

TYFOCOR® LG

Concentrate

Propylene Glycol-Based Solar Fluid



TYFOROP Chemie GmbH

Applications for TYFO products

Renewable energy



Thermal solar systems place high demands on the properties of heat transfer fluids. Both during cold winter nights and under the hot midday sun — you need your solar system to work reliably, year in and year out. Our products make sure your solar thermal fluid remains liquid and pumpable all the way down to -30°C while resisting breakdown up to 200°C . Since there is always a possibility of leakage causing contamination of the hot water supply, solar thermal fluids must not present a health risk. That's why they are formulated with non-toxic propylene glycol. Heat transfer fluids for geothermal systems have it easier in comparison. Here, the main objective is to ensure that heat is transferred from the earth to the heat pump even when temperatures are below freezing, all the while protecting the system's components against corrosion. We also provide specialized products for drinking water protection zones and other areas that fall under special regulations.

Products: TYFOCOR®, GE, L, L-eco®, LS®, G-LS, HTL, LG

HVAC



Central air-conditioning systems in large buildings provide heat in the winter and cooling in the summer. To accomplish this, the heat transfer fluid in the central air-conditioning system is either heated or cooled and then transported to the heat exchangers in the individual rooms through piping. The heat transfer fluid used has to live up to all the demands placed on it regarding heat transfer and corrosion protection over an extended period of time and under both high and low temperatures. Even in buildings at

Refrigeration



remote locations which are not heated the entire winter through, our products prevent the heating system from freezing and thus ensure a long, trouble-free service life.

Products: TYFOCOR®, GE, L, L-eco®

A number of technical processes require rapidly cooling equipment or components to very low temperatures. To achieve this, products are required which not only have good thermal transfer and corrosion inhibiting properties, but which also possess very low viscosities across the entire temperature range. This is the only way to ensure sufficient flow with rapid and efficient heat transfer.

Products:

TYFOCOR®, L, L-eco® | TYFOXIT® 1.15–1.25, F15–50

Food & Beverage



Wherever you look — refrigerated cases in the supermarket or steps during food and beverage processing: Excess heat has to be removed quickly and products need to be kept at consistently low temperatures to maintain shelf life. For use in the food and beverage industry, our products need to possess an additional quality beyond their technical specifications: they must be absolutely non-toxic. This is an important prerequisite to ensure that spills and even small leaks cannot lead to foods being contaminated with potentially hazardous substances.

Products: TYFOCOR® L, L-eco® | TYFOXIT® 1.15–1.25, F15–50

Characteristics of TYFOCOR® LG Concentrate

Appearance	clear, colorless
Boiling point	> 160 °C / 320 °F
Pour point	−60 °C / −76 °F
Density (20 °C / 68 °F)	1050–1055 kg/m ³
Refractive index n _{D20}	1.430–1.435
pH (20 °C / 68 °F) Concentr.	10.0–10.5
pH (20 °C / 68 °F) 50 % vol.	9.0–10.0
Water content	< 3 % w/w
Reserve alkalinity	10–13 ml 0.1 m HCl

Note: Above data represent average values that were valid at the time when this document went into print, and cannot be construed as specifications. Product specifications are available on request.

Properties

TYFOCOR® LG is a non-toxic, virtually odourless, hygroscopic liquid. It consists of food grade propylene glycol, food grade dipotassium phosphate, and deionized water.

TYFOCOR® LG is solely intended for use as a Solar Fluid, i.e. as an antifreeze/heat transfer fluid in Solar Thermal Systems. It meets the requirements of SRCC OG-300 Certification Standard for systems equipped with single wall heat exchangers.

FDA Reference Propylene Glycol: 21 CFR 184.1666
 FDA Reference Dipotassium Phosphate: 21 CFR 182.6285

Frost Protection

TYFOCOR® LG Concentrate is miscible with deionized water in all proportions and thus able to provide protection against freezing for Solar Thermal Systems down to −50 °C / −58 °F.

