

Tyfocor[®] L



Technical Information

® = Registered Trademark of Tyfop Chemie GmbH

Concentrated heat transfer fluid for solar heating equipment and for heating and cooling equipment used in food processing and water purification.

January 1996 (JWF)
Supersedes edition of October 1995



Tyfocor L

Properties

Appearance	Clear liquid	
Boiling point	>150 °C	ASTM D 1120
Pour point	<-50 °C	ISO 3016
Density (20 °C)	1.054 – 1.058	DIN 51757
Viscosity (20 °C)	68-72 mm ² /s	DIN 51562
Refractive index n ₂₀	1.435 – 1.437	DIN 51423
pH of concentrate	6.5 – 8.0	ASTM D 1287-78
pH of concentrate diluted 1 :2 with neutral distilled water	7.5 – 8.5	ASTM D 1287-78
Water content	max. 4.0%	ASTM D 1123
Flash point	> 130 °C	ISO 2592
Alkali reserve	10-13 ml 0.1N HCl	ASTM D 1121

Properties

Tyfocor L is a non-toxic, virtually odourless, hygroscopic liquid. It is based on polypropylene glycol, which poses no hazard to health and which may be used as a coolant or heat-transfer fluid in food processing and water purification applications.

The corrosion inhibitors contained in Tyfocor L reliably protect the metals normally used in solar collectors and other heating equipment against corrosion, ageing and deposits over long periods. Tyfocor L prevents the surfaces of heat exchangers from becoming fouled, and ensures consistently high thermal efficiency.

Tyfocor L is miscible with water in all proportions. Its mixtures with water protect against frost at temperatures of down to -50 °C, depending on their concentration. Its performance is not impaired by hard water, and there is no danger of precipitation.

Mixtures of Tyfocor L and water do not demix.

Tyfocor L does not contain any nitrites, phosphates or amines.

Miscibility

Tyfocor L is miscible with all commercial antifreezes based on propylene glycol.

Applications

Tyfocor L has to be diluted with at least 20% v/v and no more than 75%v/v of water when it is used in heating or cooling circuits. Potable water (100 mg/kg Cl⁻ max.) or demineralized water must be used.

In order to prevent corrosion, the following minimum and maximum concentrations of Tyfocor L should be observed.

In solar heating equipment	50-80% v/v Tyfocor L
In other equipment	25-80% v/v Tyfocor L

Stability in solar heating equipment

Sustained exposure to temperatures higher than 170 °C causes Tyfocor L to age prematurely. We would therefore recommend that the capacity of the expansion tanks should be sufficient to ensure that all of the heat-transfer fluid can drain out of the solar collectors when the maximum static temperature is reached.

Tyfocor L begins to undergo irreversible chemical changes at temperatures higher than 200 °C, with the result that the reliability of the equipment may be endangered.

Tyfocor L % v/v	Density at 20 °C g/cm ³	Refractive index n _D ²⁰	Freezing point °C
25	1.023	1.3627	-10
30	1.029	1.3690	-13
35	1.033	1.3747	-17
40	1.037	1.3801	-21
45	1.042	1.3855	-26
50	1.045	1.3910	-32
55	1.048	1.3966	-40

The following table shows the effectiveness of mixtures of Tyfocor L in inhibiting corrosion.

Corrosion tests according to ASTM D 1384-70 (American Society for Testing and Materials)

Average change in weight of coupons in g/m²

Material	Tyfocor L /Water (ASTM Standard) 1:2
Copper (SF Cu)	+ 0.2
Soft solder (L Sn 30)	- 0.2
Brass (Ms 63)	± 0.0
Cast iron (GG 26)	+ 0.2
Steel (HI)	+ 0.1
Cast aluminium (G AlSi6Cu4)	- 0.5
Aluminium (99.5%)	- 0.3

Mixtures of Tyfocor L and water do not attack the sealants normally used in heating systems. The following list of sealants, elastomers and plastics that are resistant to mixtures of Tyfocor L and water has been compiled from experimental results, experience, and the literature.

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

Butyl rubber	IIR
Chloroprene	CR
Ethylene-propylene-diene rubber	EPDM
Fluorocarbon elastomers	FPM
Nitrile rubber	NBR
Nylon at temperatures up to 115 °C	PA
Polyethylene, soft/hard	PE-LD/PE-HD
Polyethylene, crosslinked	VPE
Polypropylene	PP
Polytetrafluoroethylene	PTFE
Polyvinyl chloride, rigid	PVC h
Styrene-butadiene rubber at temperatures below 100 °C	SBR
Unsaturated polyester resins	UP

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

Gaskets made from Aramid and special NBR, such as Centellen 3820*, have been shown to be resistant to mixtures of Tyfocor L and water.

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 vulcanization 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 L and water before they are put into service for the first time. This applies particularly to elastomers intended as membranes for expansion tanks as described in DIN 4807.

* Manufacturer: Hecker Werke GmbH & Co
71093 Weil im Schonbuch, Germany

In view of the specific properties of Tyfocor L, the following instructions must be adhered to for ensuring long-term protection.

