



Glysofor

Glysofor TERRA - Specification

Product features

Glysofor TERRA is an environmentally friendly antifreeze concentrate based on ethylene glycol, corrosion inhibitors and stabilisers.

In geothermal probes and ground heat collectors, Glysofor TERRA acts as a frost protection agent, anticorrosive agent as well as a heat carrier medium.

Glysofor TERRA optimally prevents frost damage, corrosion, debris, accumulation of mud or biofilms.

Glysofor TERRA is completely free of nitrites, amines, phosphates, silicates and borates.

It is biodegradable and environmentally friendly.

Both as a concentrate and as a dilution, Glysofor TERRA is classified in the lowest water pollution class WPC 1.

Glysofor TERRA is resistant in the long-term against the formation of biofilms, putrescence and microbiological degradation, thus preventing precipitations and the accumulation of mud.

Homogenously mixed Glysofor TERRA/water mixtures do not separate, thus ensuring constant frost protection.

Environmentally friendly heat carrier medium, frost protection and anticorrosive agent in the area of geothermal energy

Basis: Monoethylene glycol

Operating temperature: -40 to +70 °C

Optimised efficiency and improved economy

Free of nitrites, phosphates, amines, borates and silicates

Low maintenance

This guarantees a year-round, long-term and low-maintenance operation of the plants.

A special production process ensures that Glysofor TERRA has a comparatively higher level of efficiency, ensuring a more efficient operation.

Glysofor TERRA is tested in accordance with ASTM D 1384-05.

Product data

| | |
|------------------------------|---|
| Chemical name | Ethandiol (Monoethylene glycol), anticorrosion additives, auxiliary materials |
| Appearance | Yellow liquid |
| Packaging | Canisters / barrels / IBCs / tank vehicles |
| ADR | KI 0 number |
| EC-No. | 2034733 |
| CAS-No. | 107 - 21 - 1 |
| WHC | 1 |
| Applied concentration: | At least 20 vol% (Frost protection up to approx. -9 °C) |
| Operating temperature range: | -40 to +70 °C |
| Areas of application: | Heat carrier medium in the area of geothermal energy |
| Density (20 °C) | 1,12 g/cm ³ |
| pH-value | 7,3 - 8,3 |
| Boiling point (1013 mbar) | approx. 197 °C |
| Vapour pressure (20 °C) | 0,053 mbar |
| Specific heat (20 °C) | 2,34 kJ/kg K |
| Thermal conductivity (20 °C) | 0,29 W/m K |
| Dynamic viscosity (20 °C) | 21 mPa s |

Heat carrier medium

Glysofor TERRA transports the heat collected in the geothermal probe to the earth's surface, where it is delivered to a heating system with the help of a heat pump. Heat energy acquired in this way can lead to significant savings of conventional fuels.

Frost protection agents

With a glycol (monoethylene glycol) base, Glysofor TERRA significantly lowers the freezing point of water, thus preventing the freezing of the operating liquid. With Glysofor TERRA, heat pump systems can also be temporarily deactivated in case of frost, but remain operationally ready at all times. Thanks to the ability of Glysofor TERRA to lower the freezing point, heat pump systems can be safely operated even at minus temperatures of up to -50 degrees Celsius. If any damage occurs to the system, a simultaneous frost-related explosive effect can be reliably prevented using Glysofor TERRA.

Anticorrosive agents

Thanks to a complex combination of corrosion inhibitors, metals are optimally protected against corrosive attacks. This anticorrosive protection can be used for all important metals that are usually used in heating engineering. Installations made of copper, brass, solder, grey iron, aluminium, steel and iron are optimally protected, even if they are used in multi-metal installations.

Compatibility of materials / Corrosion rates

The following values represent the corrosion caused by the loss of material ing/m^2 .

| Material | Glysofor TERRA* | Ethylene glycol* | Tap water |
|---------------------------|-----------------|------------------|-----------|
| Copper | -0,02 | -2,60 | -1 |
| Solder (WL 30) | -0,63 | -131 | -11 |
| Brass (MS 63) | -0,00 | -7,5 | -1 |
| Steel (Ck22) | -0,03 | -148 | -74 |
| Cast iron (GG25) | -0,67 | -265 | -194 |
| Cast aluminium (AlSi6Cu3) | -0,02 | -16 | -30 |
| Pure aluminium (99,5) | -0,00 | k.A. | -6 |
| Stainless steel (1.4541) | -0,00 | k.A. | -0,5 |

* = 33% concentration in tap water

Test: Use of Glysofor TERRA in geothermal probes. Duration of test: 14 days. Work stages, chemicals and the devices and materials used as per ASTM D 1384-05. Loss rates in g/m^2 .

Application

Preparation: Before the plant is filled for the first time, it should be tested for leaks. For this purpose, the plant should initially be filled with chloride-free water in the amount specified by the plant manufacturer, so that if any leakage occurs, no frost protection agent will be released accidentally. If the capacity of the plant is not known, the filling in of water must be closely monitored in order to simultaneously determine the exact capacity (via the water meter, where necessary). Determining the capacity proves helpful for calculating and adjusting the desired frost protection value. If it is not possible to test the plant using water (e.g. due to low temperatures), the plant should be observed during the filling process as far as possible.

Filling: If the capacity of the plant is not known, the required quantity of Glysofor TERRA can be calculated using the table below. In order to ensure an ideal distribution, the system should first be filled with approx. 50% of the required quantity of water, followed by the entire required quantity of Glysofor Solar and finally the remaining quantity of water.

Refilling: If the system needs to be refilled, and the required refilling quantity is not known, an estimated quantity of Glysofor TERRA is premixed, proportional to the desired level of frost protection. The premixed Glysofor TERRA /water mixture is then filled into the system.

