

TYFOCOR® GE

Concentrate

Antifreeze and Anti-corrosion Fluid
for Ground Source Heat Pump Systems



Characteristics of TYFOCOR® GE Concentrate

Appearance	Clear, green liquid	
Boiling point	> 165 °C	ASTM D 1120
Pour point	< -15 °C	DIN ISO 3016
Density (20 °C)	1.110–1.125 g/cm ³	DIN 51757
Refraction nD20	1.432–1.434	DIN 51423
pH value (20 °C)		
- Concentrate	8.0–8.5	ASTM D 1287
- 33 vol. %	7.5–8.5	ASTM D 1287
Viscosity (20 °C)	24–28 mm ² /s	DIN 51562
Reserve alkalinity	> 4.0 ml 0.1 m HCl	ASTM D 1121

The above data represent average values that were valid when this Technical Information Bulletin went into print. They do not have the status of a product specification. Specified values are the subject of a special leaflet.

Properties

TYFOCOR® GE is a clear, green, and virtually odourless liquid based on ethylene glycol. It is miscible with water in all proportions. It's mixtures with water protect against frost at temperatures down to -51 °C, depending on their concentration. **TYFOCOR® GE**/water mixtures do not separate.

The corrosion inhibitors of **TYFOCOR® GE** reliably protect all metals and alloys normally used for Ground Source Heat Pumps even in mixed installations for long periods against corrosion, ageing and fouling. An upper limit of 60 °C must be observed for the operating temperature of the brine fluid. The inhibitor system of **TYFOCOR® GE** neither contains amines nor borax, nitrites, phosphates, nor triazoles.

Miscibility

TYFOCOR® GE is miscible with all commercial antifreezes based on ethylene glycol. If mixing of **TYFOCOR® GE** with other products is intended, we recommend, however, to contact our department of application technique beforehand.

Application

In order to maintain effective protection from corrosion, the concentration of **TYFOCOR® GE** must not be allowed to fall below 20 volume percent. Lower concentrations are insufficient and incur the risk of corrosion.

Antifreeze Effect

TYFOCOR® GE Concentrate	Freezing point	Density at 20 °C	Refraction index nD20
20 vol. %	-9.0 °C	1028 kg/m ³	1.3544
25 vol. %	-12.3 °C	1035 kg/m ³	1.3596
30 vol. %	-16,1 °C	1043 kg/m ³	1.3650
35 vol. %	-20.4 °C	1050 kg/m ³	1.3702
40 vol. %	-25.2 °C	1057 kg/m ³	1.3755
45 vol. %	-30.8 °C	1064 kg/m ³	1.3807
50 vol. %	-37.6 °C	1070 kg/m ³	1.3857
55 vol. %	-45.4 °C	1076 kg/m ³	1.3907

Demineralized water or softened water with a chloride content of < 100mg/kg must be used for mixing with **TYFOCOR® GE**. The protection against frost deteriorates if the **TYFOCOR® GE** concentration exceeds 58 percent by volume.

Anticorrosion Effect

The following table demonstrates the anticorrosion effect of a 33 vol % **TYFOCOR® GE**/water mixture after 14 days at 60 °C under permanent aeration. Modified corrosion test acc. ASTM D 1384 (American Society for Testing and Materials).

Material	Average change of weight	Weight loss limit value
Copper (SF Cu)	-0.48 g/m ²	10 g/m ²
Soft solder (L Sn 30)	-2.96 g/m ²	30 g/m ²
Brass (MS 63)	-0.41 g/m ²	10 g/m ²
Cast Iron (GG 26)	-0.19 g/m ²	10 g/m ²
Steel (HI)	-1.33 g/m ²	10 g/m ²
Cast Alum. (G-ALSi6Cu4)	-0.03 g/m ²	30 g/m ²

Compatibilities with Sealing Materials

Mixtures of **TYFOCOR® GE** and water do not attack the sealants normally used for Ground Source Heat Pump Systems. The following list of sealants, elastomers and plastics that are resistant to **TYFOCOR® GE**/water mixtures has been compiled from experimental results, experience, and the literature.