- 1 Solar heating equipment must conform to DIN 4757, Part 1, and be designed as a closed circuit, because exposure to atmospheric oxygen causes the inhibitors in Tyfocor L to be consumed more rapidly.
- 2 Equipment must not be fitted with galvanized heat exchangers, heat reservoirs, tanks or pipes, because polypropylene glycol can corrode zinc.
- 3 Flexible-membrane expansion tanks must conform to DIN 4807.
- 4 Silver or copper brazing solders must be used for the joints. Fluxes must not contain any chloride.
- 5 Chemically speaking, aqueous solutions of Tyfocor L 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.
- 6 The only flexible connections that are permissible are hoses, preferably metal, that do not permit the diffusion of oxygen.
- 7 A filter should be fitted to the circuit at the lowest point in order to collect suspended solids.
- 8 It must be ensured that no **external voltages** are applied between items of equipment that come into contact with the Tyfocor L solution, as otherwise corrosion may occur. At most, an external voltage of no more than 1.5 volts may be applied to components made of copper or copper alloys.
- 9 The layout of the tubes must ensure that circulation cannot be disturbed by gas pockets or deposits.
- 10 The level of the heat-transfer liquid must **never** be allowed to fall below the highest point in the system. A closed vessel fitted with a bleed valve must be provided at the highest point in the system in order to bleed gases from the system.
- 11 Only automatic bleed valves should be used in order to ensure that no air is entrained.
- 12 Dirt and water must not be allowed to enter the installation or its components during assembly and before filling. After assembly has been completed and the connections have been soldered, the system must be flushed to remove any foreign matter (swarf, flux, packaging residues, sawdust, etc.) and material used in assembly.

After the installation is complete, the system must be cleaned and tested for leaks according to DIN 18380. The system should then be completely drained and filled with Tyfocor L solution, even if the plant is not put into operation immediately, in order to prevent corrosion.
- 13 It must be ensured that no air pockets remain in the installation after it has been filled.

It is essential to eliminate gas pockets, because a vacuum would be formed if they collapsed following a drop in temperature, and this would cause air to be sucked into the system.
- 14 In order to ensure that there are no obstructions to the flow of the heat-transfer liquid, the in-circuit filters must be cleaned within 14 days, at the latest, after the equipment has been filled with heat-transfer fluid and put into operation for the first time.
- 15 If losses occur due to evaporation, the system can be topped up with neutral potable water. If leakages or other losses occur, the heat-transfer liquid in the system must be replenished with an aqueous Tyfocor L solution of the same concentration. In cases of doubt, the Tyfocor L content must be determined.

Testing solutions of Tyfocor L

As a service to customers, we offer to test heat-transfer fluids when solar-heating equipment is being run in. If you wish to take advantage of this service, please send a 0.2 litre sample of your Tyfocor L solution within the first month of putting your equipment into service to the following address.

Tyforop Chemie GmbH
Hellbrookstr. 5 a
22305 Hamburg
Germany

Customers are supplied with a report on the test results.

Shelf life

Tyfocor L has a shelf life of at least five years in airtight containers.

Packaging

Tyfocor L is supplied in road tankers and in 35 kg and 22-kg non-returnable plastics drums, and in 220-kg non-returnable metal drums.

Safety

Tyfocor L contains 1,2-propanediol (propylene glycol). The German *Gefahrstoffverordnung* of 26 August 1986 does not require it to be labelled.

Safety Data Sheet

A Safety Data Sheet has been drawn up for Tyfocor L in accordance with EEC Directive 91/155/EEC.

Disposal

Tyfocor L spills must be taken up with an absorbent binder and disposed of in accordance with regulations.

Tyfocor L can be disposed of by special treatment, e.g. combustion in an authorized incinerator, in accordance with local authority regulations.

Regulations on waste avoidance and disposal must be observed.

Ecology

Tyfocor L is not a potential water pollutant (WGK 0; Tyforop's own classification under German clean water legislation).