Testing the frost protection: After the system has been filled, a several hours long circulation should take place (overnight, if possible). The Glysofor TERRA concentration can be determined by means of the specific density of the Glysofor TERRA/water mixture. The values listed in the table below represent the weight in grams per litre. The frost protection value setting is determined based on the temperatures that can be expected in that region. In order to ensure reliable frost protection at all times, we recommend a 5 to 10 % higher setting for this value.

| Glysofor TERRA – Active content | Frost protection up to °C |
|---------------------------------|---------------------------|
| 20 % | -9 |
| 25 % | -12 |
| 30 % | -16 |
| 35 % | -20 |
| 40 % | -25 |
| 45 % | -31 |
| 50 % | -38 |
| 55 % | -45 |
| 58 % | -51 |

Application guidelines

Galvanised components are to be avoided, as zinc is generally volatile with glycol and products which contain glycol. The water that is used for producing the solution should have a maximum hardness of 25 °dH and a maximum chloride content of 100 mg/l. Generally, tap water fulfils these requirements. Pipe connections are to be made of hard solder and chloride-containing flux materials are to be avoided or are to be removed completely by flushing after usage. Scalings on copper components, metal swarf and contaminations are to be removed completely before the plant is filled. Plants that are to be operated with Glysofor must not be in contact with any external electrical potential. When installing the plant, it must be ensured that the future operation is not interrupted by circulatory disturbances caused by air cushions or debris. Plants that are operated with Glycogard must be installed as closed systems and are to be filled completely and vented directly after the pressure test is carried out. Gas and air cushions are to be removed immediately. Breathers are to be applied in such a way that they keep the system free from air and oxygen at all times and that, in the case of low pressure, no air can be sucked in. If an existing plant is to be filled with Glysofor, the corrosion status should be checked beforehand. Before a system that is damaged by corrosion is filled, it must be completely reconstructed. In order to ensure a sufficient level of functionality and frost protection at all times, the condition and concentration of Glysofor TERRA should be tested at least once per year. This is particularly advisable if work has been carried out on the operated system or the liquid has been refilled. Overheating must be strictly avoided, as this can lead to damage and the premature ageing of Glysofor TERRA.

