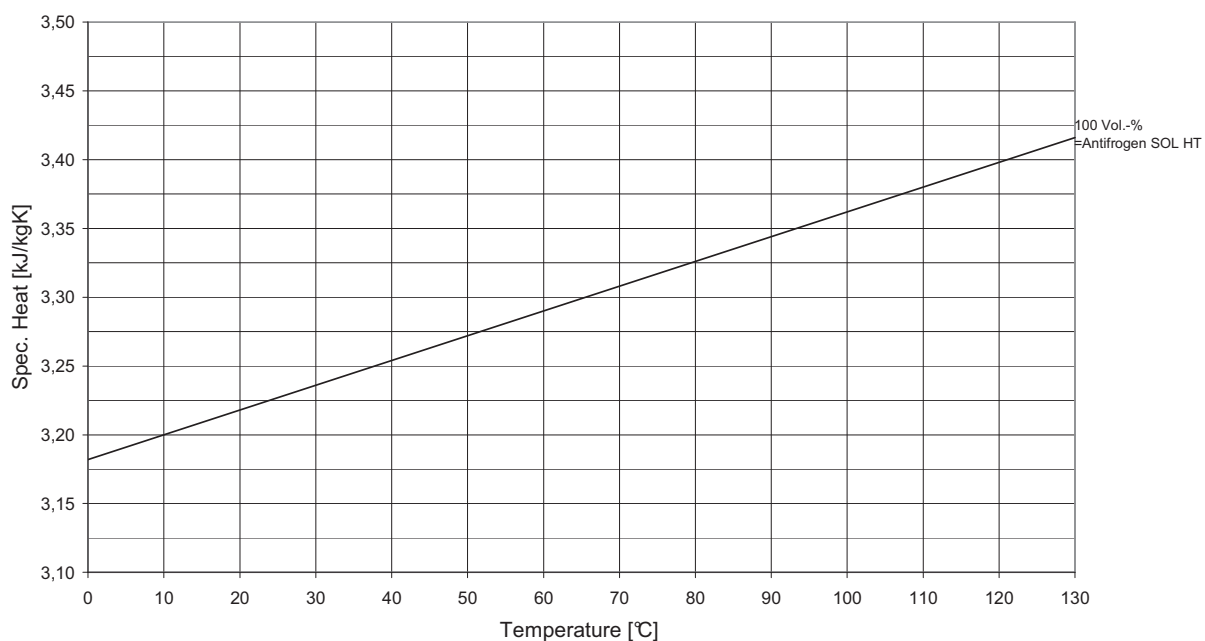


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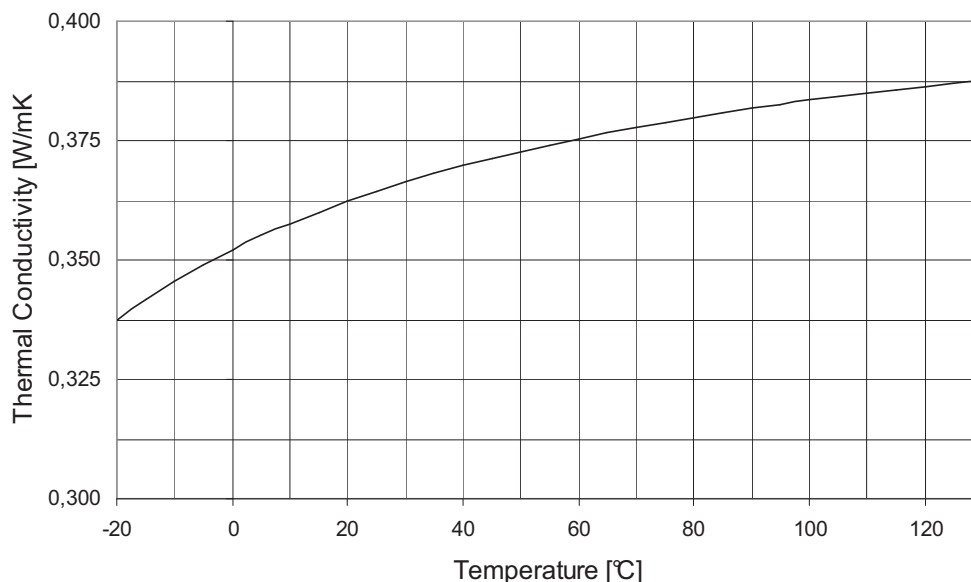
Density
of Antifrogen SOL HT - water mixtures