Examples of sealants are Fermit®, Fermitol® (registered trademarks of Nissen & Volk GmbH, Hamburg), and hemp

Butyl rubber	IIR
Chloroprene	CR
Ethylene-propylene-dien-rubber	EPDM
Fluorocarbon elastomers	FPM
Natural rubber below 80 °C	NR
Nitrile rubber	NBR
Polyacetal	POM
Polyamides below 115 °C	PA
Polybutene	PB
Polyethylene, soft, hard	PE-LD/HD
Polyethylene, crosslinked	PE-X
Polypropylene	PP
Polytetrafluorethylene	PTFE
Polyvinylchloride, rigid	PVC h
Silicone rubber	Si
Styrene butadiene rubber below 100 °C	SBR
Unsaturated polyester resins	UP

Phenolic and urea resins, plasticized PVC, and polyurethane elastomers are not resistant.

An important point to note is that the performance of elastomers is not only governed by the properties of the rubber itself, e.g. EPDM, but also by the nature and amount of the constituent additives and the vulcanisation conditions. For this reason, it is recommended that their resistance to **TYFOCOR® GE**/water mixtures is checked by

performance tests before these elastomers are taken into use for the first time. This applies particularly to elastomers intended as membranes for expansion tanks as described in DIN EN 12828 and DIN 4807 Part 2, respectively.

In some cases, the low surface tension of **TYFOCOR® GE**/water mixtures may be responsible for leakage if the sealing strips have been produced from polytetrafluoroethylene (PTFE).

Application Guidelines

In view of the specific properties of **TYFOCOR® GE**, the following application guidelines must be observed to achieve long-term protection for the installations.

1. Brine circuits must be designed as closed systems, otherwise the contact with atmospheric oxygen will accelerate the consumption of inhibitors.
2. Flexible-membrane expansion tanks must conform to DIN EN 12828 and DIN 4807 Part 2, resp.
3. Silver or copper brazing solders are to be utilised preferably on joints. Fluxes used in combination with soft solder usually contain chlorides. Their residues must be removed from the brine circuit by thorough flushing. Otherwise an increased content of chlorides in the fluid may lead to pitting corrosion on e.g. stainless steel.
4. The only flexible connections that are permitted for use are hoses, preferably made of metal, that are resistant to oxygen diffusion.
5. The layout of the piping must ensure that circulation cannot be disturbed by gas pockets or deposits.
6. The brine circuit must not be equipped with internally galvanised heat exchangers, tanks or pipes, because zinc can be detached by glycol/water mixtures.
7. Dirt, soil and water must not be allowed to enter the Ground Source Heat Pump system during the installation of the probes. After the assembly has been completed, the brine circuit must be thoroughly flushed to remove any foreign matter (swarf, fluxes, packaging residues, etc.) and assembly aids before the system is finally filled with the **TYFOCOR® GE**/water mixture.
8. It must be ensured that no air pockets remain in the brine circuit after it has been filled. It is essential to eliminate any existing gas pockets, because their collapse following a drop in temperature would give rise to a vacuum and thus cause air to be sucked into the system. Insufficient deaeration of the brine circuit furthermore affects the efficiency of the Ground Source Heat Pump.
9. In-circuit filter elements must be cleaned within 14 days at the latest after the system was put into operation in order to ensure that no obstruction to the fluid flow may occur due to deposits in any part of the installation.
10. After the system has been filled, the concentration of the **TYFOCOR® GE**/water mixture should be checked by measuring the fluid density with a hydrometer or an antifreeze tester suitable for ethylene glycol/water mixtures. An equally convenient and accurate way to determine the **TYFOCOR® GE** content is to measure the

refraction index by using a hand-held refractometer. A summary of densities and refraction indices of **TYFOCOR® GE**/water mixtures as a function of concentration can be found on page 2 of this leaflet.

11. If leakages or other losses occur, the heat transfer liquid in the system must be replenished with an aqueous **TYFOCOR® GE** solution of the same concentration. In cases of doubt, the **TYFOCOR® GE** content must be determined via density or refraction index as described in section 10.

Storage stability

TYFOCOR® GE has a shelf life of at least three years in airtight containers. It should not be stored in galvanised containers, because zinc is detached by glycol/water mixtures.

