Technical Information

TYFOXIT®

Concentrate

High-Performance Low Viscous Secondary Refrigerant
for Applications Down to –55 °C



TYFOROP Chemie GmbH

Characteristics of TYFOXIT® 1.25 Concentrate

Appearance	clear, colourless liquid	
Boiling point	> 100 °C	ASTM D 1120
Freezing point	< –50 °C	ASTM D 1177
Density (20 °C)	1.250–1.255 g/cm³	DIN 51757
pH value (20 °C)	10.0–11.0	ASTM D 1287
Viscosity (20 °C)	3.9–4.9 mm²/s	DIN 51562

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

TYFOXIT® is a potassium acetate based, high-performance secondary coolant applicable for all indirect refrigeration systems. **TYFO**XIT®/water mixtures provide, depending on the concentration, cooling limits down to –55 °C. The product combines favourable performance characteristics of traditional brines with good anti-corrosive properties of inhibited aqueous glycol solutions. The nontoxic, almost odourless liquid contains specific corrosion inhibitors, stabilizers and buffers, and is free of borax, nitrites, phosphates and amines. The long-term corrosion protection of **TYFO**XIT® covers all materials currently used in refrigeration technology such as steel, stainless steel grades, cast iron, brass, copper, red brass, bronze, and aluminium.

Characteristics of TYFOXIT®/water mixtures

TYFOXIT® 1.25 Concentrate	Cooling limit	Density (20 °C) (Product name)
60 vol. %	–20 °C	1150 kg/m³
64 vol. %	–26 °C	1160 kg/m³
68 vol. %	–29 °C	1170 kg/m³
72 vol. %	–34 °C	1180 kg/m³
76 vol. %	–37 °C	1190 kg/m³
80 vol. %	–40 °C	1200 kg/m³
84 vol. %	–45 °C	1210 kg/m³
88 vol. %	–50 °C	1220 kg/m³
92 vol. %	–52 °C	1230 kg/m³
96 vol. %	–55 °C	1240 kg/m³
100 vol. %	–53 °C	1250 kg/m³

Application

Dilute **TYFO**XIT® concentrate with demineralized water or softened water with a chloride content < 100 mg/kg to the required concentration or density, resp. In order to maintain effective corrosion protection, the concentration of **TYFO**XIT® must not fall below 60 vol. % (i.e. **TYFO**XIT® **1.15**).

Miscibility

TYFOXIT® must on no account be mixed with traditional fluids, especially not with chloride-containing brines or glycol/water mixtures, since this may lead to precipitation of solid material or chemical reactions occurring. Systems that were previously operated with other secondary coolants must be washed out and cleansed very thoroughly before refilling with **TYFO**XIT®.

Temperature stability

TYFOXIT® secondary coolants are suitable for use in systems operating between –55 °C and +80 °C. The upper temperature limit either depends on the respective **TYFO**XIT® concentration and on the installation materials. Provided the systems are designed in stainless steel, **TYFO**XIT® **1.20** to **1.24** allow a short-term maximum temperature of +80 °C, whereas in case of mixed installations, while using **TYFO**XIT® **1.15** to **1.19**, a maximum temperature of +50 °C must not be exceeded. The limit for permanent use of **TYFO**XIT® at elevated temperatures (not recommended) is set to +20 °C. Please consult our technical department in any case of application-specific questions.

Anticorrosion effect

The following table demonstrates the anticorrosion effect of **TYFO**XIT® **1.20** (cooling limit –40 °C) after a two-weeks corrosion test at 40 °C under constant aeration in accordance with ASTM D 1384 (American Society for Testing and Materials). For comparison, a 30 % calcium chloride brine (freezing point –50 °C) and a 50 vol. % monoethylene glycol/water mixture (freezing point –40 °C) were used. Corrosion rates are given in mm per year.

Material	TYFOXIT® 1.20	MEG 50 vol. %	$CaCl_2$ Brine 30 wt. %
Copper	0.0021	0.0036	0.03
Brass	0.0005	0.0039	0.11
Steel	No corrosion	0.0016	0.32
Cast Iron	No corrosion	0.0011	1.04
Cast Aluminium	No corrosion	No corrosion	1.25
Soft solder	0.18	0.0089	1.39

Compatibility with Sealing Materials

TYFOXIT®/water mixtures do not attack the sealing materials commonly used in refrigeration technology. Durable materials are, according to own testing and experience and literature data, hemp, sealants, and

Butyl rubber	IIR
Polyethylene, soft, rigid	LDPE/HDPE
Ethylene-propylene-diene rubber	EPDM
Polyethylene, crosslinked	PE-X
Epoxy resins	EP
Polypropylene	PP
Fluorocarbon elastomeres	FPM
Polytetrafluoroethylene	PTFE
Nitrile rubber	NBR
Polyvinyl chloride, soft, rigid	PVC s, r
Polyamides	PA
Styrene-butadiene rubber	SBR
Polychlorobutadiene rubber	CR
Unsaturated polyester resins	UP

Aminoplastics and silicones are reported in literature as being only partially 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 the fluid is checked by performance tests before these materials are taken into use for the first time.

