

Product Data Sheet

ANTIFROGEN[®] SOLAR, ANTIFROGEN[®] SOLAR CONC.

CLARIANT 

HEAT TRANSFER
FLUID



Product description

Antifrogen[®] SOLAR / Antifrogen[®] SOLAR Conc. are monopropylene glycol based red heat transfer fluids with an effective frost and corrosion protection. Antifrogen[®] SOLAR products were developed for the use in solar thermal energy systems, in particular for the application in flat-plate collectors and heat pipe systems.

The products contain a finely balanced combination of corrosion inhibitors (free of nitrites, amines, borates, phosphates, silicates and carcinogenic, mutagenic and reprotoxic substances) for a reliable protection against corrosion and ageing of various metallic materials.

The concentrate Antifrogen[®] SOLAR Conc. is to be diluted with water (chloride content <100 ppm, water hardness 0°–25° GH). The usage concentration recommended is between 30 and 50 % v/v, which corresponds to a frost resistance of -13 to -33 °C, respectively (taking into account an increased viscosity, also higher usage concentrations are possible). Antifrogen[®] SOLAR is a ready-to-use water mixture with a frost resistance of -28°C and does not show any bursting effect, even at lower temperatures. The water mixtures can be used up to a temperature of +150 °C in continuous operation. Clariant recommends checking the performance of the product by the free Antifrogen[®] service every two years.

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Technical Data

The following characteristics are for guidance only and should not be taken as product specifications. For more details see page 8.*

Antifrogen® SOLAR

Appearance	clear red liquid	-
Density at 20 °C	1,038 g/cm ³	DIN 51757
Refractive index at 20 °C	1,386	DIN 51423, part 2
Reserve alkalinity	2,1 ml 0.1 M HCl/10 ml	ASTM D 1121
pH-value	9	DIN 19268
Boiling point at 1013 mbar	106 °C	ASTM D 1120

Antifrogen® SOLAR Conc. Water mixtures

Concentration [% v/v]	Frost resistance [°C] (ASTM D 1177)	Refractive index at 20 °C [-] (DIN 51423, part 2)	Density at 20 °C [g/cm ³] (DIN 51757)
30	-13	1,366	1,026
35	-16	1,372	1,030
40	21	1,378	1,034
47 (= Antifrogen® SOLAR)	-28	1,386	1,038
50	-32	1,389	1,042

30 % v/v Antifrogen® SOLAR Conc.in water

Temperature [°C]	-10	0	20	40	80	100
Kin. viscosity [mm ² /s] (DIN 51562)	13,42	7,47	2,98	1,57	0,67	0,49
Density [g/cm ³] (DIN 51757)	1,035	1,033	1,026	1,015	0,989	0,975
Thermal conductivity [W/m·K]	0,439	0,443	0,449	0,455	0,465	0,470
Heat capacity [kJ/kg·K]	3,83	3,85	3,88	3,92	4,00	4,05

35 % v/v Antifrogen® SOLAR Conc. in water

Temperature [°C]	-10	0	20	40	80	100
Kin. viscosity [mm ² /s] (DIN 51562)	17,40	9,48	3,66	1,87	0,76	0,54
Density [g/cm ³] (DIN 51757)	1,041	1,038	1,030	1,019	0,992	0,977
Thermal conductivity [W/m·K]	0,426	0,428	0,433	0,436	0,442	0,445
Heat capacity [kJ/kg·K]	3,74	3,76	3,81	3,85	3,95	4,00

40 % v/v Antifrogen® SOLAR Conc. in water

Temperature [°C]	-20	-10	0	20	40	80	100
Kin. viscosity [mm ² /s] (DIN 51562)	44,40	22,22	11,85	4,44	2,21	0,87	0,61
Density [g/cm ³] (DIN 51757)	1,048	1,047	1,044	1,034	1,022	0,993	0,979
Thermal conductivity [W/m·K]	0,412	0,413	0,415	0,417	0,418	0,420	0,420
Heat capacity [kJ/kg·K]	3,62	3,65	3,68	3,73	3,78	3,89	3,95