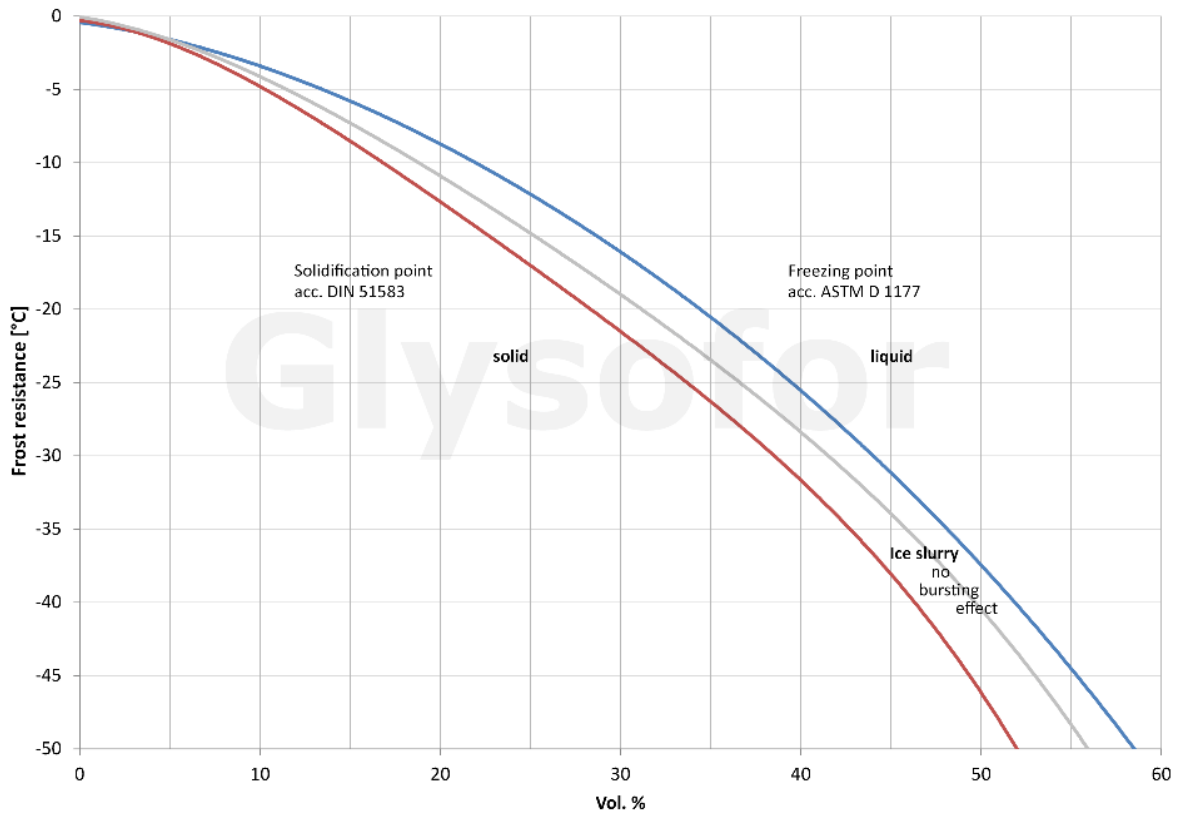


Technical data

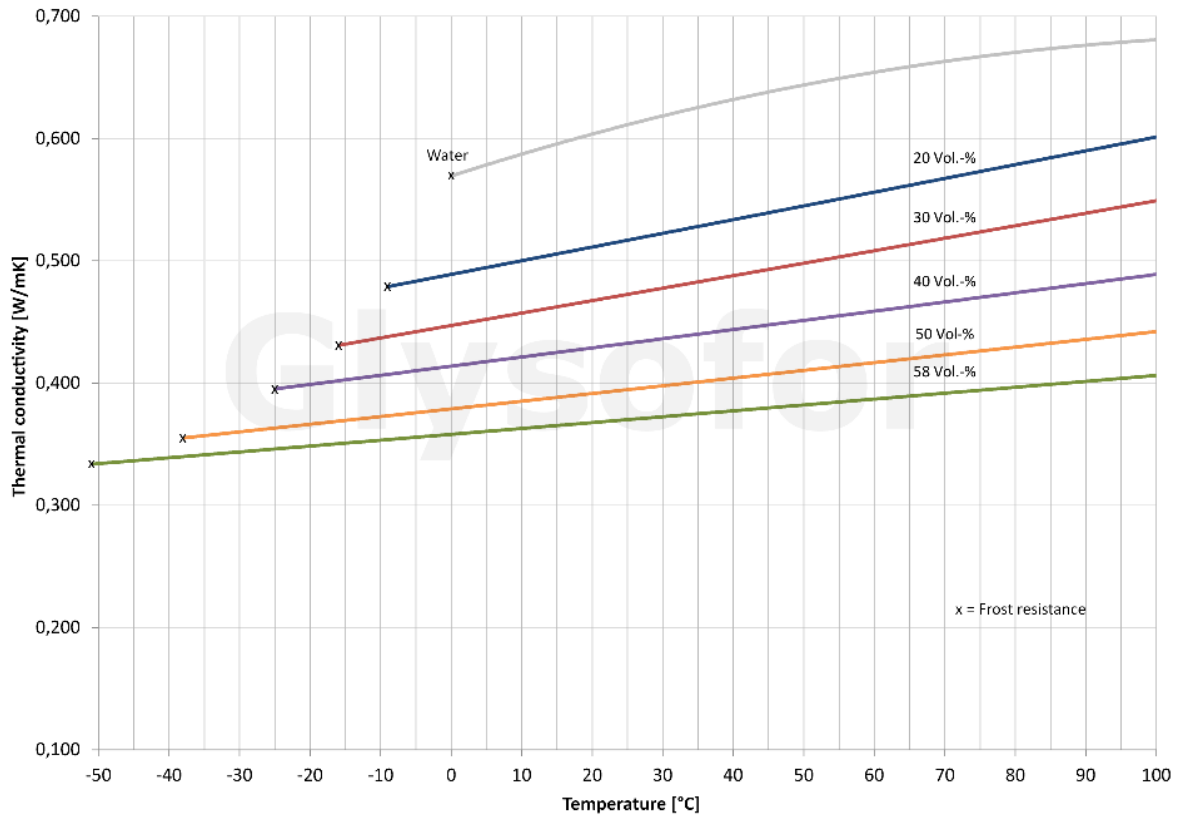
| Concentrate [Vol.%] | Frost resistance [°C] | Temp. [°C] | Thermal conductivity [W/m K] | Spec. heat capacity [kJ/kg K] | Density [g/cm ³] | Kinemat. viscosity [mm ² /s] | Cub. Expansion coefficient [K ⁻¹] | Rel. Pressure drop factor [Factor] |
|------------------------|-----------------------------|---------------|------------------------------------|-------------------------------------|---------------------------------|---|---|--|
| 20 | -9 | 0 | 0,490 | 3,92 | 1,035 | 3,34 | 0,00021 | 1,28 |
| | | 10 | 0,501 | 3,96 | 1,032 | 2,44 | 0,00028 | 1,16 |
| | | 20 | 0,512 | 3,99 | 1,029 | 1,82 | 0,00034 | 1,07 |
| | | 30 | 0,523 | 4,02 | 1,025 | 1,40 | 0,00039 | 1,00 |
| | | 40 | 0,535 | 4,04 | 1,021 | 1,11 | 0,00045 | 0,95 |
| | | 50 | 0,546 | 4,06 | 1,016 | 0,90 | 0,00050 | 0,90 |
| | | 60 | 0,557 | 4,07 | 1,010 | 0,75 | 0,00055 | 0,87 |
| | | 70 | 0,568 | 4,08 | 1,005 | 0,64 | 0,00059 | 0,84 |
| | | 80 | 0,580 | 4,08 | 0,998 | 0,57 | 0,00063 | 0,81 |
| | | 90 | 0,591 | 4,09 | 0,992 | 0,51 | 0,00067 | 0,78 |
| 25 | -12 | 100 | 0,602 | 4,08 | 0,985 | 0,47 | 0,00071 | 0,76 |
| | | -10 | 0,458 | 3,82 | 1,046 | 5,51 | 0,00022 | 1,49 |
| | | 0 | 0,469 | 3,86 | 1,044 | 3,86 | 0,00027 | 1,34 |
| | | 10 | 0,479 | 3,90 | 1,040 | 2,38 | 0,00033 | 1,22 |
| | | 20 | 0,490 | 3,93 | 1,037 | 2,06 | 0,00038 | 1,13 |
| | | 30 | 0,501 | 3,96 | 1,032 | 1,57 | 0,00043 | 1,05 |
| | | 40 | 0,511 | 3,99 | 1,028 | 1,23 | 0,00047 | 1,00 |
| | | 50 | 0,522 | 4,01 | 1,022 | 0,99 | 0,00052 | 0,94 |
| | | 60 | 0,533 | 4,02 | 1,017 | 0,82 | 0,00056 | 0,90 |
| | | 70 | 0,544 | 4,04 | 1,011 | 0,70 | 0,00061 | 0,87 |
| 30 | -16 | 80 | 0,554 | 4,04 | 1,004 | 0,62 | 0,00065 | 0,83 |
| | | 90 | 0,565 | 4,04 | 0,998 | 0,56 | 0,00069 | 0,80 |
| | | 100 | 0,576 | 4,04 | 0,990 | 0,51 | 0,00072 | 0,77 |
| | | -10 | 0,438 | 3,73 | 1,056 | 6,43 | 0,00028 | 1,58 |
| | | 0 | 0,448 | 3,78 | 1,052 | 4,45 | 0,00033 | 1,39 |
| | | 10 | 0,458 | 3,82 | 1,049 | 3,17 | 0,00037 | 1,28 |
| | | 20 | 0,468 | 3,86 | 1,044 | 2,33 | 0,00041 | 1,18 |
| | | 30 | 0,479 | 3,89 | 1,040 | 1,76 | 0,00045 | 1,10 |
| | | 40 | 0,489 | 3,92 | 1,035 | 1,37 | 0,00049 | 1,04 |
| | | 50 | 0,499 | 3,94 | 1,029 | 1,10 | 0,00053 | 0,98 |
| 35 | -20 | 60 | 0,509 | 3,96 | 1,024 | 0,90 | 0,00057 | 0,93 |
| | | 70 | 0,519 | 3,97 | 1,017 | 0,77 | 0,00061 | 0,89 |
| | | 80 | 0,530 | 3,98 | 1,011 | 0,67 | 0,00064 | 0,85 |
| | | 90 | 0,540 | 3,98 | 1,004 | 0,61 | 0,00068 | 0,82 |
| | | 100 | 0,550 | 3,98 | 0,997 | 0,56 | 0,00071 | 0,79 |
| | | -20 | 0,414 | 3,52 | 1,068 | 12,49 | 0,00030 | 1,84 |
| | | -10 | 0,423 | 3,58 | 1,064 | 8,18 | 0,00034 | 1,62 |
| | | 0 | 0,431 | 3,64 | 1,061 | 5,48 | 0,00037 | 1,44 |
| | | 10 | 0,440 | 3,69 | 1,056 | 3,79 | 0,00041 | 1,32 |
| | | 20 | 0,449 | 3,73 | 1,052 | 2,71 | 0,00044 | 1,22 |
| 40 | -25 | 30 | 0,458 | 3,76 | 1,047 | 2,00 | 0,00047 | 1,13 |
| | | 40 | 0,466 | 3,81 | 1,042 | 1,53 | 0,00050 | 1,06 |
| | | 50 | 0,475 | 3,84 | 1,036 | 1,20 | 0,00053 | 1,00 |
| | | 60 | 0,484 | 3,86 | 1,030 | 0,98 | 0,00056 | 0,95 |
| | | 70 | 0,493 | 3,88 | 1,024 | 0,83 | 0,00059 | 0,91 |
| | | 80 | 0,501 | 3,89 | 1,018 | 0,72 | 0,00062 | 0,87 |
| | | 90 | 0,510 | 3,90 | 1,012 | 0,65 | 0,00065 | 0,83 |
| | | 100 | 0,519 | 3,91 | 1,005 | 0,60 | 0,00067 | 0,80 |
| | | -20 | 0,400 | 3,34 | 1,077 | 17,09 | 0,00036 | 1,91 |
| | | -10 | 0,407 | 3,41 | 1,073 | 10,59 | 0,00038 | 1,67 |
| 45 | -31 | 0 | 0,415 | 3,47 | 1,068 | 6,84 | 0,00041 | 1,49 |
| | | 10 | 0,422 | 3,53 | 1,064 | 4,57 | 0,00044 | 1,37 |
| | | 20 | 0,430 | 3,58 | 1,059 | 3,18 | 0,00046 | 1,27 |
| | | 30 | 0,437 | 3,63 | 1,054 | 2,30 | 0,00048 | 1,17 |
| | | 40 | 0,445 | 3,67 | 1,049 | 1,72 | 0,00051 | 1,09 |
| | | 50 | 0,452 | 3,71 | 1,043 | 1,33 | 0,00056 | 1,03 |
| | | 60 | 0,460 | 3,74 | 1,037 | 1,07 | 0,00058 | 0,98 |
| | | 70 | 0,467 | 3,77 | 1,031 | 0,90 | 0,00062 | 0,93 |
| | | 80 | 0,475 | 3,79 | 1,025 | 0,78 | 0,00065 | 0,89 |
| | | 90 | 0,482 | 3,80 | 1,019 | 0,71 | 0,00068 | 0,85 |
| 45 | -31 | 100 | 0,490 | 3,81 | 1,013 | 0,66 | 0,00072 | 0,82 |
| | | -30 | 0,376 | 3,09 | 1,090 | 38,99 | 0,00039 | |
| | | -20 | 0,383 | 3,18 | 1,085 | 21,09 | 0,00041 | 1,98 |
| | | -10 | 0,390 | 3,25 | 1,081 | 12,29 | 0,00043 | 1,73 |
| | | 0 | 0,397 | 3,32 | 1,076 | 7,74 | 0,00044 | 1,55 |
| | | 10 | 0,404 | 3,39 | 1,071 | 5,15 | 0,00046 | 1,41 |
| | | 20 | 0,411 | 3,45 | 1,066 | 3,61 | 0,00048 | 1,31 |
| | | 30 | 0,417 | 3,50 | 1,060 | 2,63 | 0,00050 | 1,21 |
| | | 40 | 0,424 | 3,55 | 1,055 | 1,99 | 0,00053 | 1,13 |
| | | 50 | 0,431 | 3,60 | 1,049 | 1,55 | 0,00055 | 1,06 |
| 45 | -31 | 60 | 0,438 | 3,64 | 1,043 | 1,25 | 0,00058 | 1,01 |
| | | 70 | 0,445 | 3,67 | 1,037 | 1,04 | 0,00060 | 0,96 |
| | | 80 | 0,452 | 3,70 | 1,030 | 0,90 | 0,00063 | 0,92 |
| | | 90 | 0,459 | 3,72 | 1,024 | 0,79 | 0,00065 | 0,88 |
| | | 100 | 0,466 | 3,74 | 1,017 | 0,73 | 0,00068 | 0,84 |

