Technical Information

Ready-to-use Heat Transfer Fluid for Thermal Solar Systems with high Thermal Loads

TYFOCOR® LS

Characteristics of TYFOCOR® LS

Appearance	clear, red-fluorescent liquid	
Boiling point	102–105 °C	ASTM D 1120
Frost protection	-28 °C	ASTM D 1177
Density (20 °C)	1.032–1.035 g/cm^3	DIN 51757
Viscosity (20 °C)	4.5–5.5 mm^2/s	DIN 51562
Refraction nD20	1.380–1.384	DIN 51423
pH value (20 °C)	9.0–10.5	ASTM D 1287
Water content	55–58 %	DIN 51777
Flash point	none	DIN 51758
Reserve alcalinity	> 20 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® LS is a liquid based on an aqueous solution of physiologically unobjectionable propylene glycol with a faint odour. The fluid was developed especially for use in solar thermal systems with high thermal loads (vacuum tube collectors).

The corrosion inhibitors contained in the product reliably protect the metals normally used in solar technology even in mixed installations against corrosion, ageing and deposits over long periods of time. It keeps the surfaces of heat exchangers clean, and thus ensures consistently high thermal efficiency of the solar thermal system.

Miscibility

In order to maintain its specific properties, TYFOCOR® LS must neither be mixed with other heat-transfer fluids, nor it must be diluted with water! If any leakages occur, the system must be topped up with TYFOCOR® LS only!

Temperature Stability

TYFOCOR® LS can be used in solar thermal systems with high stagnation temperatures provided it is ensured that the solar fluid will completely drain out of the collectors into the membrane expansion vessel in case of stagnation.

TYFOCOR® LS must not be exposed to sustained temperatures higher than 170 °C. Temperatures higher than 200 °C lead to slow thermal decomposition of propylene glycol, which is indicated by darkening of the heat-transfer fluid. The lifetime of the fluid thus may be strongly reduced. and the reliability of the system may be endangered.

Anticorrosion Effect

The following table demonstrates the anticorrosion effect of TYFOCOR® LS after two weeks of testing at 88 °C under permanent aeration. Corrosion test according to ASTM D 1384 (American Society for Testing and Materials).

Material	Average change of weight
Copper (SF Cu)	– 2.0 g/m^2
Soft Solder (L Sn 30)	– 6.0 g/m^2
Brass (MS 63)	– 4.0 g/m^2
Steel (HI)	– 0.1 g/m^2
Cast Iron (GG 26)	– 0.2 g/m^2
Cast Aluminium (G-AlSi6Cu4)	– 0.3 g/m^2

Compatibility with Sealing Materials

TYFOCOR® LS does not attack the sealings that are normally used in solar technology. The following table of sealants, elastomers and plastics that are resistant to TYFOCOR® LS has been compiled from experimental results, experience, and from literature data:

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

Butyl rubber	IIR
Chloroprene	CR
Ethylene-propylene-diene-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, urea-formaldehyde 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® LS is checked by performance tests before these elastomers are taken into use for the first time. This applies in particular to elastomers intended as membranes for expansion vessels as described in DIN EN 12828 and in DIN 4807 Part 2, respectively.

Gaskets that have proved to be resistant to hot TYFOCOR® LS are: up to 160 °C gaskets made from 70 EPDM 281 (Carl Freudenberg GmbH, D-69465 Weinheim). Up to 200 °C: flat gaskets such as REINZ-AFM 34 (REINZ-Dichtungs-GmbH, D-89229 Neu-Ulm) or Centellen 3820 based on aramide/special-NBR. (Hecker Werke GmbH, D-71093 Weil im Schönbuch).

Application guidelines

In view of the specific properties of TYFOCOR® LS the following instructions must be observed to ensure long-term protection for the installations.

1. Installations must be designed as closed circuits, as 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 preferably to be used on joints. Fluxes used in combination with soft solder usually contain chlorides. Their residues must be removed from the system by thorough flushing. Otherwise, an increased content of chlorides in the heat-transfer fluid may lead for example to pitting corrosion on 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 systems must not be equipped with internally galvanised heat exchangers, tanks or pipes, because zinc can be detached by propylene glycol / water mixtures.

