

TYFOXIT®



**High-performance Secondary Refrigerant
for cooling to -55 °C**

Technical Information

General

TYFOXIT® is a high-capacity cooling medium applicable for all types of cooling plants operated with indirect cooling. Depending on the concentration of the TYFOXIT®/water mixture, cooling limits down to -55 °C will be possible. The product combines the favourable cooling qualities of traditional brines with the good anti-corrosive properties of inhibited aqueous glycol solutions. TYFOXIT® is a non-toxic, almost odourless liquid containing specific corrosion inhibitors, stabilizers, and buffering agents. Its long-

term corrosion protection covers all materials used to date in refrigeration technology such as steel, stainless steel grades, cast iron, brass, copper, bronze, and aluminium.

Application

Dilute the TYFOXIT®-concentrate with neutral water (drinking water quality, max. 100 mg/kg Cl⁻, 25 °e) to the required density. For reason of corrosion resistance a minimum concentration of 60 vol% TYFOXIT®-concentrate must be kept.

Table 1: Cooling limits of TYFOXIT®/water mixtures

Cooling limit [°C]	Density (20 °C) [g/cm ³]	Conc. / water [vol-% : vol-%]	Cooling limit [°C]	Density (20 °C) [g/cm ³]	Conc. / water [vol-% : vol-%]
-20	1.150	60 : 40	-45	1.210	84 : 16
-26	1.160	64 : 36	-50	1.220	88 : 12
-29	1.170	68 : 32	-52	1.230	92 : 08
-34	1.180	72 : 28	-55	1.240	96 : 04
-37	1.190	76 : 24	-60	1.245	98 : 02
-40	1.200	80 : 20	-53	1.250	100 : 0

Physical Data

Appearance: clear, colourless liquid
Boiling point: approx. 100 °C
Solidification point: < -50 °C
Density at 20 °C: 1.250 g/cm³
Viscosity at 20 °C: 3.98 mm²/s
pH value at 20 °C: 10.0-11.0

Safety Data

MAK-value: not stipulated
Flash point: not applicable
Advice for disposal: see below
Water danger class: 0
Transport regulations: no compulsory labelling for surface-, sea-, and air transport

Corrosion Protection

Table 2 shows the good anti-corrosive properties of aqueous TYFOXIT® solutions of distinct concentrations compared to an ethylene glycol/water mixture (cooling limit -40 °C) and calcium chloride brine (cooling limit -50 °C) tested according to ASTM D 1384 (336 h, 40 °C, 6 litres air/h)

Table 2: Corrosion test acc. ASTM D 1384

Material	Ethylene glycol / H ₂ O 1:1	Tyfoxit 1.10 [g/cm ³]	Tyfoxit 1.20 [g/cm ³]	CaCl ₂ brine 30 %
Copper	-1.24	-0.32	-0.72	-11.0
Brass	-1.28	-0.08	-0.16	-36.0
Steel	-0.48	-0.52	+0.72	-95.0
Cast iron	-0.32	-4.28!	+0.84	-310.0
Aluminium	+0.64	+0.28	+0.08	-135.0
Soft solder	-2.84	-24.16	-57.60	-443.0

Average change of weight in g/m². The corrosion limit values for copper, brass, steel, grey cast iron, and cast aluminium are: 2.0 g/m², for soft solder: 3.0 g/m² (glycol testing specification).

Application Guidelines

The properties of TYFOXIT® require that the user adheres to the following guidelines to ensure long term corrosion protection.

1. Miscibility with other secondary refrigerants

TYFOXIT® may on no account be mixed with traditional brines, especially chloride-containing brines or glycol/water mixtures since this may lead to precipitation of solid material or chemical reactions occurring. Plants that have previously utilised such secondary refrigerants must be washed out and cleansed thoroughly.