| Concentrate [Vol.%] | Frost resistance [°C] | Temp. [°C] | Thermal conductivity [W/m K] | Spec. heat capacity [kJ/kg K] | Density [g/cm ³] | Kinemat. viscosity [mm ² /s] | Cub. Expansion coefficient [K ⁻¹] | Rel. Pressure drop factor [Factor] |
|------------------------|-----------------------------|---------------|------------------------------------|-------------------------------------|---------------------------------|---|---|--|
| 50 | -38 | -30 | 0,361 | 2,96 | 1,099 | 54,19 | 0,00045 | |
| | | -20 | 0,367 | 3,04 | 1,094 | 26,19 | 0,00045 | 2,05 |
| | | -10 | 0,374 | 3,12 | 1,088 | 14,39 | 0,00046 | 1,79 |
| | | 0 | 0,380 | 3,19 | 1,083 | 8,83 | 0,00048 | 1,60 |
| | | 10 | 0,386 | 3,26 | 1,078 | 5,84 | 0,00049 | 1,45 |
| | | 20 | 0,392 | 3,32 | 1,072 | 4,10 | 0,00051 | 1,34 |
| | | 30 | 0,399 | 3,38 | 1,067 | 3,01 | 0,00053 | 1,25 |
| | | 40 | 0,405 | 3,43 | 1,061 | 2,29 | 0,00056 | 1,16 |
| | | 50 | 0,411 | 3,48 | 1,055 | 1,75 | 0,00058 | 1,09 |
| | | 60 | 0,418 | 3,53 | 1,048 | 1,39 | 0,00061 | 1,04 |
| | | 70 | 0,424 | 3,57 | 1,042 | 1,15 | 0,00064 | 0,99 |
| | | 80 | 0,430 | 3,60 | 1,035 | 0,96 | 0,00068 | 0,94 |
| | | 90 | 0,437 | 3,63 | 1,027 | 0,84 | 0,00072 | 0,90 |
| | | 100 | 0,443 | 3,66 | 1,020 | 0,75 | 0,00073 | 0,86 |
| 55 | -45 | -40 | 0,345 | 2,80 | 1,112 | 149,99 | 0,00047 | |
| | | -30 | 0,350 | 2,88 | 1,107 | 68,29 | 0,00048 | |
| | | -20 | 0,356 | 2,96 | 1,101 | 34,69 | 0,00048 | 2,20 |
| | | -10 | 0,361 | 3,04 | 1,096 | 19,29 | 0,00049 | 1,92 |
| | | 0 | 0,367 | 3,11 | 1,090 | 11,59 | 0,00050 | 1,70 |
| | | 10 | 0,372 | 3,18 | 1,085 | 7,36 | 0,00052 | 1,54 |
| | | 20 | 0,377 | 3,24 | 1,079 | 4,95 | 0,00054 | 1,41 |
| | | 30 | 0,383 | 3,30 | 1,073 | 3,48 | 0,00055 | 1,31 |
| | | 40 | 0,388 | 3,35 | 1,067 | 2,54 | 0,00058 | 1,21 |
| | | 50 | 0,393 | 3,40 | 1,060 | 1,93 | 0,00060 | 1,13 |
| | | 60 | 0,399 | 3,45 | 1,054 | 1,52 | 0,00063 | 1,07 |
| | | 70 | 0,404 | 3,49 | 1,047 | 1,24 | 0,00066 | 1,01 |
| | | 80 | 0,410 | 3,52 | 1,040 | 1,04 | 0,00069 | 0,96 |
| | | 90 | 0,415 | 3,55 | 1,033 | 0,90 | 0,00072 | 0,92 |
| 100 | 0,420 | 3,58 | 1,025 | 0,80 | 0,00074 | 0,87 | | |
| 58 | -51 | -50 | 0,335 | 2,68 | 1,122 | | 0,00048 | |
| | | -40 | 0,340 | 2,76 | 1,117 | 152,99 | 0,00049 | |
| | | -30 | 0,345 | 2,85 | 1,111 | 76,99 | 0,00049 | |
| | | -20 | 0,349 | 2,93 | 1,106 | 40,99 | 0,00050 | 2,34 |
| | | -10 | 0,354 | 3,00 | 1,100 | 23,09 | 0,00051 | 2,04 |
| | | 0 | 0,359 | 3,07 | 1,094 | 13,69 | 0,00052 | 1,79 |
| | | 10 | 0,364 | 3,14 | 1,089 | 8,53 | 0,00053 | 1,63 |
| | | 20 | 0,369 | 3,20 | 1,083 | 5,56 | 0,00055 | 1,48 |
| | | 30 | 0,373 | 3,26 | 1,076 | 3,78 | 0,00057 | 1,36 |
| | | 40 | 0,378 | 3,31 | 1,070 | 2,69 | 0,00059 | 1,26 |
| | | 50 | 0,383 | 3,36 | 1,064 | 1,99 | 0,00061 | 1,17 |
| | | 60 | 0,388 | 3,41 | 1,057 | 1,54 | 0,00063 | 1,09 |
| | | 70 | 0,393 | 3,45 | 1,050 | 1,25 | 0,00066 | 1,03 |
| | | 80 | 0,398 | 3,48 | 1,043 | 1,05 | 0,00069 | 0,98 |
| 90 | 0,402 | 3,52 | 1,036 | 0,92 | 0,00072 | 0,93 | | |
| 100 | 0,407 | 3,54 | 1,028 | 0,83 | 0,00075 | 0,89 | | |