The low surface tension of **TYFO**XIT®/water mixtures may occasionally lead to leakages in case PTFE made sealing strips are used for connections, where large temperature differences occur during operation.

Application Guidelines

The following application guidelines must be strictly observed to achieve long-term corrosion protection for systems operated with **TYFO**XIT®.

1. We recommend to use **TYFO**XIT® in closed secondary loops. Otherwise contact with atmospheric oxygen will accelerate the consumption of the corrosion inhibitors. If an open circuit is used, however, it must be ensured that the return lines are situated below the surface level of the fluid to avoid any unnecessary entrainment of air. The pH value of the fluid must be checked more frequently as in case of closed systems.

2. A settling pot must be installed at the lowest part of the circuit to trap any washed down matter.

3. Piping must be installed so that no disruption of coolant circulation may occur due to the formation of gas pockets or deposits.

4. The level of the secondary coolant must always be kept at the highest point in the circuit. A closed tank with a venting valve should also be installed at this point. Do not use automatic venting valves of a type that might allow air to enter the system.

5. Internally galvanized pipes or tanks must not be used. In case exterior galvanized coatings (e.g. cover plates, beams) have come into contact with **TYFO**XIT®, wash down with plenty of water.

6. External surfaces of plant components that have been exposed to the product should be rinsed immediately with plenty of water and then dried using clean cloths. The use of warm water or steam improves the cleansing efficiency. Industrial floors are to be treated in the same manner.

7. Copper brazing solders must be preferably used on joints. The use of lead-containing soft solder must be avoided. If in any doubt please consult the manufacturer of the respective solder. Furthermore, no chloride-containing fluxes must be used. Otherwise an increased content of chlorides in the secondary coolant may lead to pitting corrosion on e.g. stainless steel.

8. It must be ensured that no external electrical potential exists between parts of the system that come into contact with the secondary coolant.

9. Dirt and water must not be allowed to enter the system or its components during installation or before it is filled. After the installation is finished, the system should be flushed out in order to remove any foreign material (swarf, scale, remains of packaging etc.) and other contaminants. After internal cleaning and a leak test have been carried out, the system must be emptied completely and immediately filled with the secondary coolant to protect it from corrosion — even if the plant will be set into operation at a later date.

10. 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 system.

11. In-circuit filter elements must be cleaned within 14 days at the latest after the system was put into operation. This is necessary to ensure that neither obstruction to the fluid flow, nor malfunction of the system pumps might occur.

12. Fluid losses caused by leakage or removal from the system must be replaced by a **TYFO**XIT® water mixture of equal concentration. In cases of doubt, the content of **TYFO**XIT® can be checked via density measurement (hydrometer).

13. We provide a check of the relevant fluid parametres, i.e. density, inhibitor concentration, pH value etc., upon request. A sample of 0.2 litres can be sent to our lab for initial analysis within one month after the system was set into operation. The client will receive a test report on the analytical results. Further samples should be sent after six months and one year of operation.

Storage stability

TYFOXIT® has a shelf life of at least three years in airtight containers. The product must never be stored in galvanised containers.

Delivery form and packaging

TYFOXIT® is available as a concentrate or ready-mix according to customer's specification. It is supplied in road tankers, in 1,000 litre IBCs, in 200 litre PE drums, and in 30, 20 and 10 litre non-returnable plastic cans.

Disposal

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

Ecology

TYFOXIT® 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).