2. Temperature stability

TYFOXIT® is suitable for use in systems operating between **-55 °C and +80 °C**. The upper temperature limit depends both on the respective TYFOXIT® concentration and the materials used for the installation. Concerning densities 1.20 g/cm³ and higher, +80 °C is the temperature limit for short-termed overshooting in stainless steel systems, whereas in mixed installations and with densities in the range of 1.15-1.19 g/cm³ +50 °C should not be exceeded. The limit for permanent application of

Compatibility with Sealing Materials

TYFOXIT® does not affect sealing materials used for construction of refrigeration equipment. Durable materials include natural products such as cotton, hemp,

Butyl rubber	IIR
Polyethylene soft .hard	L/HDPE
Ethylene-propylene-diene rubber	EPDM
Polyethylene vulcanized	VPE
Epoxide resins	EP
Polypropylene	PP
Fluorocarbon elastomers	FPM
Polytetrafluoroethylene	PTFE
Nitrile rubber	NBR
Polyvinyl chloride soft, hard	PVC
Polyamide	PA
Styrene-butadiene rubber	SBR
Polychlorobutadiene rubber	CR
Unsaturated polyester resins	UP

Aminoplastic and silicone compounds have been reported in literature as not being unconditionally stable. If necessary, please consult the manufacturers. If using PTFE note that although this material is chemically inert towards TYFOXIT®, it shows irreversible thermal expansion behaviour which may lead to seal leakage.

TYFOXIT® at elevated temperatures (not recommended) is set to +20 °C. In case of application-specific questions, we kindly ask you to contact us.

3. Design of the cooling plant

1. It is recommended that TYFOXIT® should be used in **closed-circuit** cooling plants. This is because the presence of excess oxygen will decrease the concentration of the corrosion inhibitors. To avoid unnecessary entrainment of air in open systems, ensure that system return lines are situated below the surface level of the coolant. If an open system is used it is advisable to regularly check the pH value of the coolant.
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 coolant must never be allowed to fall below the highest point in the circuit. A closed tank with a venting valve should also be installed at this point. Do not fit venting valves of a type that might allow air to enter the system.

5. The surface of heat exchangers, tanks, and piping exposed to the coolant must not be galvanised. In the event of exterior galvanised coatings being exposed to TYFOXIT®, wash down with plenty of water.

6. Copper brazing solders must be used on joints. The use of soft solder is not advised. If in any doubt consult the manufacturer of the particular solder. Chloride containing fluxes must not be used.

7. It must be ensured that no external electrical potential exists between parts of the system that come into contact with TYFOXIT® (due to risk of corrosion).

4. Cleansing and filling of the cooling plant

1. Dirt and water must not be allowed to enter the system or its components during installation or before it is filled. After the installation, 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 TYFOXIT® to protect it from corrosion - even if the plant is to be run for the first time at a later date.

2. The system must be checked for air pockets after it has been filled. When the temperature decreases any pockets of gas will create a reduced pressure

that enables air to be drawn into the system. These gas pockets must be removed from time to time.

3. If the system is being run for the first time, the in-circuit filters must be cleaned within 14 days so as not to block the free flow of coolant or affect the function of the system pumps.

4. Losses of liquid through evaporation must be replaced by neutral water. Losses caused by leakage, or bleeding the system, must be replaced by TYFOXIT®/water solution of similar concentration. If need be, check the TYFOXIT® content.

5. Testing of TYFOXIT®

If desired, there is available a service whereby the relevant TYFOXIT® parameters may be checked (pH value, density, condition of inhibitor system, etc.). A sample of 0.5 litres should be taken within one month of installation and sent to us for initial analysis. Samples should be sent after six months and one year's operation for testing and comparison with the original data. Should the results indicate that some adjustments are required we will advise on what is needed to return the system to optimal operating parameters. For measurement of density on site a hydrometer can be supplied if requested.

Handling Instructions for TYFOXIT®

1. Packaging

TYFOXIT® is supplied in road tankers, in 1 cubic metre containers, in 250 kg drums, and in 38 kg cans.