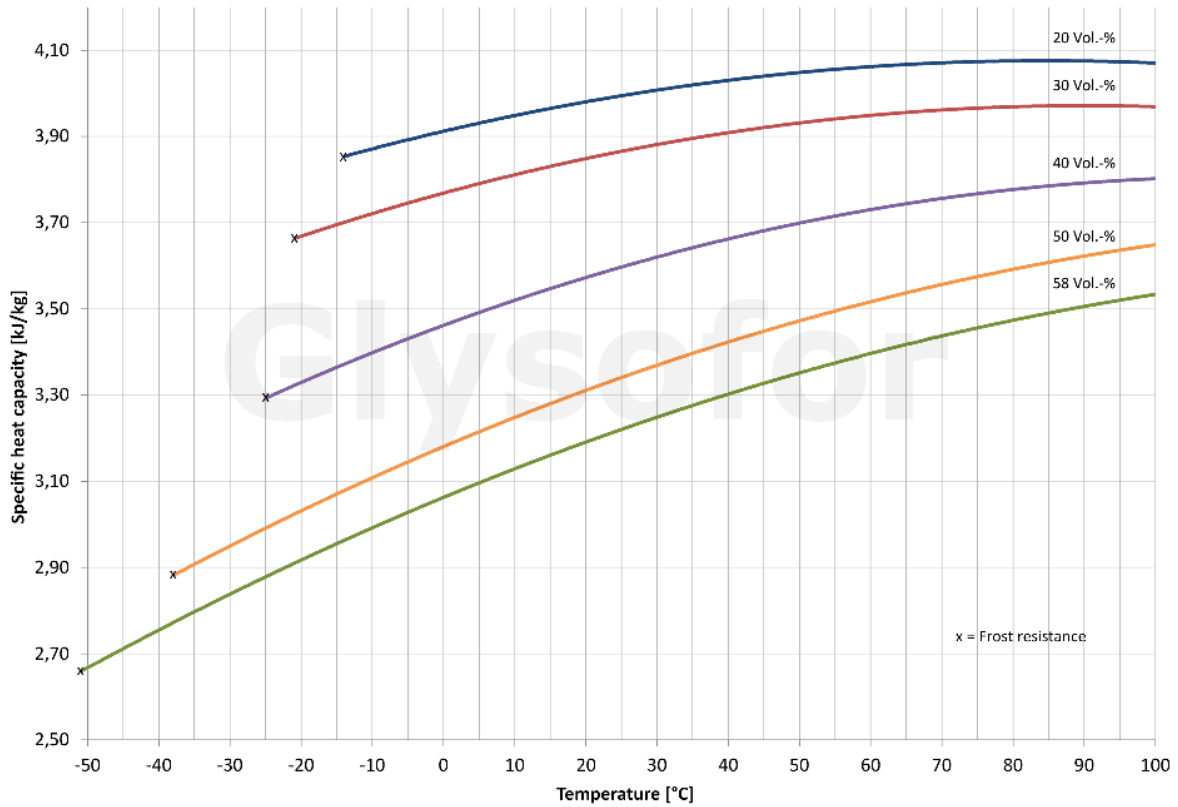
Frost resistance of Glysofor TERRA - water mixtures