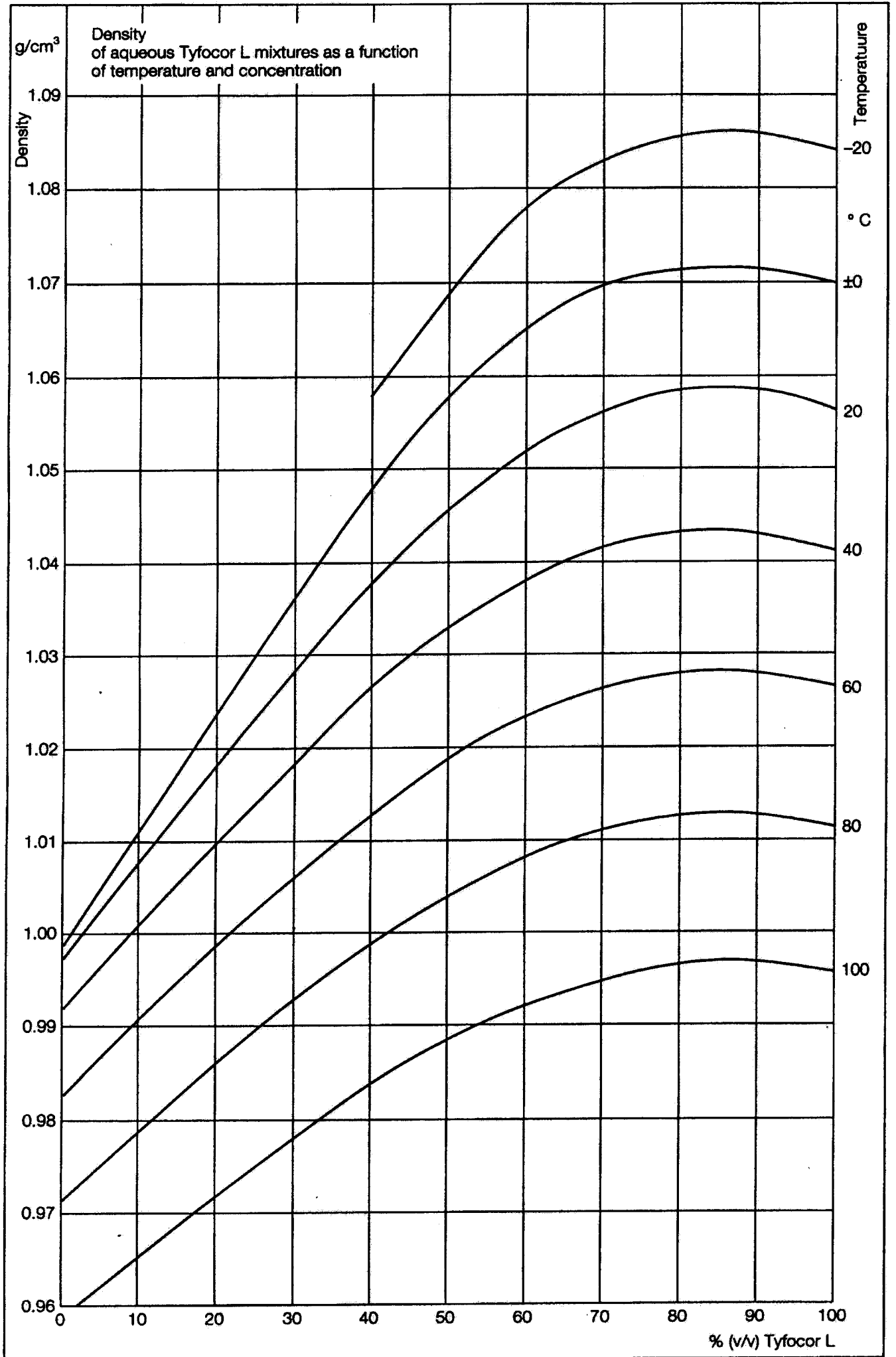
Tyfocor L is biodegradable. It does not impair the efficiency of the activated sludge if it is run with the appropriate care into an acclimated effluent treatment plant.

Calculation of expansion coefficient β

The expansion coefficient is dependent on temperature. It can be calculated from the density as follows.

$$\beta = - \frac{1}{\text{Density } t_2} \times \frac{(\text{Density } t_2 - \text{Density } t_1)}{(t_2 - t_1) \text{ } ^\circ\text{C}}$$

The most important physical properties of mixtures of Tyfocor L and water are shown in the diagrams overleaf.



Thermal conductivity of aqueous Tyfocor L mixtures as a function of temperature and concentration