Delivery Form and Packaging

TYFOCOR® GE is available as a concentrate or ready-mix according to customer's specification. It is supplied in road tankers, in 1000 litre IBCs, in 200 litre drums, and in 30, 20 and 10 litre non-returnable plastic cans.

Disposal

Spills of **TYFOCOR® GE** must be taken up in an absorbent binder and disposed of in accordance with the regulations. For further information, please refer to the Material Safety Data Sheet.

Ecology

TYFOCOR® GE is readily biodegradable. It is classified in water hazard class 1, (WGK 1, low-rate endangering) according to German water hazard regulations '*Verordnung über Anlagen zum Umgang mit wassergefährdenden Stoffen vom 18. April 2017*' (AwSV).

TYFOCOR® GE meets the criteria for the use of substances hazardous to water as a heat transfer medium in geothermal probes and collectors in the commercial sector and public facilities in accordance with section 35(2) sentence 1 no. 3 AwSV.

TYFOCOR® GE is included in the positive list of '*Empfehlungen der LAWA (Bund/Länder-Arbeitsgemeinschaft Wasser) f. wasserwirtschaftliche Anforderungen an Erdwärmesonden und Erdwärmekollektoren*' (Recommendations of German Federal/States Working Group for water management requirements for geothermal probes and collectors).

Handling

The usual safety and industrial hygiene measures relating to chemicals must be observed in handling **TYFOCOR® GE**. The information and instructions given in our Safety Data Sheet must be strictly observed.

Safety Data Sheet

A Safety Data Sheet in accordance with Directive 1907/2006/EC [REACH] is available for download on www.tyfo.de.

Density of TYFOCOR® GE/water mixtures [kg/m³]

as a function of temperature and concentration

T [°C]	20 vol. %	25 vol. %	30 vol. %	35 vol. %	40 vol. %	45 vol. %	50 vol. %	55 vol. %	58 vol. %
120	969	973	981	989	997	1000	1001	1005	1009
110	977	981	989	996	1004	1008	1010	1014	1017
100	984	988	996	1003	1011	1015	1018	1022	1025
90	991	996	1003	1010	1017	1022	1025	1030	1033
80	997	1002	1010	1016	1023	1028	1033	1037	1040
70	1004	1009	1016	1022	1029	1035	1040	1044	1047
60	1009	1015	1023	1028	1035	1041	1046	1051	1054
50	1015	1020	1028	1034	1041	1047	1053	1057	1061
40	1020	1026	1034	1040	1047	1053	1059	1064	1067
30	1024	1030	1039	1045	1052	1058	1065	1070	1073
20	1028	1035	1043	1050	1057	1064	1070	1076	1080
10	1031	1038	1048	1054	1062	1069	1076	1082	1086
0	1034	1042	1051	1059	1066	1074	1081	1087	1091
-10	-	1044	1055	1062	1071	1079	1086	1093	1097
-20	-	-	-	1066	1075	1083	1092	1098	1103
-30	-	-	-	-	-	1088	1097	1104	1108
-40	-	-	-	-	-	-	-	1109	1114
-50	-	-	-	-	-	-	-	-	1119

Note: The data for the temperature range above 60 °C are for informational purposes only

Specific heat capacity of TYFOCOR® GE/water mixtures [kJ/kg·K]