Specific Heat
of Antifrogen SOL HT

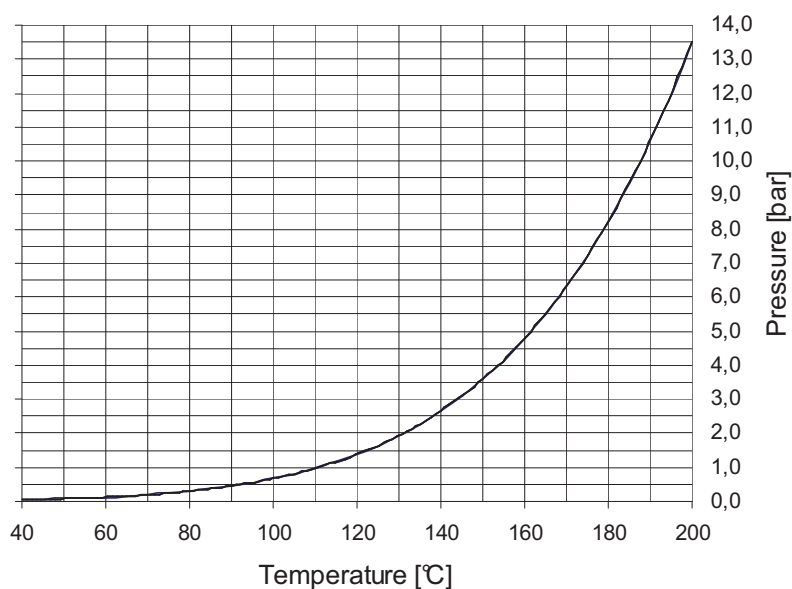


Thermal Conductivity
of Antifrogen SOL HT

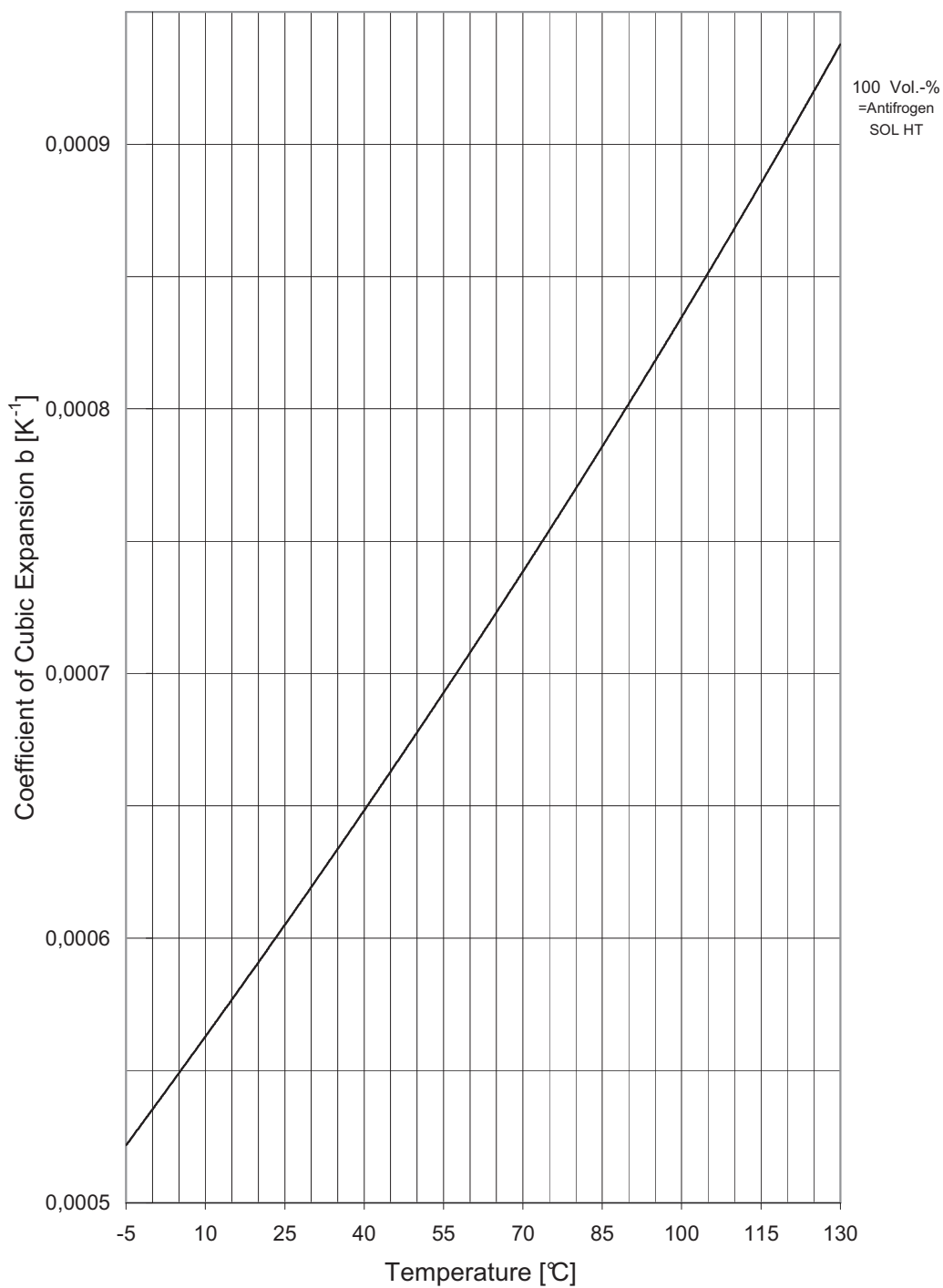


Addition: The thermal conductivity has been determined in two independent external instituts. There has been detected a multiplied spread of the values, especially at low temperatures. In the grafic the mean values are illustrated.