Handling

The usual safety and industrial hygiene measures relating to chemicals must be observed in handling **TYFO**XIT®. 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 TYFOXIT®**/water mixtures [kg/m³]**

as a function of temperature and concentration

T [°C]	60 vol. % Tx 1.15	64 vol. % Tx 1.16	68 vol. % Tx 1.17	72 vol. % Tx 1.18	76 vol. % Tx 1.19	80 vol. % Tx 1.20	84 vol. % Tx 1.21	88 vol. % Tx 1.22	92 vol. % Tx 1.23	96 vol. % Tx 1.24
40	1142	1152	1162	1172	1182	1192	1202	1212	1222	1232
30	1146	1156	1166	1176	1186	1196	1206	1216	1226	1236
20	1150	1160	1170	1180	1190	1200	1210	1220	1230	1240
10	1154	1164	1174	1184	1194	1204	1214	1224	1234	1244
0	1158	1168	1178	1188	1198	1208	1218	1228	1238	1248
–10	1162	1172	1182	1192	1202	1212	1222	1232	1242	1252
–20	1166	1176	1186	1196	1206	1216	1226	1236	1246	1256
–30	-	-	-	1200	1210	1220	1230	1240	1250	1260
–40	-	-	-	-	-	1224	1234	1242	1254	1264
–50	-	-	-	-	-	-	-	1246	1258	1268
–55	-	-	-	-	-	-	-	-	-	1270

Specific heat capacity of TYFOXIT®**/water mixtures [kJ/kg·K]**

as a function of temperature and concentration

T [°C]	60 vol. % Tx 1.15	64 vol. % Tx 1.16	68 vol. % Tx 1.17	72 vol. % Tx 1.18	76 vol. % Tx 1.19	80 vol. % Tx 1.20	84 vol. % Tx 1.21	88 vol. % Tx 1.22	92 vol. % Tx 1.23	96 vol. % Tx 1.24
40	3.34	3.30	3.25	3.21	3.16	3.12	3.09	3.06	3.03	3.00
30	3.32	3.27	3.23	3.19	3.14	3.10	3.07	3.04	3.01	2.98
20	3.30	3.25	3.21	3.16	3.12	3.08	3.04	3.01	2.98	2.95
10	3.27	3.23	3.19	3.14	3.10	3.05	3.02	2.99	2.95	2.92
0	3.25	3.21	3.16	3.12	3.08	3.03	3.00	2.96	2.93	2.90
–10	3.23	3.19	3.14	3.10	3.05	3.01	2.97	2.94	2.90	2.86
–20	3.21	3.16	3.12	3.08	3.03	2.99	2.95	2.91	2.87	2.83
–30	-	-	-	3.05	3.01	2.96	2.93	2.88	2.84	2.80
–40	-	-	-	-	-	2.94	2.90	2.86	2.82	2.77
–50	-	-	-	-	-	-	-	2.83	2.79	2.74
–55	-	-	-	-	-	-	-	-	-	2.73

Thermal conductivity of TYFOXIT®**/water mixtures [W/m·K]**

as a function of temperature and concentration

T [°C]	60 vol. % Tx 1.15	64 vol. % Tx 1.16	68 vol. % Tx 1.17	72 vol. % Tx 1.18	76 vol. % Tx 1.19	80 vol. % Tx 1.20	84 vol. % Tx 1.21	88 vol. % Tx 1.22	92 vol. % Tx 1.23	96 vol. % Tx 1.24
40	0.513	0.507	0.501	0.495	0.489	0.481	0.476	0.468	0.461	0.455
30	0.506	0.500	0.494	0.488	0.482	0.474	0.469	0.462	0.454	0.448
20	0.499	0.493	0.487	0.481	0.475	0.468	0.462	0.455	0.448	0.442
10	0.492	0.486	0.480	0.474	0.468	0.461	0.455	0.449	0.442	0.435
0	0.485	0.479	0.473	0.467	0.461	0.455	0.449	0.442	0.436	0.429
–10	0.478	0.472	0.466	0.460	0.454	0.448	0.442	0.436	0.429	0.423
–20	0.471	0.465	0.459	0.453	0.447	0.441	0.435	0.429	0.423	0.417
–30	-	-	-	0.446	0.440	0.435	0.428	0.423	0.417	0.411
–40	-	-	-	-	-	0.428	0.422	0.416	0.411	0.404
–50	-	-	-	-	-	-	-	0.410	0.404	0.398
–55	-	-	-	-	-	-	-	-	-	0.395