as a function of temperature and concentration

T [°C]	20 vol. %	25 vol. %	30 vol. %	35 vol. %	40 vol. %	45 vol. %	50 vol. %	55 vol. %	58 vol. %
120	4.05	4.01	3.96	3.89	3.81	3.76	3.68	3.61	3.57
110	4.06	4.03	3.97	3.89	3.81	3.75	3.67	3.59	3.56
100	4.07	4.03	3.97	3.90	3.80	3.73	3.65	3.57	3.53
90	4.08	4.03	3.97	3.89	3.79	3.71	3.62	3.54	3.51
80	4.07	4.03	3.97	3.88	3.78	3.69	3.59	3.51	3.47
70	4.07	4.03	3.96	3.87	3.76	3.66	3.56	3.48	3.44
60	4.06	4.01	3.95	3.85	3.73	3.63	3.52	3.44	3.40
50	4.05	4.00	3.93	3.83	3.70	3.59	3.47	3.39	3.35
40	4.03	3.98	3.91	3.80	3.66	3.54	3.42	3.34	3.30
30	4.01	3.95	3.88	3.75	3.62	3.49	3.37	3.29	3.25
20	3.98	3.92	3.85	3.72	3.57	3.44	3.31	3.23	3.19
10	3.95	3.89	3.81	3.68	3.52	3.38	3.25	3.17	3.13
0	3.91	3.85	3.77	3.63	3.46	3.31	3.18	3.10	3.06
-10	-	3.81	3.72	3.57	3.40	3.24	3.11	3.03	2.99
-20	-	-	-	3.51	3.33	3.17	3.03	2.95	2.92
-30	-	-	-	-	-	3.08	2.95	2.87	2.84
-40	-	-	-	-	-	-	-	2.79	2.75
-50	-	-	-	-	-	-	-	-	2.67

Note: The data for the temperature range above 60 °C are for informational purposes only

Thermal conductivity of TYFOCOR® GE/water mixtures [W/m-K]

as a function of temperature and concentration

T [°C]	20 vol. %	25 vol. %	30 vol. %	35 vol. %	40 vol. %	45 vol. %	50 vol. %	55 vol. %	58 vol. %
120	0.624	0.596	0.569	0.535	0.504	0.479	0.454	0.430	0.416
110	0.612	0.585	0.559	0.527	0.496	0.472	0.448	0.425	0.411
100	0.601	0.575	0.549	0.518	0.489	0.465	0.442	0.419	0.406
90	0.590	0.564	0.539	0.509	0.481	0.458	0.436	0.414	0.401
80	0.579	0.553	0.529	0.500	0.474	0.451	0.429	0.409	0.397
70	0.567	0.543	0.518	0.492	0.466	0.444	0.423	0.403	0.392
60	0.556	0.532	0.508	0.483	0.459	0.437	0.417	0.398	0.387
50	0.545	0.521	0.498	0.474	0.451	0.430	0.410	0.392	0.382
40	0.534	0.510	0.488	0.465	0.444	0.423	0.404	0.387	0.377
30	0.522	0.500	0.478	0.457	0.436	0.416	0.398	0.382	0.372
20	0.511	0.489	0.467	0.448	0.429	0.410	0.391	0.376	0.368
10	0.500	0.478	0.457	0.439	0.421	0.403	0.385	0.371	0.363
0	0.489	0.468	0.447	0.430	0.414	0.396	0.379	0.366	0.358
-10	-	0.457	0.437	0.422	0.406	0.389	0.373	0.360	0.353
-20	-	-	-	0.413	0.399	0.382	0.366	0.355	0.348
-30	-	-	-	-	-	0.375	0.360	0.349	0.344
-40	-	-	-	-	-	-	-	0.344	0.339
-50	-	-	-	-	-	-	-	-	0.334

Note: The data for the temperature range above 60 °C are for informational purposes only

Kinematic viscosity of TYFOCOR® GE/water mixtures [mm²/s]

as a function of temperature and concentration

T [°C]	20 vol. %	25 vol. %	30 vol. %	35 vol. %	40 vol. %	45 vol. %	50 vol. %	55 vol. %	58 vol. %
120	0.42	0.45	0.49	0.52	0.57	0.61	0.62	0.67	0.71
110	0.45	0.49	0.53	0.57	0.63	0.67	0.68	0.73	0.77
100	0.48	0.52	0.57	0.61	0.67	0.73	0.76	0.81	0.84
90	0.52	0.57	0.62	0.66	0.72	0.80	0.87	0.91	0.93
80	0.58	0.63	0.68	0.73	0.79	0.91	1.01	1.05	1.06
70	0.65	0.71	0.78	0.84	0.91	1.05	1.20	1.25	1.26
60	0.76	0.83	0.91	0.99	1.08	1.26	1.45	1.53	1.55
50	0.91	1.00	1.11	1.21	1.34	1.56	1.81	1.94	2.00
40	1.12	1.24	1.38	1.54	1.73	2.00	2.30	2.55	2.70
30	1.41	1.58	1.77	2.01	2.31	2.64	3.02	3.49	3.79
20	1.83	2.07	2.34	2.72	3.19	3.62	4.11	4.96	5.57
10	2.45	2.79	3.18	3.80	4.58	5.16	5.85	7.37	8.54
0	3.35	3.87	4.46	5.49	6.85	7.75	8.84	11.6	13.7
-10	-	5.52	6.44	8.19	10.6	12.3	14.4	19.3	23.1
-20	-	-	-	12.5	17.1	21.1	26.2	34.7	41.0
-30	-	-	-	-	-	39.0	54.2	68.3	77.0
-40	-	-	-	-	-	-	-	150.0	153.0
-50	-	-	-	-	-	-	-	-	-