47 % v/v Antifrogen® SOLAR Conc. in water (= Antifrogen® SOLAR)

Temperature [°C]	-20	-10	0	20	40	80	100
Kin. viscosity [mm ² /s] (DIN 51562)	65,36	30,65	15,81	5,71	2,77	1,04	0,72
Density [g/cm ³] (DIN 51757)	1,056	1,054	1,050	1,038	1,027	0,997	0,982
Thermal conductivity [W/m·K]	0,396	0,396	0,396	0,395	0,394	0,390	0,389
Heat capacity [kJ/kg·K]	3,47	3,51	3,54	3,61	3,67	3,81	3,88

50 % v/v Antifrogen® SOLAR Conc. in water

Temperature [°C]	-20	-10	0	20	40	80	100
Kin. viscosity [mm ² /s] (DIN 51562)	77,03	34,94	17,75	6,32	3,03	1,12	0,77
Density [g/cm ³] (DIN 51757)	1,060	1,057	1,053	1,042	1,028	0,998	0,983
Thermal conductivity [W/m·K]	0,389	0,389	0,388	0,387	0,384	0,378	0,376
Heat capacity [kJ/kg·K]	3,41	3,44	3,48	3,55	3,62	3,76	3,84

Corrosion protection

Corrosion test according to ASTM D 1384 (88 °C, 6 l/h air):

Metallic material	Average change in weight of the metallic material [g/m ²]		
	Antifrogen® SOLAR 336 h	Antifrogen® SOLAR 1000 h	Limits 336 h (according to ASTM D 3306-05)
Copper	-0,7	-2,6	3,6
Soft solder (WL 30)	+0,6	-3,2	11,2
Brass (MS 63)	-0,4	-3,2	3,6
Steel (C15)	+0,2	+0,2	3,6
Gray iron (CG 22)	+0,3	-4,0	3,5
Cast aluminium (AlSi6Cu3)	-0,8	-1,2	10,4

Antifrogen® SOLAR shows superior anti-corrosion properties, even after a long test period of 1000 hours. The minor weight changes of the metals and alloys tested confirm the suitability for long-term usage.

Compatibility with sealing materials

According to data published in literature and the results of our own experiments, the following plastics and elastomers are suitable for the use in components that come in contact with Antifrogen® SOLAR or SOLAR Conc. water mixtures of common concentration:

ABS	Acrylonitrile-butadiene-styrene	PB	Polybutene
CPE	chlorinated polyethylene	POM	Polyacetal
CR	Polychlorbutadiene rubber	PP	Polypropylene
EPDM	Olefin rubber	PTFE	Polytetrafluorethylene
FKM	Fluorkarbon-Elastomere	RPVC	Polyvinyl chloride rigid
IIR	Butyl rubber	SBR	Styrene-butadiene rubber up to 100 °C
LDPE/ HDPE	Polyethylene low/high density	SI	Silicone rubber
NBR	Nitril rubber	UP	Polyester resins
NR	Nature rubber up to 80 °C		

** The sealing materials have been tested at 80 °C under specific conditions. Please also consider the data on the chemical resistance of these materials given by the respective manufacturers.

Polyurethane elastomers (PU), flexible PVC and phenol formaldehyde resins are not resistant.

Application guidelines

1. The concentrate Antifrogen® SOLAR Conc. is only to be used in dilution with water. For this purpose tap water with a chloride content < 100 ppm or demineralized water should be used to prevent pitting corrosion, particularly when components made of aluminium or aluminium alloys are used. Concentration lower than the minimum usage concentration of 30 % v/v Antifrogen® SOLAR Conc. in water should not be applied as they lead to the growth of microorganisms and no longer provide sufficient corrosion protection. The maximum usage concentration is 50 % v/v. Antifrogen® SOLAR is readily to be used. Phase separation of Antifrogen® SOLAR water mixtures does not occur.
2. Antifrogen® SOLAR products should only be applied in closed systems as the contact with atmospheric oxygen has negative effects on the corrosion-inhibiting properties of all glycol based fluids.
3. When assembling the plant, only chloride-free soldering agents should be used.
4. The contact of Antifrogen® SOLAR/SOLAR Conc. water mixtures with galvanized components should be prevented as all glycol water mixtures dissolve zinc and precipitate as zinc glycolate. In case the zinc layer is dissolved the subjacent steel is protected against corrosion by the

inhibitor package present. If the formation of zinc glycolate is observed we suggest to install a microfilter (approx. 100 to 150 µm).