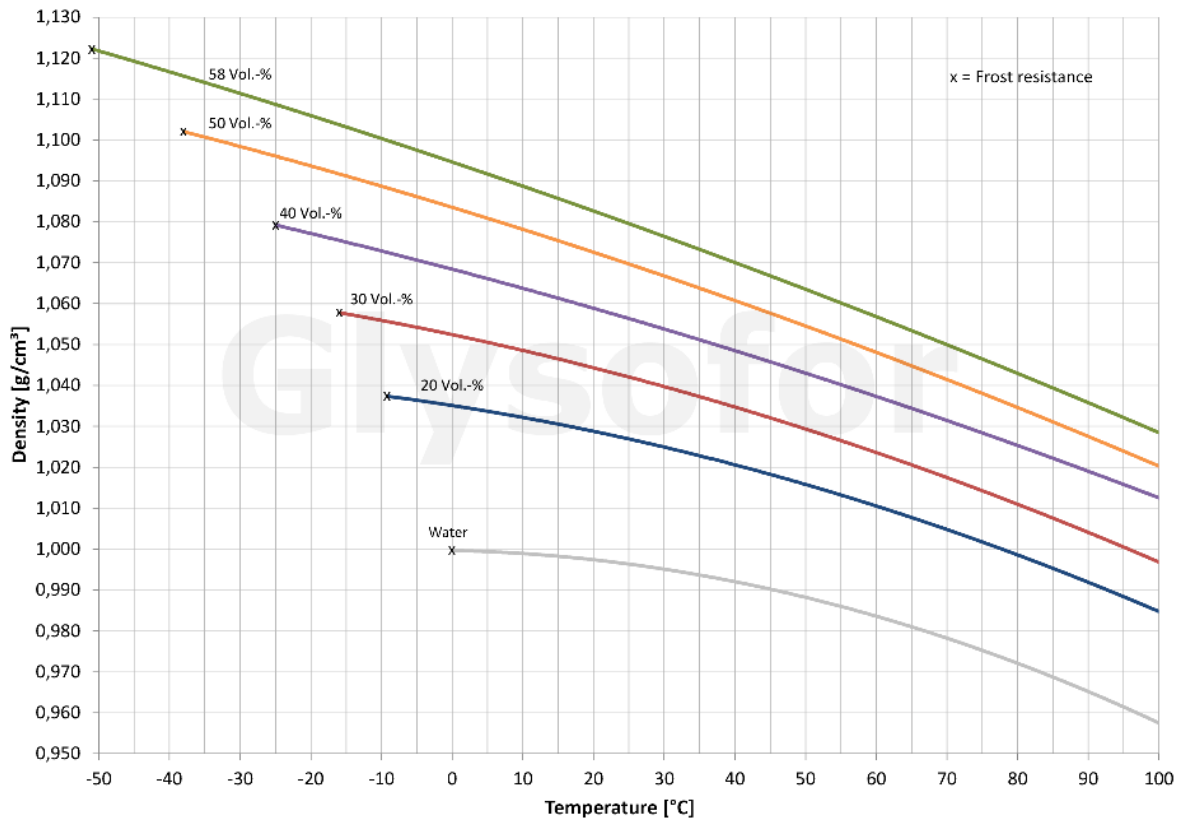
Thermal conductivity of Glysofor TERRA - water mixtures



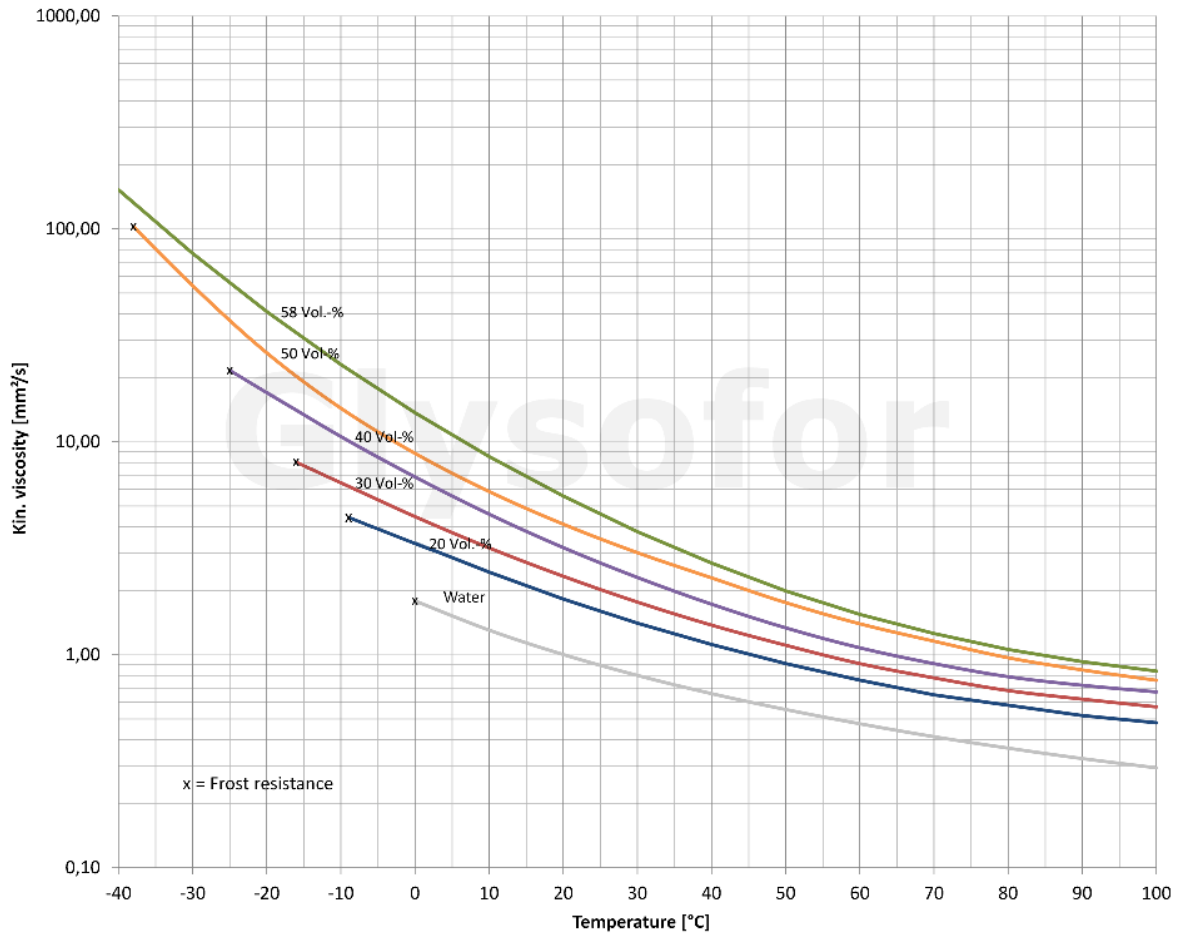
Spec. heat capacity of Glysofor TERRA - water mixtures