Note: The data for the temperature range above 60 °C are for informational purposes only

Prandtl number of TYFOCOR® GE/water mixtures

as a function of temperature and concentration

T [°C]	20 vol. %	25 vol. %	30 vol. %	35 vol. %	40 vol. %	45 vol. %	50 vol. %	55 vol. %	58 vol. %
120	2.64	2.95	3.35	3.74	4.30	4.79	5.03	5.65	6.15
110	2.92	3.31	3.72	4.19	4.84	5.37	5.63	6.25	6.78
100	3.20	3.60	4.11	4.61	5.26	5.94	6.39	7.05	7.49
90	3.56	4.06	4.58	5.09	5.77	6.62	7.40	8.02	8.41
80	4.06	4.60	5.15	5.76	6.45	7.65	8.73	9.34	9.64
70	4.68	5.32	6.06	6.75	7.55	8.96	10.5	11.3	11.7
60	5.60	6.35	7.24	8.11	9.08	10.9	12.8	13.9	14.4
50	6.86	7.89	9.00	10.1	11.5	13.6	16.1	17.7	18.6
40	8.62	9.93	11.4	13.1	14.9	17.6	20.6	23.4	25.2
30	11.1	12.9	14.9	17.2	20.2	23.4	27.2	32.2	35.5
20	14.7	17.2	20.1	23.7	28.1	32.3	37.2	45.8	52.2
10	20.0	23.6	27.8	33.6	40.7	46.3	53.1	68.1	80.0
0	27.7	33.2	39.5	49.1	61.0	69.6	80.2	106.8	127.8
-10	-	48.0	57.8	73.6	95.1	110.5	130.4	177.6	214.6
-20	-	-	-	113.3	153.4	189.6	236.9	316.6	379.5
-30	-	-	-	-	-	348.5	487.2	620.1	704.4
-40	-	-	-	-	-	-	-	1349	1383
-50	-	-	-	-	-	-	-	-	-

Note: The data for the temperature range above 60 °C are for informational purposes only

Vapour pressure of TYFOCOR® GE/water mixtures [bar]

as a function of temperature and concentration

T [°C]	20 vol. %	25 vol. %	30 vol. %	35 vol. %	40 vol. %	45 vol. %	50 vol. %	55 vol. %	58 vol. %
180	9.25	8.99	8.70	8.39	8.06	7.65	7.19	6.73	6.42
170	7.32	7.11	6.88	6.65	6.40	6.07	5.71	5.34	5.10
160	5.71	5.55	5.38	5.20	5.01	4.76	4.48	4.19	4.00
150	4.40	4.28	4.15	4.01	3.87	3.68	3.47	3.24	3.09
140	3.34	3.25	3.15	3.05	2.94	2.80	2.64	2.47	2.36
130	2.50	2.43	2.36	2.28	2.20	2.10	1.98	1.85	1.77
120	1.83	1.78	1.77	1.67	1.62	1.54	1.46	1.37	1.34
110	1.32	1.28	1.25	1.29	1.17	1.11	1.05	0.99	0.94
100	0.93	0.91	0.88	0.85	0.82	0.79	0.74	0.70	0.66
90	0.64	0.62	0.61	0.59	0.57	0.54	0.51	0.48	0.46
80	0.43	0.42	0.41	0.39	0.38	0.36	0.34	0.32	0.31
70	0.28	0.27	0.27	0.26	0.25	0.24	0.22	0.21	0.20
60	0.18	0.17	0.17	0.16	0.16	0.15	0.14	0.13	0.13
50	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.08	0.08
40	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05
30	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03