W/m·K

Thermal conductivity

% (v/v) Tyfocor L

0.50

0.40

0.30

0.20

0.12

-20

±0

+20

40

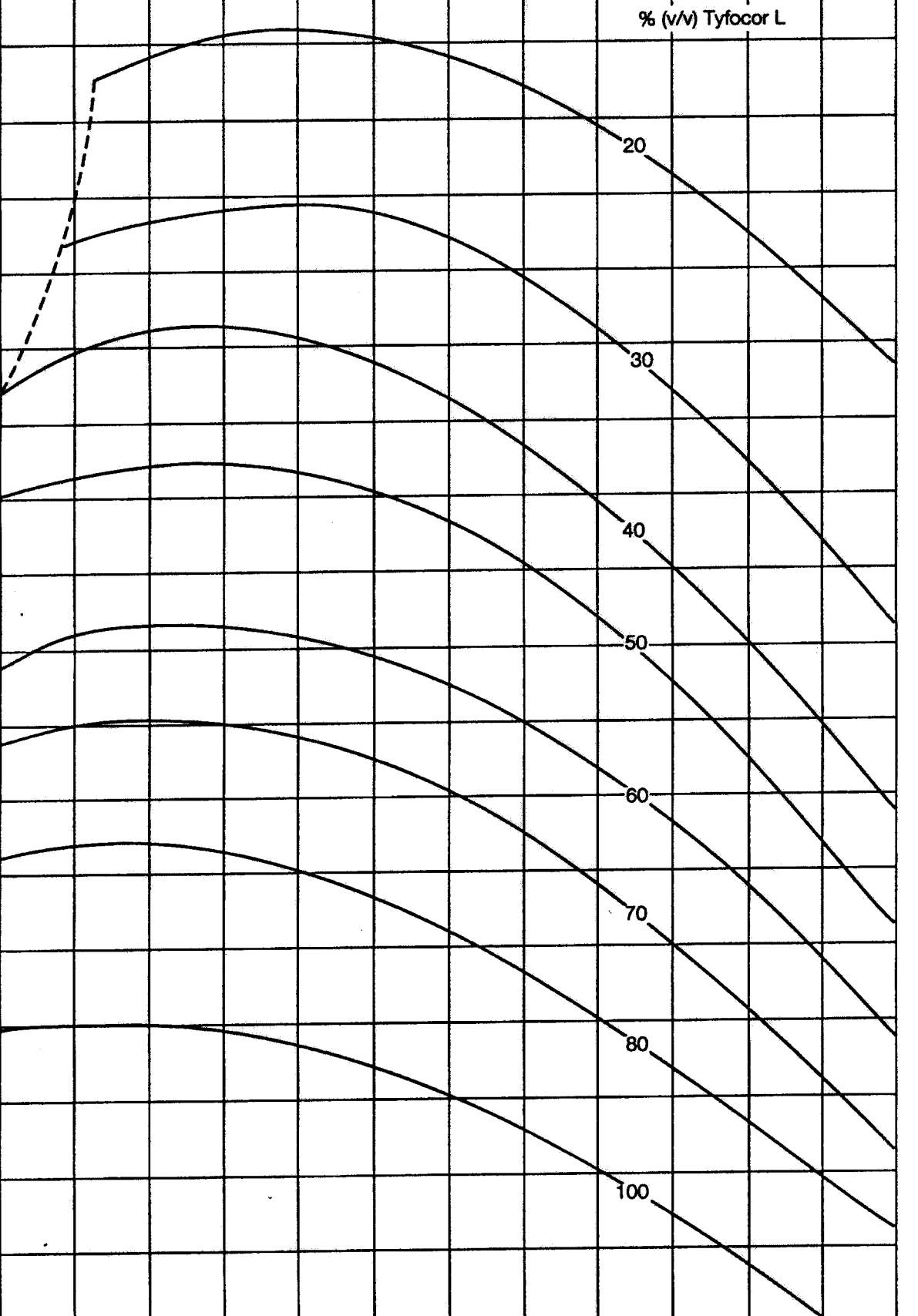
60

80

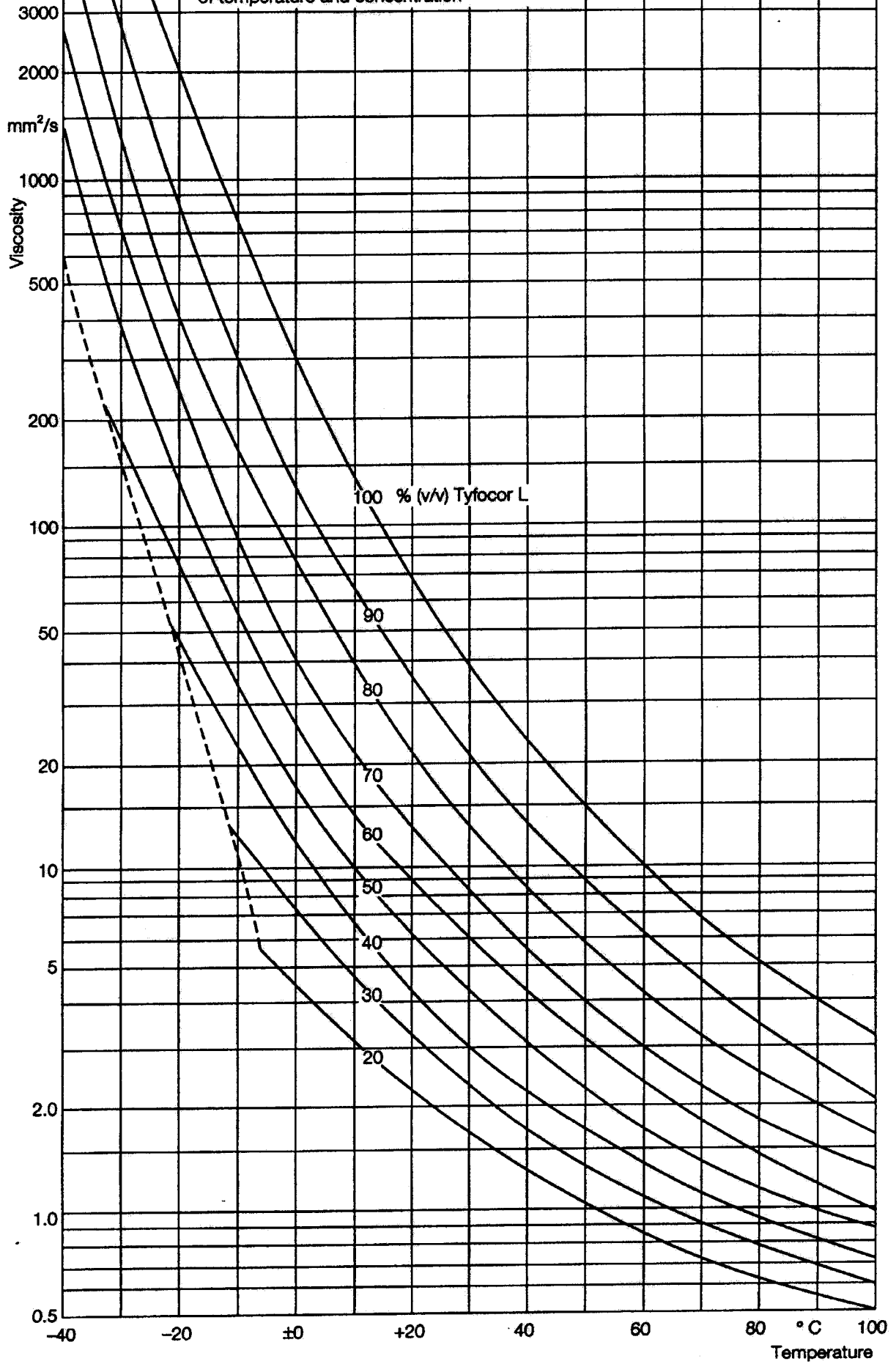
°C

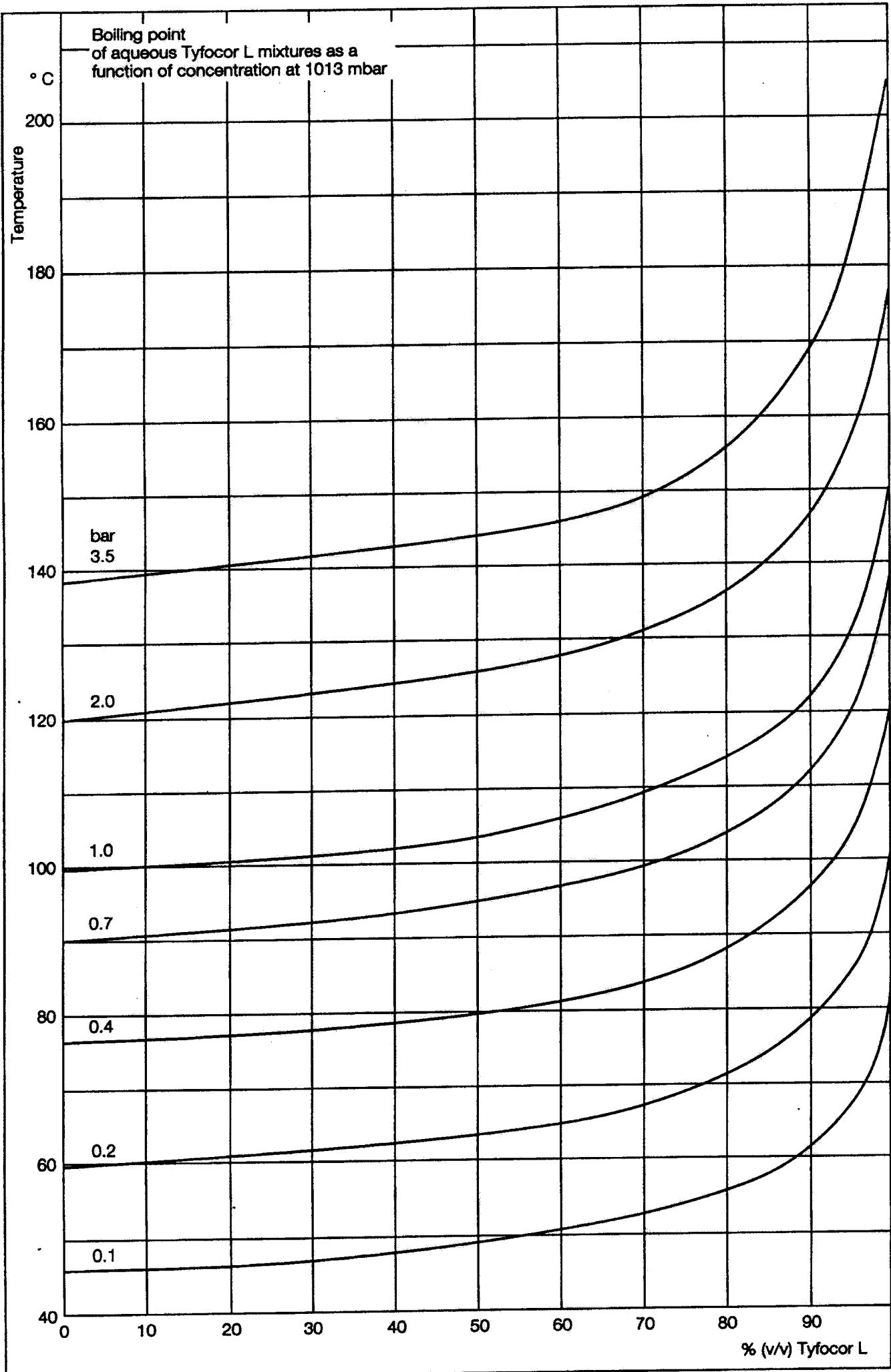