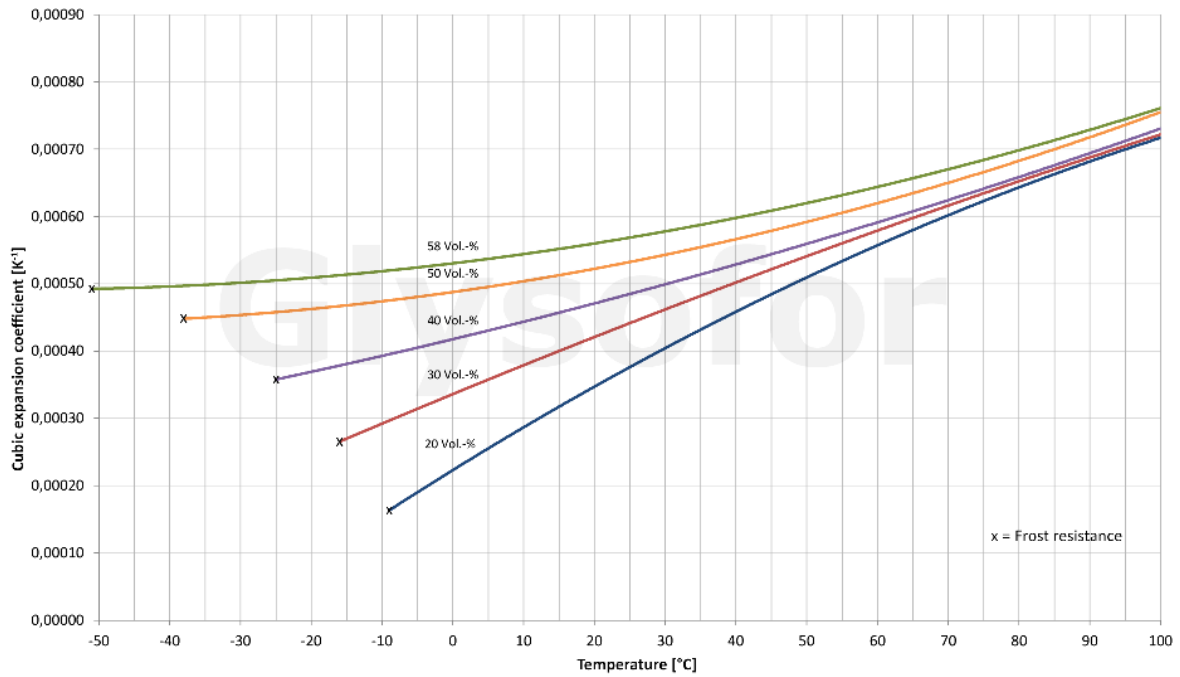
Density of Glysofor TERRA - water mixtures



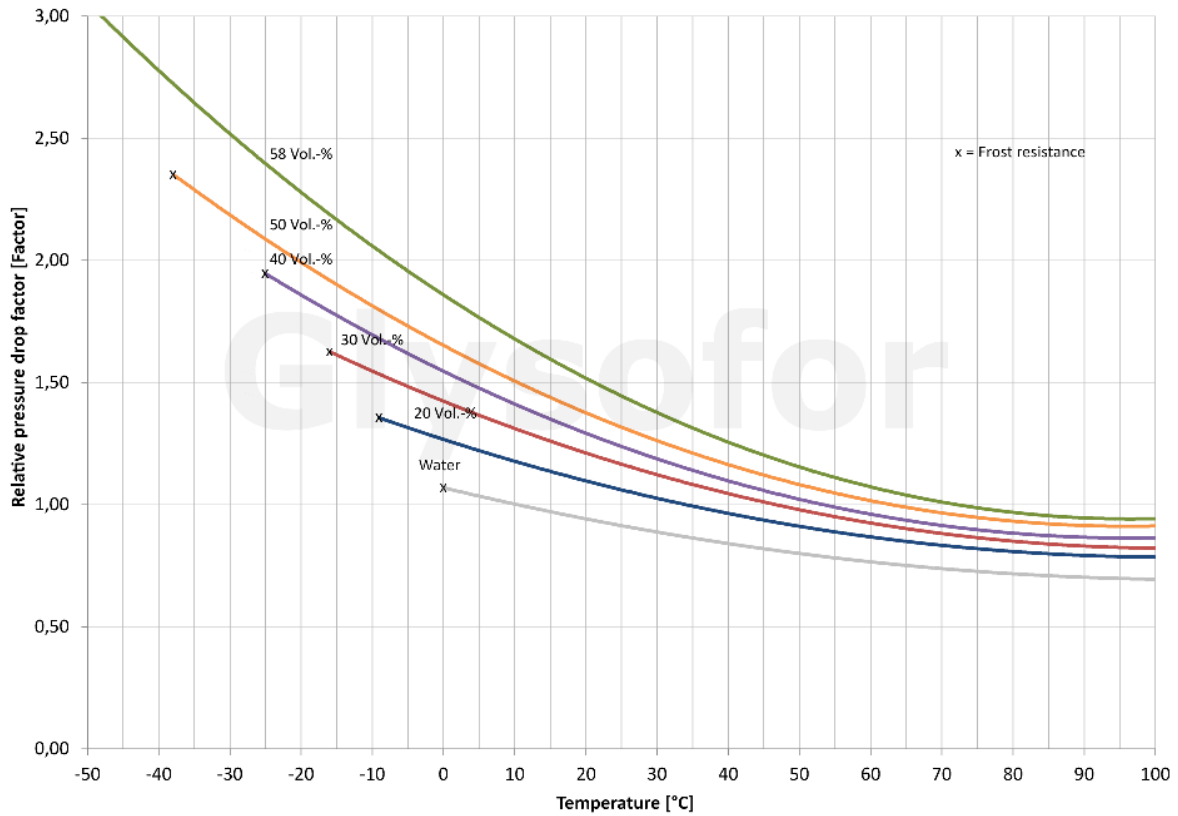
Kinematic viscosity of Glysofor TERRA - water mixtures