6. Chemically speaking, TYFOCOR® LS is largely inert, but it is important to ensure that the manufacturer's recommendations state that all the seals and connector materials used are resistant up to the maximum fluid temperature.

7. Scaling on copper surfaces must be removed from the system before filling. Otherwise, these particles will be removed by the hot heat-transfer fluid and transported into other areas of the system, which may subsequently lead to formation of deposits and obstruction of the fluid flow rate.

8. It must be ensured that no external voltages are applied between parts of the system that come into contact with the solar fluid.

9. The layout of the piping must ensure that the circulation of the heat-transfer fluid will not be disturbed by gas pockets or deposits.

10. The fluid level must never be allowed to fall below the highest point in the system.

11. If automatic bleed valves are used, they must not allow subsequent suction of air into the system.

12. Dirt and water must not be allowed to enter the installation or its components during assembly and before filling. After the assembly has been completed, the system should be flushed to remove e.g. swarf, fluxes, assembly aids and any other impurities. Following to the flushing process and the leak test, the installation should be completely drained and then filled immediately with TYFOCOR® LS.

13. It must be ensured that no air remains in the solar thermal system after it has been filled. It Is essential to eliminate any existing air or gas pockets, because their collapse following a temperature drop would give rise to a vacuum and thus cause air to be sucked into the system. An insufficient deaeration furthermore affects the heat-transfer efficiency of the system.

14. 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.

15. If fluid losses occur due to evaporation, the system must be topped up with demineralised water. Losses due to leakage or removal from the system must be replaced with TYFOCOR® LS only!

16. The frost protection of TYFOCOR® LS can be checked by measuring the fluid density with a hydrometer or an antifreeze tester suitable for propylene glycol / water mixtures. An equally convenient and accurate way to determine the frost protection is the measurement of the refractive index by using a hand-held refractometer.

Storage Stability

The product has a shelf life of at least three years in airtight containers. It must not be stored in galvanised containers.

Delivery Form and Packaging

TYFOCOR® LS is available in road tankers, in 1000 litre IBCs, in 200 litre drums, and in 30, 25, 20 and 10 litre non-returnable plastic cans.

Disposal

Spills of the product must be taken up with an absorbent binder and disposed of in accordance with the regulations. For further information please refer to the Safety Data Sheet.

Ecology

TYFOCOR® LS is classified in water hazard class (WGK) 1, (low-rate endangering, Germany) acc. german water hazard regulations (*Verwaltungsvorschrift für wassergefährdende Stoffe* of May 17, 1999). The product is readily biodegradable.

Handling

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

Safety Data Sheet

A current Safety Data Sheet in accordance with EU Directive 1907/2006/EC [REACH] is available on our website www.tyfo.de.

Thermophysical properties of TYFOCOR® LS as a function of temperature

T [°C]	Density [kg/m^3]	Specific heat capacity [kJ/kg·K]	Thermal conductivity [W/m·K]	Kinematic viscosity [mm^2/s]	Cubic expansion coefficient [●10^{-5}/K]	Vapour pressure [bar]
200	-	-	-	-	-	14.9
190	-	-	-	-	-	12.0
180	-	-	-	-	-	9.20
170	-	-	-	-	-	7.10
160	-	-	-	-	-	5.60
150	-	-	-	-	-	4.20
140	-	-	-	-	-	3.20
130	-	-	-	-	-	2.50
120	959	3990	0.483	0.50	87	1.80
110	969	3960	0.476	0.63	84	1.40
100	977	3920	0.469	0.76	81	0.90
90	986	3880	0.462	0.91	78	0.62
80	993	3840	0.456	1.08	75	0.42
70	1001	3800	0.449	1.32	72	0.29
60	1008	3760	0.442	1.66	69	0.19
50	1015	3720	0.434	1.91	66	0.12
40	1021	3680	0.427	2.52	63	0.07
30	1029	3640	0.420	3.40	59	0.04
20	1034	3600	0.413	4.95	56	-
10	1040	3560	0.406	7.90	53	-
0	1045	3520	0.399	14.5	49	-
-10	1049	3480	0.392	26.9	46	-
-20	1053	3440	0.385	57.1	43	-

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.

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