TYFOCOR® LG Concentrate	Frost Protection [°C] [°F]		Density (20 °C / 68 °F) [kg/m ³] [lb/ft ³]		Refractive index (20 °C / 68 °F)
10 vol. %	−4.1	24.6	1008	62.93	1.3441
20 vol. %	−10.6	12.9	1018	63.55	1.3557
30 vol. %	−19.3	−2.7	1028	64.18	1.3673
40 vol. %	−27.8	−18.0	1038	64.80	1.3788
42 vol. %	−30.0	−22.0	1039	64.86	1.3810
50 vol. %	−45.0	−49.0	1045	65.24	1.3897
60 vol. %	<−50	<−58	1050	65.55	1.3998

Note: Above table displays typical values which are not to be regarded as specifications. **TYFOROP** does not guarantee results from use of these data or products herein. **TYFOROP** gives no warranty, express or implied.

“Frost protection” is the arithmetic mean of the freezing point — initial formation of ice crystals occur at this temperature — and the pour point, i.e. the solidification temperature of the respective **TYFOCOR® LG**/water mixture.

Application Temperature Range

Mixtures of **TYFOCOR® LG** and deionized water can be used in a temperature range of −50 °C / −58 °F to 120 °C / 250 °F. Sustained higher temperatures cause premature aging of propylene glycol, which is indicated by darkening of the fluid and accelerated drop of

pH and reserve alkalinity. Therefore it must be ensured that the fluid drains out of the collectors into the correctly dimensioned expansion tanks, as completely as possible, in case the system’s maximum static temperature will be reached.

Compatibility with Sealing Materials

The following list displays a variety of sealants, elastomers and plastics which have proven compatibility with propylene glycol/water mixtures, according to literature data and experimental results.

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

Phenolic and urea resins, plasticised PVC, and polyurethane elastomers are reported to be not resistant.

An important point to note is that the performance of elastomers such as EPDM is determined by the nature and amount of the constituent additives and the vulcanisation conditions, as well as the properties of the rubber itself. For this reason, we would recommend testing the resistance of these elastomers to mixtures of **TYFOCOR® LG**/water before they are put into service for the first time.

Application guidelines

We recommend to adhere to the following instructions to avoid premature aging of the fluid:

1. Solar systems must be designed as closed circuits to minimize the access of atmospheric oxygen to the solar fluid. In presence of oxygen, propylene glycol undergoes oxidation to organic acids, which will shift the pH to values below 7. Metal corrosion is significantly accelerated under acidic conditions.
2. Zinc will be removed by propylene glycol/water mixtures, hence neither heat exchangers, expansion tanks, pipes nor any other system component system must be galvanized.
3. Silver or copper brazing solders are to be utilised preferably on joints. Soft solder fluxes usually contain chlorides. Their residues must be removed by thorough cleansing of the system, because chloride concentrations >100 ppm in the solar fluid increase the risk of pitting corrosion on system components.

4. Chemically speaking, aqueous solutions of propylene glycol are largely inert, but it is important to ensure that the manufacturer's recommendations state that all the seals and connectors used in solar heating equipment are resistant to temperatures up to the maximum static temperature of the system.

5. Flexible connections/hoses must consist of metal or other materials which do not permit oxygen diffusion.

6. The hydraulic layout of the system must ensure that fluid circulation cannot be disturbed by gas pockets or any deposits.

7. The level of the solar fluid must never fall below the highest point in the system. An air bleed valve must be installed appropriately to allow accurate deaeration/degasification. In case automatic air bleed valves are used it must be ensured that no air can be sucked in during standstill of the system.

8. Dirt and water must not be allowed to enter the system or its components during assembly and before filling. After the assembly has been completed and the connections have been soldered, the system must be flushed to remove any foreign matter (copper scale, rust swarf, fluxes, packaging residues, sawdust, etc) and material used during assembly as completely as possible. Subsequently, the system should be checked for leaks and drained completely afterwards. We recommend to fill the system with **TYFOCOR® LG**/water mixture immediately in order to prevent corrosion.

9. It must be ensured that no air pockets remain in the installation after the filling. It is essential to eliminate any gas pockets, because a vacuum would form if they collapsed following a drop in operation temperature, and this would finally cause air to be sucked into the system.

10. Provided in-circuit filter elements were installed, they must be cleaned within 14 days at the latest after the solar 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.