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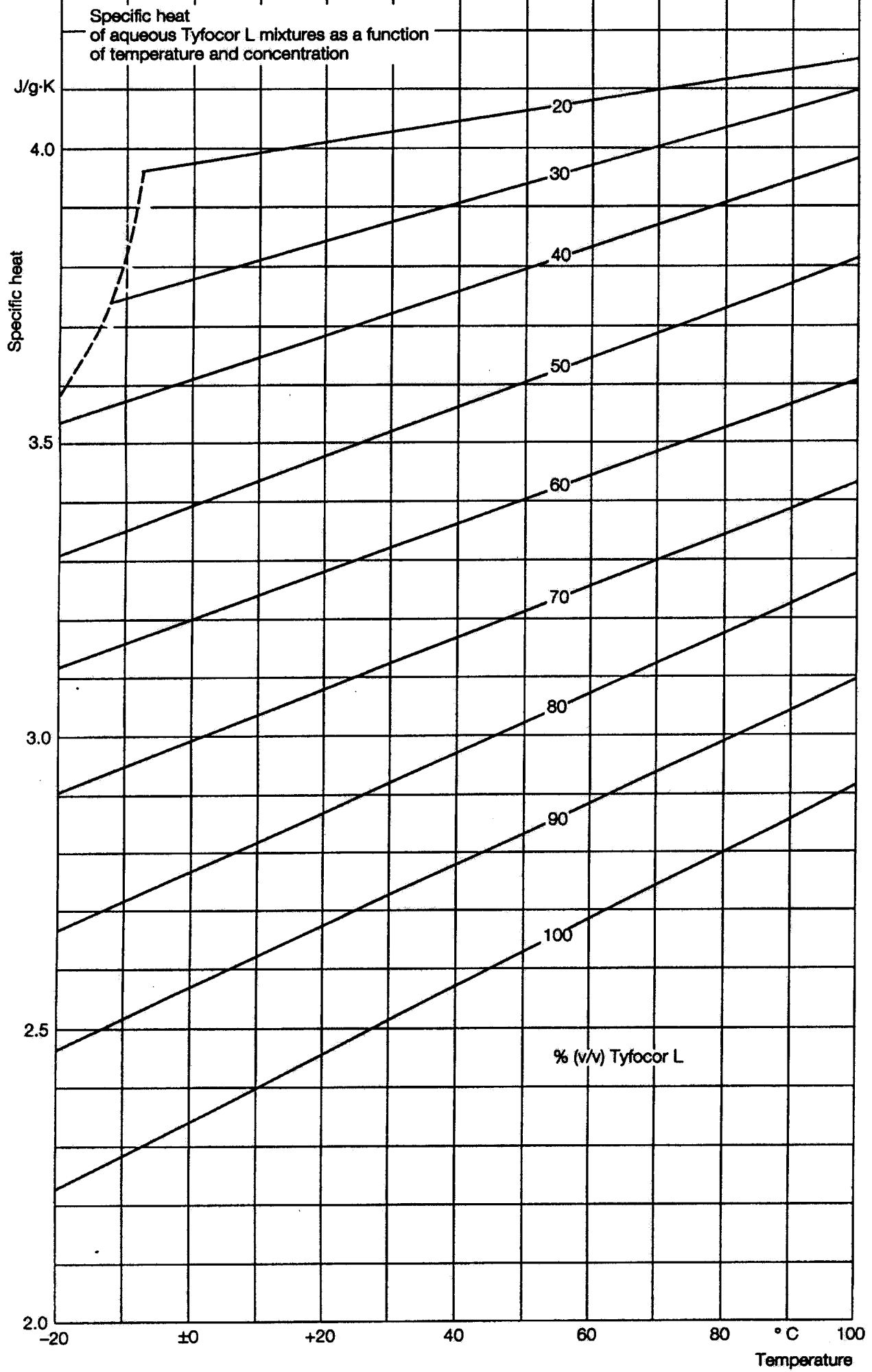
Temperature