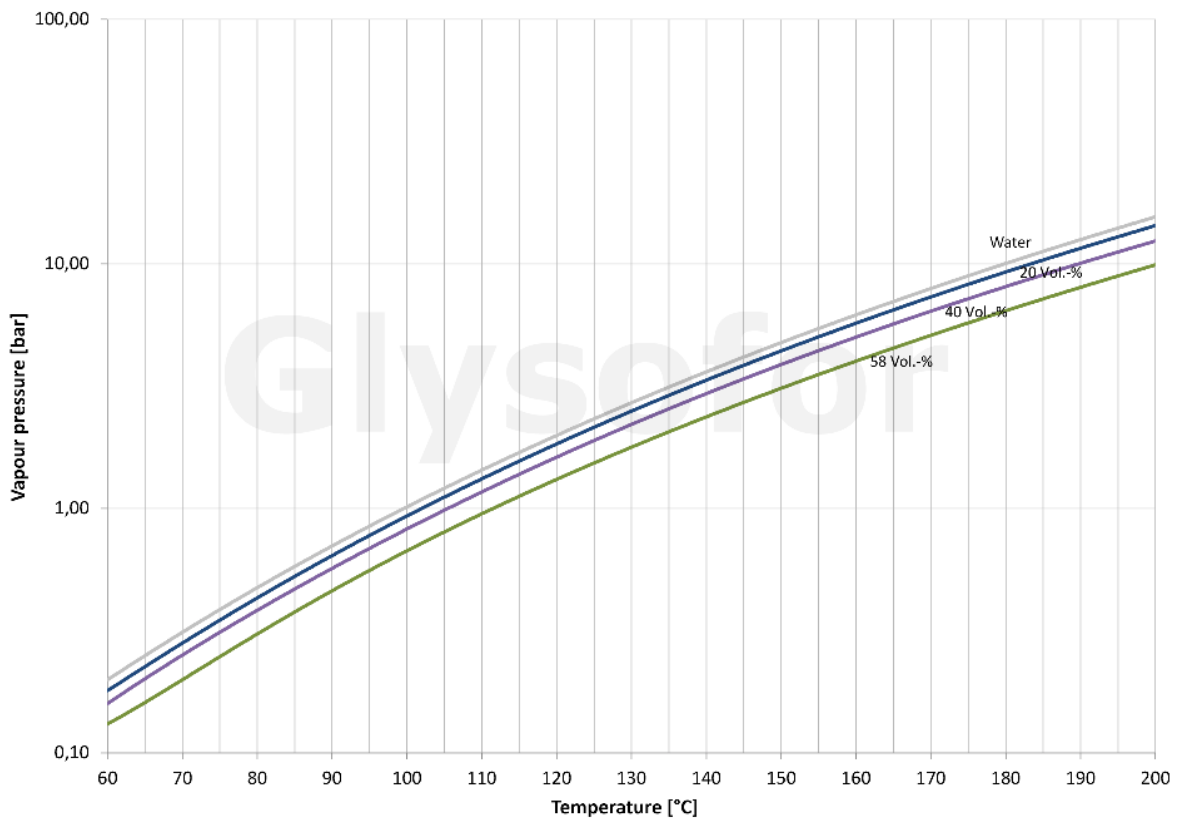
Cub. expansion coefficient of Glysofor TERRA - water mixtures



Relative pressure drop factor of Glysofor TERRA - water mixtures



Vapour pressure of Glysofor TERRA - water mixtures




Other

Pure water/glycol mixtures have very distinctive corrosive properties. You must therefore never use pure water/glycol mixtures without inhibitor equipment. We recommend Glysofor L, based on propylene, for applications in connection with food and the refrigeration or heating of food.

Packaging sizes

- 10 kg canister
- 25 kg canister
- 30 kg canister
- 220 kg barrel
- 1.000 kg IBC
- 24.000 kg tank vehicle

This data relates to the correct and appropriate application of our products, with due consideration of the professional standards and regulations of the area of application. It is for informational purposes only and does not absolve the obligation to carry out the due materials testing upon arrival. The data is based on our current state of knowledge and is not meant to guarantee specific properties. No general or legally binding statement on certain features, in a concrete application, can be derived from the above data. It is meant to describe our products with regard to their composition and offer application advice. Any industrial property rights of third parties and the suitability for a special application purpose are to be observed and verified by the user.

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|  | WITTIG Umweltchemie GmbH Carl-Bosch-Straße 17 D-53501 Grafschaft-Ringen | Tel.: +49 (0) 2641 - 20510 0 Fax: +49 (0) 2641 - 20510 22 info@glysofor.de – www.glysofor.de |
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