2. Accidental release measures

Short term exposure to TYFOXIT® should produce no ill effects. However, in accordance with guidelines for the general handling of chemical substances, it is recommended that protective rubber gloves are worn during handling. In the event of unprotected exposure to TYFOXIT® the following measures should be taken:

Nature of exposure	Symptoms	Treatment
Contact with eyes	Temporary burning and redness may occur	Rinse thoroughly with water for at least 10 minutes, keeping eyes open
Contact with skin	Longer exposure may produce slight irritation	Wash affected parts thoroughly with water. Remove clothing
Inhalation	Inhalation of mists or aerosols may irritate mucosal membranes	Remove patient to fresh air
Ingestion	Irritations of mucosal membranes may occur	Wash out mouth cavity with water. Do not induce vomiting

In the event of accidental release of TYFOXIT® the following measures should be taken:

1. Spills should be absorbed using a suitable absorbent material (saw dust, sand, etc.) and then disposed off in accordance with regulations (see below, 3. Disposal).

2. Smaller amounts should be washed away with large quantities of water. If larger quantities enter the drains contact the local water authority.

3. Plant components that have been exposed to TYFOXIT® should be rinsed immediately with plenty of water and then dried using clean cloths. The use of warm water or steam will improve the cleansing efficiency. Industrial floors are to be treated in the same manner.

3. Disposal

Absorbed TYFOXIT® should be sent for incineration to a licensed disposal contractor. Contaminated packaging may be reused after thorough cleansing.

4. Storage and stability

TYFOXIT® can be stored indefinitely in air-tight polyethylene containers if the correct conditions are observed. The product is chemically stable if higher temperatures and storage with strong oxidising agents (e.g. hydrogen peroxide, nitric acid) and mineral acids (hydrochloric acid) are avoided.

5. Safety

The usual safety and industrial hygiene measures relating to chemicals must be observed in handling the TYFOXIT®. The information and instructions

given in the Safety Data Sheet based on EEC-directive 91/155/EEC must be strictly observed. TYFOXIT® requires no special labelling according to the latest legislations of COSHH and C(HIP).

6. Ecology

TYFOXIT® is biodegradable. It does not affect the performance of activated sludge in a biological effluent treatment plant if introduced according the regulations by the responsible authorities.

Table 3: Physical Data of Tyfoxit® 1.10-1.24

Product	T [°C]	Specific thermal capacity [J/g·K]	Thermal conductivity [W/m·K]	Viscosity		Density [g/cm ³]
				[mm ² /s]	[mPas]	
T TYFOXIT® 1.10 Cooling limit -10 °C	+40	3.59	0.546	1.18	1.29	1.092
	+30	3.57	0.538	1.33	1.46	1.096
	+20	3.55	0.531	1.67	1.84	1.100
	+10	3.52	0.524	2.13	2.36	1.104
	±00	3.50	0.517	2.79	3.10	1.108
	-10	3.48	0.510	3.98	4.43	1.112
TYFOXIT® 1.15 Cooling limit -20 °C	+40	3.34	0.513	1.40	1.60	1.142
	+30	3.32	0.506	1.62	1.85	1.146
	+20	3.30	0.499	2.10	2.42	1.150
	+10	3.27	0.492	2.75	3.17	1.154
	±00	3.25	0.485	3.64	4.22	1.158
	-10	3.23	0.478	5.47	6.36	1.162
TYFOXIT® 1.20 Cooling limit -40 °C	+40	3.12	0.481	1.72	2.05	1.192
	+30	3.10	0.474	2.05	2.45	1.196
	+20	3.08	0.468	2.82	3.39	1.200
	+10	3.05	0.461	3.66	4.41	1.204
	±00	3.03	0.455	5.18	6.26	1.208
	-10	3.01	0.448	7.62	9.24	1.212
	-20	2.99	0.441	12.75	15.50	1.216
	-30	2.96	0.435	23.89	29.19	1.220
TYFOXIT® 1.24 Cooling limit -55 °C	+40	3.00	0.455	2.12	2.61	1.232
	+30	2.98	0.448	2.61	3.23	1.236
	+20	2.95	0.442	3.65	4.53	1.240
	+10	2.92	0.435	4.92	6.12	1.244
	±00	2.90	0.429	7.25	9.05	1.248
	-10	2.86	0.423	10.82	13.55	1.252
	-20	2.83	0.417	18.57	23.32	1.256
	-30	2.80	0.411	35.76	45.06	1.260
	-40	2.77	0.404	63.85	80.83	1.264
	-50	2.74	0.398	169.88	215.41	1.268
-55	2.73	0.395	275.59	349.99	1.270	