11. In case a loss of solar fluid due to water evaporation occurs during operation, solely deionized or distilled water must be used to top up the system. If leakages or other losses occur, the system must be replenished with **TYFOCOR® LG**/water mixture of similar content. The concentration can be checked by either measuring the density or the refractive index.

Storage Stability

TYFOCOR® LG has a shelf life of at least three years in airtight containers. Do not store in galvanized containers, because zinc can be dissolved by propylene glycol/water mixtures.

Handling, Health and Safety Information

The usual safety and industrial hygiene measures relating to chemicals must be observed in handling **TYFOCOR® LG**/water mixtures.

The information and instructions given in the Material Safety Data Sheet (MSDS) must be strictly observed. The MSDS is available by direct download at **www.tyfo.de** or can be requested per e-mail via **info@tyfo.de**

Density of TYFOCOR® LG/water mixtures in kg/m³

Temperature [°C]	10 vol. %	20 vol. %	30 vol. %	40 vol. %	42 vol. %	50 vol. %	60 vol. %
-40	-	-	-	-	-	-	1077
-30	-	-	-	-	-	1066	1074
-20	-	-	-	1054	1055	1063	1070
-10	-	-	1039	1051	1052	1059	1066
0	1014	1025	1036	1047	1048	1055	1061
10	1011	1022	1033	1043	1044	1050	1056
20	1008	1018	1028	1038	1039	1045	1050
30	1004	1014	1024	1033	1034	1039	1044
40	1000	1009	1019	1027	1028	1033	1037
50	996	1004	1013	1021	1022	1027	1031
60	990	998	1007	1014	1015	1020	1023
70	985	992	1000	1007	1008	1013	1015
80	979	985	993	1000	1001	1004	1007
90	972	978	985	991	992	995	998
100	965	970	977	982	983	986	988
110	958	962	968	973	974	976	978
120	950	953	959	963	964	966	967

Density of TYFOCOR® LG/water mixtures in lb/ft³

Temperature [°F]	10 vol. %	20 vol. %	30 vol. %	40 vol. %	42 vol. %	50 vol. %	60 vol. %
-40	-	-	-	-	-	-	67.23
-22	-	-	-	-	-	66.55	67.05
-4	-	-	-	65.80	65.86	66.36	66.80
14	-	-	64.86	65.61	65.67	66.11	66.55
32	63.30	63.99	64.68	65.36	65.42	65.86	66.24
50	63.11	63.80	64.49	65.11	65.17	65.55	65.92
68	62.93	63.55	64.18	64.80	64.86	65.24	65.55
86	62.68	63.30	63.93	64.49	64.55	64.85	65.17
104	62.43	62.99	63.61	64.11	64.18	64.48	64.74
122	62.18	62.68	63.24	63.74	63.80	64.11	64.36
140	61.80	62.30	62.86	63.30	63.36	63.68	63.86
158	61.49	61.93	62.43	62.86	62.93	63.24	63.36
176	61.12	61.49	61.99	62.43	62.43	62.68	62.86
194	60.68	61.05	61.49	61.87	61.93	62.11	62.30
212	60.25	60.55	60.99	61.30	61.37	61.55	61.68
230	59.81	60.05	60.43	60.74	60.80	60.93	61.05
248	59.31	59.49	59.67	60.12	60.18	60.31	60.37

Specific Heat Capacity of TYFOCOR® LG/water mixtures in kJ/kg·K

Temperature [°C]	10 vol. %	20 vol. %	30 vol. %	40 vol. %	42 vol. %	50 vol. %	60 vol. %
-40	-	-	-	-	-	-	3.09
-30	-	-	-	-	-	3.35	3.13
-20	-	-	-	3.58	3.54	3.39	3.18
-10	-	-	3.78	3.61	3.57	3.43	3.22
0	4.05	3.94	3.80	3.65	3.61	3.47	3.26
10	4.07	3.96	3.83	3.68	3.64	3.50	3.31
20	4.09	3.98	3.86	3.71	3.68	3.54	3.35
30	4.10	4.00	3.89	3.74	3.71	3.58	3.39
40	4.12	4.03	3.91	3.77	3.74	3.62	3.44
50	4.13	4.05	3.94	3.81	3.78	3.66	3.48
60	4.15	4.07	3.97	3.84	3.81	3.70	3.53
70	4.17	4.09	4.00	3.88	3.85	3.74	3.57
80	4.18	4.11	4.03	3.91	3.88	3.77	3.61
90	4.20	4.14	4.05	3.95	3.92	3.81	3.66
100	4.21	4.16	4.08	3.98	3.95	3.85	3.70
110	4.23	4.18	4.11	4.01	3.98	3.89	3.75
120	4.25	4.20	4.13	4.04	4.01	3.93	3.79