Note: The data for the temperature range above 60 °C are for informational purposes only

Cubic Expansion Coefficient of TYFOCOR® GE/water mixtures [$\cdot 10^{-5}/K$]

as a function of temperature and concentration

T [°C]	20 vol. %	25 vol. %	30 vol. %	35 vol. %	40 vol. %	45 vol. %	50 vol. %	55 vol. %	58 vol. %
120	79	80	79	73	67	75	86	85	83
110	76	77	76	71	66	72	81	81	80
100	72	73	72	68	64	69	77	79	76
90	68	70	69	66	62	66	73	73	73
80	64	66	65	63	60	64	69	70	70
70	60	62	62	60	58	61	65	67	67
60	56	57	58	57	56	59	62	64	64
50	51	53	54	54	54	56	59	61	62
40	46	48	50	51	52	54	57	59	60
30	40	44	46	48	49	51	54	56	58
20	35	39	42	45	47	49	52	55	56
10	29	34	38	42	45	47	50	53	54
0	22	28	34	38	42	45	49	51	53
-10	-	23	29	35	39	44	47	50	52
-20	-	-	-	31	37	42	46	49	51
-30	-	-	-	-	-	40	46	49	50
-40	-	-	-	-	-	-	-	48	50
-50	-	-	-	-	-	-	-	-	49

Note: The data for the temperature range above 60 °C are for informational purposes only

Example for calculating the volume expansion:

What would be the increase in volume (in litres) if $V_0 = 80$ litres of a 30 vol. % TYFOCOR® GE/water mixture will be heated from

$t_0 = -10$ °C to $t_1 = +90$ °C ?

$$\Delta t = t_1 - t_0 = +90 - (-10) = 100 \text{ °C}, t_{\text{average}} = t_0 + \Delta t/2 = -10 + 100/2 = +40 \text{ °C}$$

$$\beta_{\text{average}} \text{ (from table for 30 vol. \%)} = 50 \cdot 10^{-5}$$

$$\Delta V = \beta_{\text{average}} \cdot \Delta t \cdot V_0 = 50 \cdot 10^{-5} \cdot 100 \cdot 80 = 4.0 \text{ litres increase in volume}$$

Relative pressure drop factor of TYFOCOR® GE/water mixtures

in comparison with water at 10 °C, turbulent pipe flow (approximate values)

T [°C]	20 vol. %	25 vol. %	30 vol. %	35 vol. %	40 vol. %	45 vol. %	50 vol. %	55 vol. %	58 vol. %
100	0.77	0.78	0.80	0.81	0.83	0.85	0.87	0.88	0.90
90	0.79	0.81	0.83	0.84	0.86	0.89	0.91	0.93	0.94
80	0.82	0.84	0.86	0.88	0.90	0.93	0.95	0.97	0.99
70	0.85	0.88	0.90	0.92	0.94	0.97	1.00	1.02	1.04
60	0.88	0.91	0.94	0.96	0.99	1.02	1.05	1.08	1.10
50	0.91	0.95	0.99	1.01	1.04	1.07	1.10	1.14	1.18
40	0.96	1.01	1.05	1.07	1.10	1.14	1.17	1.22	1.27
30	1.01	1.06	1.11	1.14	1.18	1.22	1.26	1.32	1.37
20	1.08	1.14	1.19	1.23	1.28	1.32	1.35	1.42	1.49
10	1.17	1.23	1.29	1.33	1.38	1.42	1.46	1.55	1.64
0	1.29	1.35	1.40	1.45	1.50	1.56	1.61	1.71	1.80
-10	-	1.50	1.59	1.63	1.68	1.74	1.80	1.93	2.05
-20	-	-	-	1.85	1.92	1.99	2.06	2.21	2.35

Note: The data for the temperature range above 60 °C are for informational purposes only

Antifreeze effect of TYFOCOR® GE/water mixtures

The **freezing point**, colloquially called 'antifreeze', is a measure for the freezing point depression effect of antifreeze fluids. When a given TYFOCOR® GE/water mixture is cooled down, the freezing point is the temperature at which initial ice crystals begin to form. The resulting ice slurry does not possess any expansive force. Further reduction in temperature causes further thickening of the ice slurry until it solidifies at the **pour point**. Only below this temperature, there is danger of bursting for the installation. The arithmetic mean from freezing point and pour point is referred to as **frost protection**.

