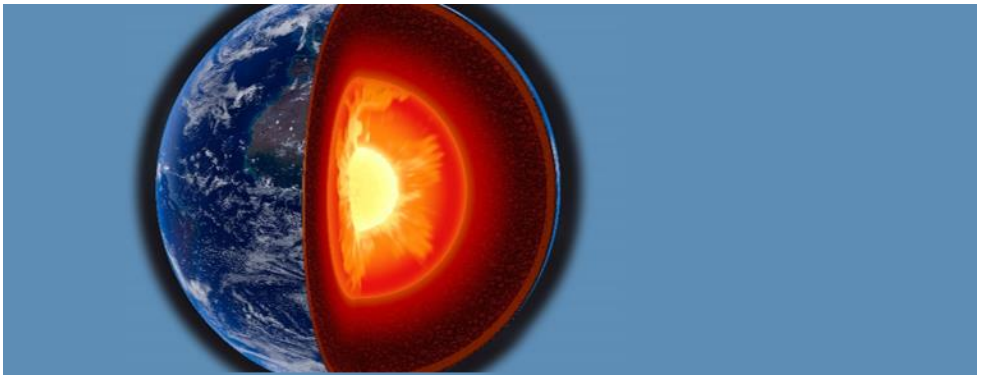
Product Sheet
ANTIFROGEN

ANTIFROGEN ® GEO



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Product description

Antifrogen® GEO is a monoethylene glycol based orange heat transfer fluid with an effective frost and corrosion protection. The product was developed for the application in near-surface geothermal systems.

Antifrogen® GEO contains 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.

Antifrogen® GEO is to be diluted with water (chloride content <100 ppm, water hardness 0°—25° GH). The product is offered in three standard usage concentrations/frost resistances:

- 25 % v/v / -10 °C
- 33 % v/v / -15 °C
- 40 % v/v / -21 °C

The water mixtures can be used up to a temperature of +40°C in continuous operation. Clariant recommends checking the performance of the product by the free Antifrogen® service every two years.

Technical data

The following characteristics are for guidance only and should not be taken as product specifications. For more details see page 7.*

Antifrogen® GEO

Appearance	clear orange liquid	-
Density at 20 °C	1,105 g/cm³	DIN 51757
Refractive index at 20 °C	1,421	DIN 51423, part 2
Reserve alcalinity	1,5 ml 0.1 M HCl/10 ml	ASTM D 1121
pH-value (Antifrogen® GEO: water = 1:2)	7,8	DIN 19268
Boiling point at 1013 mbar	134 °C	ASTM D 1120

Antifrogen® GEO 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/cm³] (DIN 51757)
25	-10	1,356	1,029
33	-15	1,364	1,040
40	-21	1,370	1,048

25 % v/v Antifrogen® GEO in water

Temperature [°C]	**-5**	**0**	**20**	**40**
Kin. viscosity [mm²/s] (DIN 51562)	4,37	3,55	1,81	1,12
Density [g/cm³] (DIN 51757)	1,035	1,034	1,030	1,021
Thermal conductivity [W/m·K]	0,487	0,489	0,500	0,512
Heat capacity [kJ/kg·K]	3,85	3,85	3,86	3,88

33 % v/v Antifrogen® GEO in Water

Temperature [°C]	**-10**	**0**	**20**	**40**
Kin. viscosity [mm²/s] (DIN 51562)	6,24	4,35	2,14	1,29
Density [g/cm³] (DIN 51757)	1,048	1,045	1,040	1,030
Thermal conductivity [W/m·K]	0,465	0,468	0,474	0,482
Heat capacity [kJ/kg·K]	3,70	3,71	3,73	3,76

40 % v/v Antifrogen® GEO in Water

Temperature [°C]	**-10**	**0**	**20**	**40**
Kin. viscosity [mm²/s] (DIN 51562)	8,05	5,11	2,48	1,46
Density [g/cm³] (DIN 51757)	1,057	1,054	1,047	1,037
Thermal conductivity [W/m·K]	0,450	0,452	0,455	0,458
Heat capacity [kJ/kg·K]	3,56	3,57	3,61	3,65

Corrosion protection

Corrosion test according to ASTM D 1384 (336 h, 88 °C, 6 l/h air):

	Average change in weight of the metallic material [g/m²]	
Metallic material	30 % v/v Antifrogen® GEO in water **336 h**	Limits (according to ASTM D 3306-05)
Copper	-0,2	3,6
Soft solder (WL 30)	-2,2	11,2
Brass (MS 63)	-0,2	3,6
Steel (C15)	+0,1	3,6
Gray iron (CG 22)	-0,2	3,5
Cast aluminium (AlSi6Cu3)	-1,4	10,4

The minor weight changes of the metals and alloys tested confirm the suitability of Antifrogen® GEO 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® GEO water mixtures of common concentration:

ABS	Acrylonitrile-butadiene-styrene	**PA**	Polyamide
CPE	Chlorinated polyethylene	**PB**	Polybutene
CR	Polychlorbutadiene rubber	**PC**	Polycarbonate
EPDM	Olefin rubber	**POM**	Polyacetal
FKM	Fluorocarbon elastomer	**PP**	Polypropylene
IIR	Butyl rubber	**PTFE**	Polytetrafluorethylene
LDPE/ HDPE	Polyethylene low/high density	**RPVC**	Polyvinyl chloride rigid
MFQ	Fluorosilicone rubber	**SBR**	Styrene-butadiene rubber
NBR	Nitril rubber	**SI**	Silicone rubber
NR	Nature rubber	**UP**	Polyester resins

** 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. Antifrogen® GEO 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. Concentrations lower than the minimum usage concentration of 25 % v/v Antifrogen® GEO in water should not be applied as they lead to the growth of mircoorganisms and no longer provide sufficient corrosion protection. The maximum usage concentration is 40 % v/v. Phase separation of Antifrogen® GEO water mixtures does not occur.
2. Antifrogen® GEO 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® GEO 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® GEO, it has to be drained, thoroughly rinsed with water (esp. if the system was filled with a brine or 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® GEO 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 Antifrogen® GEO, even if the system is to be operated at a later date.
7. Even though Antifrogen® GEO 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® GEO 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® GEO 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® GEO 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 an Antifrogen® GEO water mixture 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® GEO products can be kept for two years.

12. Antifrogen® GEO 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® GEO 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® GEO water mixtures have neither a flash point nor a fire point.

Antifrogen® GEO is inhibited without the use of nitrites, amines, borates, phosphates and silicates and does 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® GEO is readily biodegradable and classified in water hazard class WHC 1 (slightly hazardous to water).

Antifrogen® GEO is according to the EC Directives 67/548/EEC and 1999/45/EC harmful if swallowed (Cat. 4) and therefore not suitable for pharmaceutical or food applications. Alternatively, the use of Antifrogen® L or Antifrogen® KF VP 1974 is recommended.

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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