Specific Heat Capacity of TYFOCOR® LG/water mixtures in Btu/lb·°F

Temperature [°F]	10 vol. %	20 vol. %	30 vol. %	40 vol. %	42 vol. %	50 vol. %	60 vol. %
-40	-	-	-	-	-	-	0.738
-22	-	-	-	-	-	0.800	0.747
-4	-	-	-	0.855	0.846	0.809	0.759
14	-	-	0.903	0.862	0.857	0.819	0.769
32	0.967	0.941	0.908	0.872	0.862	0.829	0.779
50	0.972	0.946	0.915	0.879	0.869	0.836	0.791
68	0.977	0.951	0.922	0.886	0.879	0.846	0.800
86	0.979	0.955	0.929	0.893	0.886	0.855	0.809
104	0.984	0.963	0.934	0.900	0.893	0.865	0.822
122	0.986	0.967	0.941	0.910	0.903	0.874	0.831
140	0.991	0.972	0.948	0.917	0.910	0.884	0.843
158	0.996	0.977	0.955	0.927	0.919	0.893	0.857
176	0.998	0.982	0.963	0.934	0.927	0.900	0.862
194	1.003	0.988	0.967	0.943	0.936	0.910	0.874
212	1.006	0.994	0.974	0.951	0.943	0.919	0.884
230	1.010	0.998	0.982	0.958	0.951	0.929	0.896
248	1.015	1.003	0.986	0.965	0.958	0.939	0.905

Thermal Conductivity of TYFOCOR® LG/water mixtures in W/m·K

Temperature [°C]	10 vol. %	20 vol. %	30 vol. %	40 vol. %	42 vol. %	50 vol. %	60 vol. %
-40	-	-	-	-	-	-	0.324
-30	-	-	-	-	-	0.354	0.331
-20	-	-	-	0.389	0.396	0.363	0.337
-10	-	-	0.431	0.399	0.406	0.371	0.344
0	0.522	0.479	0.443	0.409	0.415	0.379	0.350
10	0.538	0.493	0.455	0.419	0.426	0.386	0.356
20	0.553	0.506	0.465	0.427	0.435	0.393	0.361
30	0.567	0.517	0.475	0.435	0.443	0.399	0.366
40	0.579	0.528	0.484	0.442	0.450	0.405	0.370
50	0.590	0.537	0.491	0.448	0.456	0.410	0.373
60	0.599	0.544	0.497	0.453	0.461	0.414	0.376
70	0.607	0.551	0.503	0.456	0.464	0.417	0.379
80	0.613	0.556	0.507	0.461	0.469	0.419	0.380
90	0.618	0.559	0.510	0.463	0.471	0.421	0.382
100	0.621	0.563	0.512	0.465	0.473	0.422	0.382
110	0.624	0.565	0.514	0.466	0.474	0.423	0.382
120	0.625	0.566	0.514	0.466	0.474	0.423	0.382

Thermal Conductivity of TYFOCOR® LG/water mixtures in Btu/(hr·ft²)·(°F/ft)