5. Before the system is filled with Antifrogen® SOLAR or an Antifrogen® SOLAR Conc. water mixture, it has to be drained, thoroughly rinsed with water (esp. if the system was filled with a brine of chloride containing fluid) and carefully checked for corrosion damages. If necessary, we recommend an acid pickling with subsequent neutralization to remove persistent rust deposits. Systems with corrosion or deposits (e. g. limescale, biological deposits) present cannot be operated corrosion-proof with Antifrogen® SOLAR products later on, since the metals may be unevenly inhibited and the inhibitors may be prematurely consumed.
6. To prevent corrosion, drained systems should immediately be refilled with an Antifrogen® SOLAR product, even if the system is to be operated later on.
7. Even though Antifrogen® SOLAR Conc. can be mixed with water in any ratio, it is advisable when using circulating pumps to first fill the system with about two-thirds of the amount of water required. Next Antifrogen® SOLAR Conc. is to be added, followed by filling up the system with the water still needed. Complete mixing is achieved by starting up the system which may take up to several days depending on the system.
8. For pure gravity systems, Antifrogen® SOLAR Conc. should be mixed with water before filling the system. This is recommended in particular if the frost protection should be effective from the start on.
9. Since Antifrogen® SOLAR/SOLAR Conc. water mixtures exhibit a higher viscosity and density than pure water, a higher pressure drop in pipelines must be taken into account.
10. After leakage or withdrawal, the system is only to be filled up with Antifrogen® SOLAR product of the same concentration! Mixing with other products is to be avoided, as it can lead to incompatibilities. In addition, characteristics like the frost resistance can no longer be analyzed by the methods recommended.
11. When stored in the closed original packaging Antifrogen® SOLAR products can be kept for two years.

12. Antifrogen® SOLAR products can be disposed of in accordance with local regulations. In each case, the water and waste regulations have to be taken into account.

Antifrogen® Service

According to our experience Antifrogen® SOLAR products can be relied upon to give many years protection. Clariant recommends checking the performance of the product by the free Antifrogen service every two years. This includes an extensive analysis of the heat transfer fluid provided (a 250 ml sample is required) and a service report with instructions on further use. The samples can be sent to the Antifrogen® dealer or directly to Clariant Produkte (Deutschland) GmbH (BU ICS/TA, Industrieparkstr. 1, 84508 Burgkirchen, Germany, telephone number +49 86 79 7-17046). All analytical results and statements in the Clariant Service report solely refer to the sample supplied. Guidance on further use for the product tested assumes that the system is in proper condition and properly operated.

Toxicological characteristics and safety

Antifrogen® SOLAR Conc. water mixtures have neither a flash point nor a fire point.

Antifrogen® SOLAR products are inhibited without the use of nitrites, amines, borates, phosphates and silicates and do not contain any CMR substances nor other substances restricted in accordance with the EC Directive 2011/65/EU, Article 4 §1 (such as lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls and polybrominated diphenyl ethers).

Antifrogen® SOLAR products are toxicologically harmless, readily biodegradable and classified in water hazard class WHC 1 (slightly hazardous to water).

When dealing with chemical products all necessary precautions have to be taken and industrial sanitary standards have to be met.

*) The product specifications are given in the product specification sheet. The certified quality system in accordance with DIN EN ISO 9001 is used in production and quality control. This ensures a consistent high product quality. For further information to product characteristics, toxicological, ecological and safety-related data, please refer to the MSDS currently in force.

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