The following table displays the freezing points, frost protection and pour points of TYFOCOR® GE/water mixtures as a function of concentration:

TYFOCOR® GE Concentrate	Freezing point (acc. ASTM D 1177)	Frost protection (calculated)	Pour point (acc. DIN EN ISO 3016)
20 vol. %	-9.0 °C	-11.0 °C	-13.0 °C
25 vol. %	-12.3 °C	-14.8 °C	-17.3 °C
30 vol. %	-16.1 °C	-19.1 °C	-22.0 °C
35 vol. %	-20.4 °C	-23.7 °C	-26.9 °C
40 vol. %	-25.2 °C	-28.6 °C	-32.0 °C
45 vol. %	-30.8 °C	-33.4 °C	-37.2 °C
50 vol. %	-37.6 °C	-40.7 °C	-45.2 °C
55 vol. %	-45.4 °C	< -50 °C	< -50 °C
58 vol. %	< -50 °C	< -50 °C	< -50 °C

Note

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application these data do not relieve processors of the responsibility of carrying out their own tests and experiments, neither do they imply any legally binding assurance of certain properties or of suitability for a specific purpose. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislations are observed.

The TYFO product range

TYFOCOR® is a long-life, corrosion-inhibiting antifreeze based on ethylene glycol for cooling and heating, air-conditioning, heat pump, and under-soil heating systems. It can be supplied as a concentrate or a pre-mixed, ready-to-use product as desired.

TYFOCOR® GE is a long-life, corrosion-inhibiting antifreeze based on ethylene glycol specially formulated for use in geothermal heat pump systems. It can be supplied as desired in the form of a concentrate or a pre-mixed, ready-to-use product.

TYFOCOR® L is a long-life corrosion-inhibiting antifreeze based on propylene glycol for heating and air-conditioning, solar thermal, and heat pump systems. It is also used as a special food-grade brine by food and beverage manufacturers and is supplied both as a concentrate and a pre-mixed, ready-to-use product.

TYFOCOR® Leco® is a long-life corrosion-inhibiting antifreeze based on propylene glycol that covers the same applications as **TYFOCOR® L**. Practically all of the substances contained in the product are derived from 100% renewable resources.

TYFOCOR® LS® is a special, ready-to-use, almost completely vaporizable, propylene-glycol-based heat transfer fluid for use in solar systems that are subject to extreme thermal conditions.

TYFOCOR® G-LS is a special, ready-to-use, almost completely vaporizable, propylene-glycol-based heat transfer fluid for use in solar systems that are subject to extreme thermal conditions. It contains a glass protection additive that makes it suitable for use in all-glass solar collectors.

TYFOCOR® HTL is a special, ready-to-use heat transfer fluid based on non-toxic glycols for use in solar systems that are subject to extreme thermal conditions.

TYFO-SPEZIAL is a special, high-performance brine formulated for geothermal heat pumps located in areas subject to special government regulations. Due to its lack of glycols, it does not cause any underground biological oxygen depletion in the event of a leak.

TYFOXIT® 1.15–1.25 are non-toxic, high-performance, glycol-free secondary coolants based on potassium acetate with very low viscosities for chiller systems with secondary cooling. They are available as concentrates (**TYFOXIT® 1.25**) and ready-to-use mixtures ranging from -20 °C (**TYFOXIT® 1.15**) to -55 °C (**TYFOXIT® 1.25**).

TYFOXIT® F15–50 are non-toxic, high-performance, glycol-free, potassium-formate-based secondary coolants with very low viscosities for chiller systems with secondary cooling. They are available as ready-to-use mixtures ranging from -15 °C (**TYFOXIT® F15**) to -50 °C (**TYFOXIT® F50**).

To learn more about our products, visit www.tyfo.de





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