Viscosity
of aqueous Tyfocor L mixtures as a function
of temperature and concentration







Thermal conductivity
of aqueous Tyfocor L mixtures as a function
of temperature and concentration

0.50
W/m·K

Thermal conductivity

% (v/v) Tyfocor L

0.40

20

30

40

0.30

50

60

70

0.20

80

100

0.12
-20

±0

+20

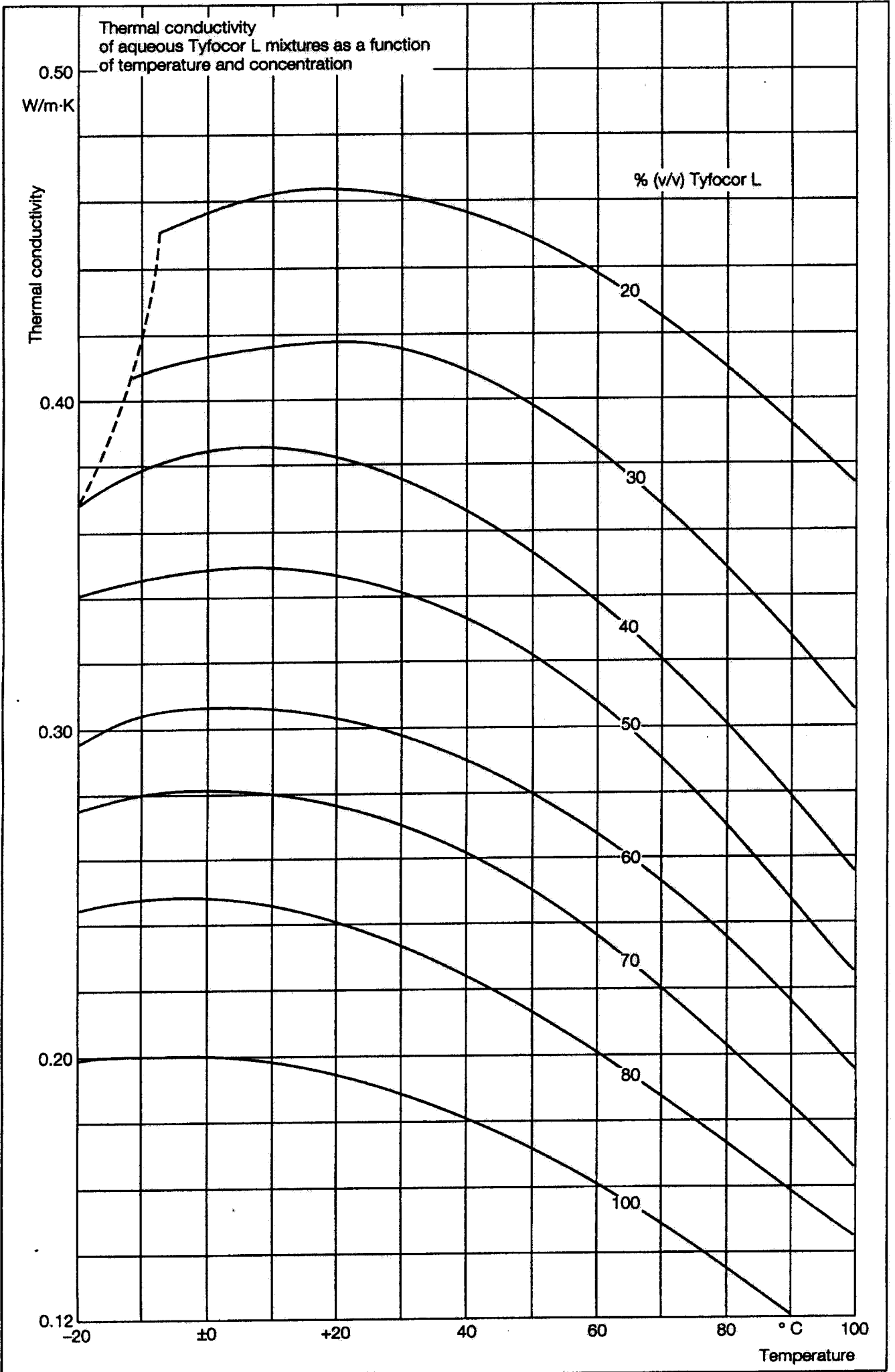
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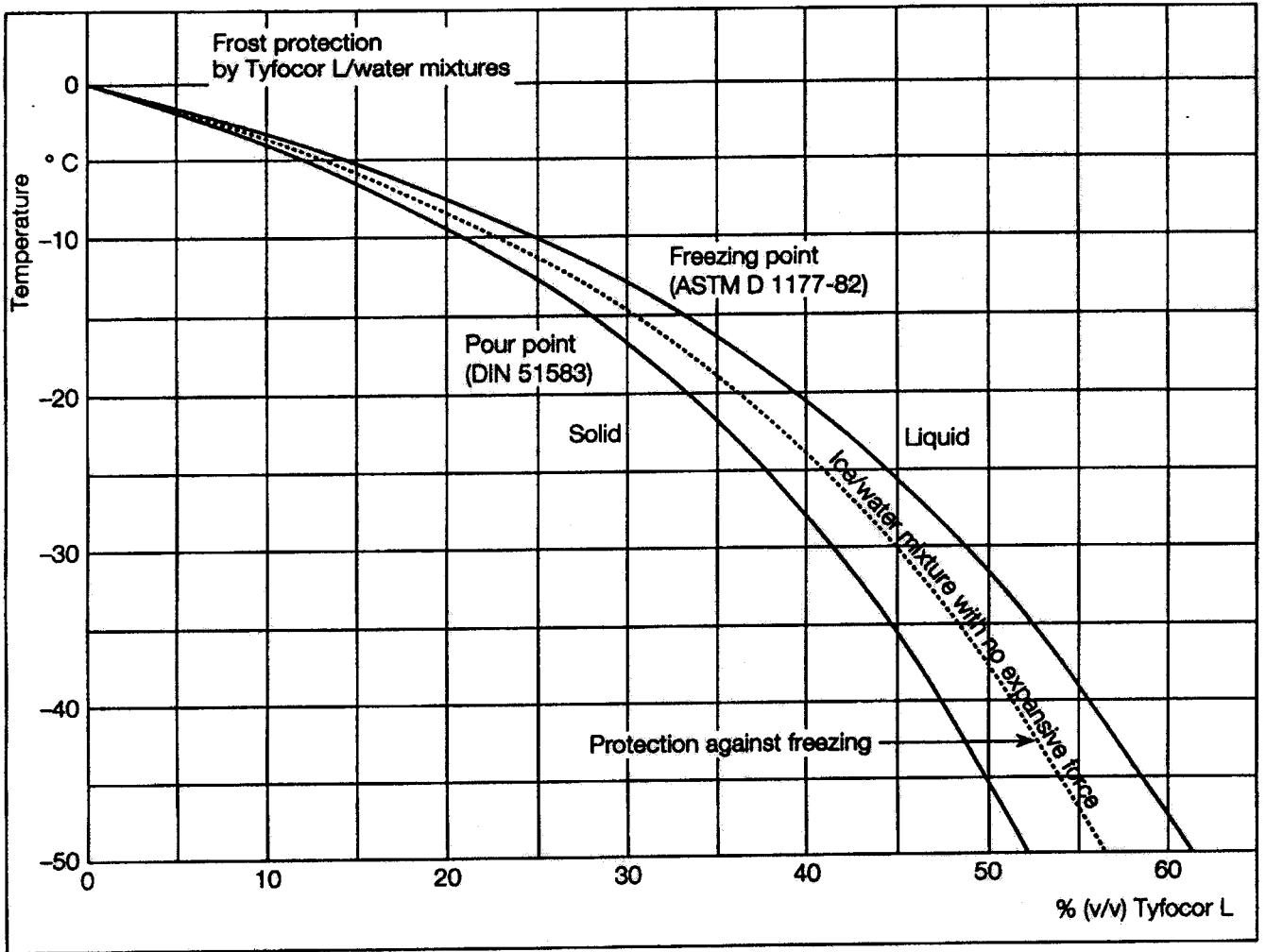
60