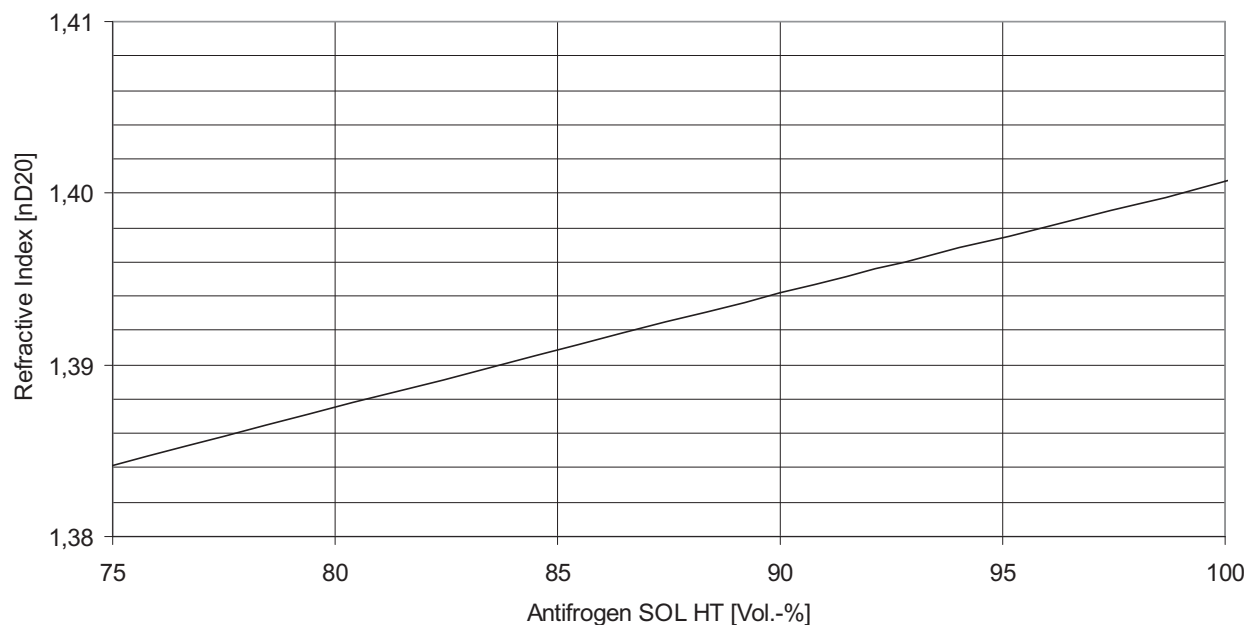
Vapor Pressure
of Antifrogen SOL HT



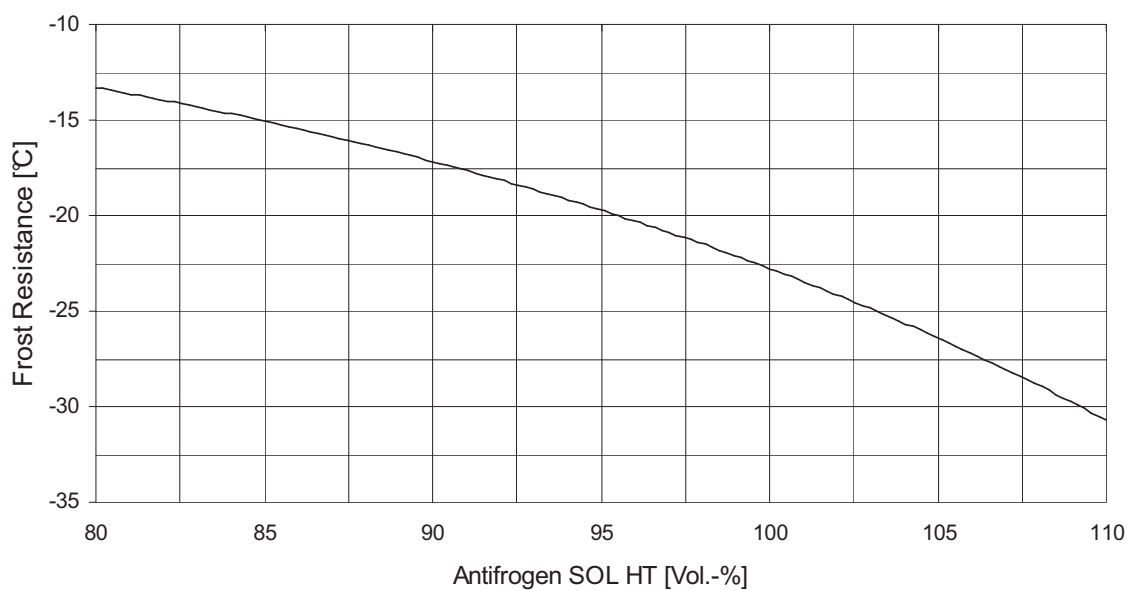
Coefficient of Cubic Expansion
of Antifrogen SOL HT



Refractive Index
of Antifrogen SOL HT



Frost Resistance
of Antifrogen SOL HT



This information is based on our present state of knowledge 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.

Issued in January 2011

Clariant Vertrieb (Deutschland) GmbH & Co KG
BU ICS, Am Unisys Park 1
D-65840 Sulzbach
Phone: +49 6196/757-81 21,
Fax: +49 6196/757-89 63

Clariant Produkte (Deutschland) GmbH
Werk Gendorf, BU ICS / Engineering & Aviation
Industrieparkstr. 1
D-84508 Burgkirchen
Phone: +49 8679/7-22 72,
Fax: +49 8679/7-50 85

Internet:

<http://www.clariant.com>

<http://www.antifrogen.com>