Kinematic viscosity of TYFOXIT®**/water mixtures [mm²/s]**

as a function of temperature and concentration

T [°C]	60 vol. % Tx 1.15	64 vol. % Tx 1.16	68 vol. % Tx 1.17	72 vol. % Tx 1.18	76 vol. % Tx 1.19	80 vol. % Tx 1.20	84 vol. % Tx 1.21	88 vol. % Tx 1.22	92 vol. % Tx 1.23	96 vol. % Tx 1.24
40	1.40	1.45	1.51	1.57	1.63	1.72	1.79	1.89	1.99	2.12
30	1.62	1.76	1.86	1.96	2.05	2.05	2.29	2.43	2.57	2.61
20	2.10	2.21	2.35	2.49	2.63	2.82	2.98	3.19	3.39	3.65
10	2.75	2.90	3.10	3.29	3.48	3.66	4.00	4.32	4.64	4.92
0	3.64	4.01	4.29	4.57	4.34	5.18	5.64	6.16	6.67	7.25
–10	5.47	5.90	6.35	6.80	7.24	7.62	8.53	9.38	10.21	10.82
–20	8.42	9.32	10.20	11.06	11.91	12.75	14.18	15.60	16.99	18.57
–30	-	-	-	20.22	22.23	23.89	26.63	29.01	31.35	35.76
–40	-	-	-	-	-	54.88	58.41	62.18	65.89	63.85
–50	-	-	-	-	-	-	-	159.5	162.9	169.9
–55	-	-	-	-	-	-	-	-	-	275.6

Dynamic viscosity of TYFOXIT®**/water mixtures [mPa·s]**

as a function of temperature and concentration

T [°C]	60 vol. % Tx 1.15	64 vol. % Tx 1.16	68 vol. % Tx 1.17	72 vol. % Tx 1.18	76 vol. % Tx 1.19	80 vol. % Tx 1.20	84 vol. % Tx 1.21	88 vol. % Tx 1.22	92 vol. % Tx 1.23	96 vol. % Tx 1.24
40	1.60	1.67	1.75	1.84	1.92	2.05	2.15	2.29	2.43	2.61
30	1.85	2.03	2.17	2.30	2.43	2.45	2.76	2.95	3.15	3.23
20	2.42	2.57	2.75	2.94	3.13	3.39	3.60	3.89	4.17	4.53
10	3.17	3.38	3.64	3.90	4.15	4.41	4.85	5.29	5.73	6.12
0	4.22	4.69	5.06	5.48	5.80	6.26	6.87	7.56	8.26	9.05
–10	6.36	6.91	7.51	8.10	8.70	9.24	10.43	11.56	12.69	13.55
–20	9.82	10.96	12.09	13.23	14.36	15.50	17.39	19.28	21.17	23.32
–30	-	-	-	24.26	26.90	29.19	32.76	35.97	39.19	45.06
–40	-	-	-	-	-	67.28	72.07	77.35	82.62	80.83
–50	-	-	-	-	-	-	-	199.1	204.9	215.4
–55	-	-	-	-	-	-	-	-	-	349.9

Prandtl numbers of TYFOXIT®**/water mixtures**

as a function of temperature and concentration

T [°C]	60 vol. % Tx 1.15	64 vol. % Tx 1.16	68 vol. % Tx 1.17	72 vol. % Tx 1.18	76 vol. % Tx 1.19	80 vol. % Tx 1.20	84 vol. % Tx 1.21	88 vol. % Tx 1.22	92 vol. % Tx 1.23	96 vol. % Tx 1.24
40	10.32	10.86	11.39	11.92	12.45	12.98	13.97	14.97	15.98	17.02
30	12.45	13.31	14.16	15.01	15.86	16.70	18.06	19.43	20.83	22.24
20	15.71	16.92	18.13	19.34	20.54	21.74	23.72	25.73	27.76	29.81
10	20.78	22.46	24.15	25.82	27.49	29.16	32.18	35.32	38.29	41.39
0	28.95	31.40	33.34	36.27	38.70	41.12	45.87	50.65	53.46	60.29
–10	42.67	46.65	50.62	54.57	58.52	62.46	70.16	77.89	85.65	93.44
–20	66.88	74.55	82.20	89.82	97.43	105.0	117.9	130.8	143.7	156.6
–30	-	-	-	166.1	184.0	201.9	223.7	245.6	267.4	289.2
–40	-	-	-	-	-	460.6	496.1	531.6	566.9	602.0
–50	-	-	-	-	-	-	-	1377	1414	1450
–55	-	-	-	-	-	-	-	-	-	2398

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® L-eco® is a long-life corrosion-inhibiting antifreeze based on propylene glycol that covers the same applications as **TYFO**COR® 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 (**TYFO**XIT® 1.25) and ready-to-use mixtures ranging from –20 °C (**TYFO**XIT® 1.15) to –55 °C (**TYFO**XIT® 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 (**TYFO**XIT® F15) to –50 °C (**TYFO**XIT® F50).

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





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