Temperature [°F]	10 vol. %	20 vol. %	30 vol. %	40 vol. %	42 vol. %	50 vol. %	60 vol. %
-40	-	-	-	-	-	-	0.187
-22	-	-	-	-	-	0.205	0.191
-4	-	-	-	0.225	0.229	0.209	0.195
14	-	-	0.249	0.231	0.235	0.214	0.199
32	0.301	0.277	0.256	0.236	0.239	0.219	0.202
50	0.311	0.285	0.263	0.242	0.246	0.223	0.206
68	0.319	0.292	0.269	0.247	0.251	0.227	0.209
86	0.327	0.299	0.274	0.251	0.256	0.231	0.211
104	0.335	0.305	0.279	0.255	0.260	0.234	0.214
122	0.341	0.310	0.284	0.259	0.263	0.237	0.216
140	0.346	0.314	0.287	0.262	0.266	0.239	0.217
158	0.351	0.318	0.291	0.263	0.268	0.241	0.219
176	0.354	0.321	0.293	0.266	0.271	0.242	0.220
194	0.357	0.323	0.295	0.268	0.272	0.243	0.221
212	0.359	0.325	0.296	0.269	0.273	0.244	0.221
230	0.361	0.326	0.297	0.269	0.274	0.244	0.221
248	0.361	0.327	0.297	0.269	0.274	0.244	0.221

Kinematic Viscosity of TYFOCOR® LG/water mixtures in mm²/s

Temperature [°C] [°F]		10 vol. %	20 vol. %	30 vol. %	40 vol. %	42 vol. %	50 vol. %	60 vol. %
-40	-40	-	-	-	-	-	-	1565
-30	-22	-	-	-	-	-	235.0	447.0
-20	-4	-	-	-	48.30	54.80	87.80	153.0
-10	14	-	-	12.80	22.80	25.40	38.00	61.60
0	32	2.88	4.68	7.54	12.10	13.20	18.80	28.70
10	50	2.01	3.08	4.76	7.04	7.65	10.40	15.30
20	68	1.48	2.15	3.20	4.49	4.84	6.42	9.08
30	86	1.15	1.60	2.28	3.09	3.31	4.31	5.94
40	104	0.93	1.24	1.71	2.27	2.42	3.11	4.20
50	122	0.77	1.01	1.34	1.76	1.87	2.38	3.16
60	140	0.66	0.84	1.08	1.42	1.51	1.90	2.49
70	158	0.58	0.73	0.91	1.18	1.25	1.56	2.02
80	176	0.52	0.64	0.78	1.00	1.05	1.29	1.65
90	194	0.46	0.57	0.68	0.85	0.89	1.08	1.34
100	212	0.41	0.51	0.60	0.72	0.75	0.88	1.07
110	230	0.37	0.45	0.53	0.60	0.62	0.70	0.81
120	248	0.32	0.40	0.47	0.49	0.49	0.53	0.59

Dynamic Viscosity of TYFOCOR® LG/water mixtures in mPa·s

Temperature [°C] [°F]		10 vol. %	20 vol. %	30 vol. %	40 vol. %	42 vol. %	50 vol. %	60 vol. %
-40	-40	-	-	-	-	-	-	1585
-30	-22	-	-	-	-	-	250.5	480.0
-20	-4	-	-	-	50.91	57.81	93.33	163.7
-10	14	-	-	13.30	23.96	26.72	40.24	65.67
0	32	2.92	4.80	7.81	12.67	13.83	19.83	30.45
10	50	2.03	3.15	4.92	7.34	7.99	10.92	16.16
20	68	1.49	2.19	3.29	4.66	5.03	6.71	9.53
30	86	1.16	1.62	2.33	3.19	3.42	4.48	6.20
40	104	0.93	1.25	1.74	2.33	2.49	3.21	4.36
50	122	0.77	1.01	1.36	1.80	1.91	2.44	3.26
60	140	0.65	0.84	1.09	1.44	1.53	1.94	2.55
70	158	0.57	0.72	0.91	1.19	1.26	1.58	2.05
80	176	0.51	0.63	0.78	1.00	1.05	1.30	1.66
90	194	0.45	0.56	0.67	0.84	0.88	1.07	1.34
100	212	0.40	0.49	0.59	0.71	0.74	0.87	1.06
110	230	0.35	0.43	0.51	0.58	0.60	0.68	0.79
120	248	0.30	0.38	0.45	0.47	0.47	0.51	0.57

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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, air conditioning units, and under-soil heating. It can be supplied as desired in the form of a concentrate or a premixed, 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 $-15\text{ }^{\circ}\text{C}$ (**TYFOXIT® F15**) to $-50\text{ }^{\circ}\text{C}$ (**TYFOXIT® F50**).

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





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