For reason of maintaining sufficient corrosion inhibitor concentration, TYFOXIT 1.15-1.24 should be used in practice. The data for TYFOXIT 1.10 are listed here for information only.

The data given above has been determined under laboratory conditions which are not transferable to technical installations. We do not guarantee the values as being attainable in a cooling system and recommend that these figures are used only as a guideline in the design of a plant.



EEC – SAFETY DATA SHEET

Acc. 91/155/EEC

Last Revision Date: 01/04/97

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1. Identification of compound/preparation, and company

Trade name: TYFOXIT®
Distributor: Environmental Process Systems Limited, Unit 18, The Business Village,
Wexham Road, Slough, UK, SL2 5HF
Tel: +44 (0)1753 692212 Fax: +44 (0)1753 692457
e-mail: info@epsltd.co.uk
Producer: Tyforop Chemie GmbH, Hamburg, Germany

2. Composition/Information on ingredients

Chemical characterisation: Inhibited aqueous potassium acetate solution

3. Possible dangers

Hazardous to health if swallowed. Symbol: x_i , R-phrases: 22, 36.

The product is not subject to registration according to GefstoffV (German regulations of dangerous goods) and does not fall under legislation according to COSHH and CHIP (Great Britain). The classification corresponds to present EC-lists and additional data from relevant literature and product information given by other companies.

4. First aid measures

Contact with eyes Rinse thoroughly with plenty of water for at least 10 minutes, keeping eyes open

Contact with skin Wash affected parts thoroughly with soap and water

Inhalation Expose person to fresh air

Swallowing Wash out mouth cavity with water, do not try to cause vomiting. In case of continuous complaints consult a physician

Advice for the physician: No specific antidote. Supporting measures required. If larger amounts are swallowed, hyperkalemia and possibly heart arrhythmia may be caused.

5. Measures to be taken in the event of fire

Suitable extinguishing agents TYFOXIT® is non-flammable. Water spray, carbon dioxide, alcohol resistant foam, and dry extinguishers are suitable for extinguishing environmental fires

Dangerous combustion products In cases of complete water evaporation combustion will result in carbon dioxide and water

Special safety equipment Use respiratory protective device. Wear fire brigade clothing

Special dangers caused by the substance itself or during its production, by its combustion products or gases thus generated None

6. Accidental release measures

Personal protective measures	Avoid excessive contact with skin and eyes. The wearing of rubber gloves is recommended. In case of release of larger amounts remove contaminated clothing and wash body down thoroughly with water
Environmental protection measures	No special measures required. Wash away spills thoroughly with large quantities of water. In case of release of larger quantities which might flow into the draining system or waters, contact the appropriate authorities.
Process of cleaning/absorption	Bind the liquid by using a suitable absorbent material (sawdust, sand, etc.) and dispose of in accordance with local regulations

7. Handling and storage

Handling	When correctly used, no special measures required
Fire and explosion protection	Not applicable
Storage	Store in polyethylene or steel containers. Storage in galvanised containers is not recommended. Do not store with acids and oxidising agents. Keep containers tightly shut