80

°C

Temperature





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 legislation are observed.



EEC – SAFETY DATA SHEET

Acc. 91/155/EEC

Last Revision Date: 01/07/97

Page 1 of 4

1. Identification of compound/preparation, and company	
Trade name:	TYFOCOR® L
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: Propan-1,2-diol with corrosion inhibitors CAS No: 57-55-6	
3. Possible dangers	
None anticipated	
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 and keep them calm
Swallowing	Wash out mouth cavity with water and drink plenty of water
5. Measures to be taken in the event of fire	
Suitable extinguishing agents	Water spray, carbon dioxide, alcohol resistant foam, and dry extinguishers
Dangerous combustion products	Propionaldehyde. 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 Propylene glycol and its aqueous solutions may form flammable vapour-air mixtures upon heating	

6. Accidental release measures

Personal protective measures	Not relevant. Remove contaminated clothing and wash body down thoroughly with water
Environmental protection measures	Do not discharge product into natural waters without pretreatment (biological treatment plant). Bind the liquid by using a suitable absorbent material (sawdust, sand, etc.) and dispose of in accordance with local regulations
Process of cleaning/absorption	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.

7. Handling and storage

Handling	Ensure thorough ventilation of stores and work areas. When correctly used, no special measures required
Fire and explosion protection	If exposed to fire keep containers cool by spraying with water
Storage	Store in polyethylene or steel containers. Do not expose containers to direct sunlight. Earth all containers and equipment. Storage in galvanised containers is not recommended

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	>150 °C
Freezing point	<-50 °C
Density at 20 °C	approx. 1.053 g/cm ³
Vapour pressure at 20 °C	2 mbar
Viscosity at 20 °C	approx. 70 mm ² /s
Solubility in water	completely soluble
pH value (500 g/l 20 °C)	6.5-8.5
Flash point	>100 °C
Ignition temperature	>200 °C
Lower explosion limit	2.6 vol%
Upper explosion limit	12.6 vol%

10. Stability and reactivity**Chemical stability** Stable with usual handling and storage**Substances to be avoided** Oxidising agents**11. Toxicological data****Acute oral toxicity** (LD₅₀): >2000 mg/kg (rat)**Primary skin irritation** (OECD 404): non-irritant to rabbit**Primary mucosal membrane irritation** (OECD 405): non-irritant to rabbit's eyes**Inhalation risk** (rat): no diagnosis

Uptake of harmful amounts through skin reabsorption unlikely.

Contact with eyes Temporary burning and redness may occur**Contact with skin** Occasional contact produces no or only slight effects. Single exposure unlikely to cause harm**Inhalation** Inhalation of mists or aerosols are not harmful although irritation of mucosal membranes in the respiratory system may occur**Swallowing** Irritation of mucosal membranes and digestive system possible**Mutagenicity** No mutagenic effects observed**Carcinogenicity** Not carcinogenic**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****Elimination information** Test method: OECD 302 B/ISO 9888/EEC 88/3032 C
>70% (Zahn-Wellens test): easy to eliminate

The product will not affect the activity of activated sludge in a biological effluent clarification plant if introduced correctly according to local regulations

Water danger class (wdc) 0 (self-classification)**Toxicity to fish** LC₅₀: >10,000 mg/l (Leuciscus idus, 96h)**13. Information about the disposal of toxic waste****Disposal** TYFOCOR® must be disposed of by special means, e.g. suitable incineration, in accordance with local regulations
Waste code no. 55303 (Germany)**Contaminated packaging** Contaminated packaging may be used again after cleansing it thoroughly