8. Measures to restrict exposure and for personnel protection equipment

Additional comments regarding the design of the technical installations	see item 7
Workplace related limits to be controlled	None
Personal protection equipment	
Breathing protection	Not required
Eye protection	Protective goggles
Hand protection	Rubber gloves
Body protection	Observe usual precautions when handling chemicals

Physical and chemical characteristics

Form	liquid
Colour	colourless
Odour	almost odourless
Boiling point	approx. 100 °C
Freezing point	<-50 °C
Density at 20 °C	approx. 1.250 g/cm ³
Viscosity at 20 °C	4.98 mPas
Viscosity at 0 °C	10.22 mPas
Solubility in water	completely soluble
pH value	6.5-8.5
Flash point	not applicable
Ignition temperature	not inflammable
Lower explosion limit	not applicable
Upper explosion limit	not applicable

10. Stability and reactivity

Chemical stability Stable with usual handling and storage, elevated temperatures are to be avoided

Substances to be avoided Strong oxidising agents and mineral acids

11. Toxicological data

Acute oral toxicity (LD₅₀): >2000 mg/kg (rat)
(LC₀): at a dilution of 1:399 no more deaths occur

Contact with eyes Temporary burning and redness may occur, avoid contact with eyes

Contact with skin Occasional contact produces no or only slight effects. Longer exposure may produce slight irritation

Inhalation Inhalation of mists or aerosols may lead to irritation of mucosal membranes in the respiratory system

Swallowing Irritation of mucosal membranes and digestive system possible

Additional information When correctly used as prescribed the product will not, according to best available knowledge and experience, be damaging to health

12. Ecological data

General Indications Water danger class: 0 (self classification)

Classification numbers: Toxicity towards mammals: 1.0, toxicity towards fish: 2.5
Toxicity towards bacteria: 2.4

Classification criteria: Biological degradability: bonus, others: 0
BOD-value (48 h) 100 mg/l TYFOXIT® at 1.2 °C: <9.0 mg O₂/l
BOD-value (24 h) 20 mg/l TYFOXIT® at 1.4 °C: 2.92 mg O₂/l
Acute toxicity (LC₅₀) >1000 mg/l, 96 h (rainbow trout)

Avoid pollution of groundwater and sewage systems by undiluted liquid or larger amounts of TYFOXIT/water mixtures. The product will not affect the performance of activated sludge in a biological effluent clarification plant if introduced correctly according to local regulations

13. Information about the disposal of toxic waste

Disposal According to local legislations.
Recommendation: small quantities may be treated like domestic waste.
Waste code no. 991 (Germany)

Contaminated packaging Contaminated packaging may be used again after cleansing it thoroughly

Recommended cleaning agent Water

14. Transportation data

Not subject to the regulations for inflammable liquids. May be sent by post

GGVE/RID: -	GGVS/ADR: -	IMDG-Code: -
UN-No: -	IATA-DGR: -	TA-air: -

The product is not classified according to transport regulations

15. Regulations

The product is not subject to registration according to paragraph 2 (1) 2 of the GefStoffV (German regulations of dangerous goods) and therefore does not have to be marked by law. However, in accordance with the data to hand, we voluntarily mark the product according to appendix 1, No. 1.1 of the GefStoffV concerning the EC-guide to Classification and Marking

Contents	Potassium acetate	
Symbol	X _i	Irritant
R-phrases	22	Hazardous to health if swallowed
	36	Irritant to eyes
S-phrases	24	Avoid contact with skin
	25	Avoid contact with eyes
Water danger class (wdc)	0 (self classification)	

Wear suitable protective clothing. In dealing with chemicals observe the usual protection measures. When storing observe the "Wasserhaushaltsgesetz" of 16 October 1976 (BGB 1I, p.373), including the 1st addendum of 26 April 1987 (German Water Metabolism Law)

16. Further information

This safety data sheet is intended to provide information and recommendations as to how to handle chemical substances and preparations in accordance with the essential requirements of safety precautions and physical, toxicological, and ecological data, and how to handle, store, transport, and use them safely.

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