

Low Temperature Heat Transfer Fluids

(LTHTFs)

RECOTHERM
(Ethylene Glycol based)

RECOFREEZE
(Propylene Glycol based)



Recochem Inc.
Your Partner in Formulating Solutions

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Recochem is a Canadian owned, privately held company with a global reputation for quality products and outstanding customer service. For over sixty years we have been known for innovation, agility, growth and socially responsible business practices. Our reputation has earned us vendor appreciation awards and longstanding relationships with our suppliers around the world.

Recochem's Consumer Division (Americas) is a producer, formulator, contract packager and wholesale distributor of household chemical products and automotive fluids from five locations. We are strategically located in Saint John, Montreal, Toronto, Edmonton and Vancouver allowing us to cost effectively service our customers coast to coast and throughout North and South America.

Our Industrial Division includes refining and distillation of both Crude and Refined Naphthalene in Canada and in Belgium, as well as the ability to supply Chlorinated Benzenes for a wide range of applications.

Our Australia Asia-Pacific Division manufactures and distributes a broad range of Industrial and Consumer chemicals throughout the entire region.

Recochem product distribution includes Low Temperature Heat Transfer Fluids (LTHTFs), which are described in this

brochure. Our line of RECOTHERM (ethylene glycol based) and RECOFREEZE (propylene glycol based) LTHTFs provide the same level of manufacturing expertise, product quality, consistency and reliability for which Recochem is known.

All of us at Recochem are committed to service and quality. Customers can rely on our manufactured products, whether under private brand or the Recochem label, and can be assured of expert technical support and quick responses to customer inquiries.

Our Vision

We will be recognized as a respected leader in our target segments because of our efficiency, customer service, market knowledge and innovative technical expertise.

Our Mission

We serve the global market with selected industrial chemicals, as well as finished products for consumer use in areas such as automotive and household chemicals.

We are committed to be a strong corporate leader by partnering with our customers and suppliers to find solutions for our customers' needs. We respect our environment and provide a safe workplace that offers growth opportunities for our employees.



Where to Use RECOTHERM and RECOFREEZE LTHTFs

RECOTHERM Ethylene Glycol (EG) and RECOFREEZE Propylene Glycol (PG) LTHTFs are used in primary and secondary cooling or heating applications, freeze and burst protection of pipes and for a variety of deicing, defrosting and dehumidifying applications. These products are supplied in both concentrate and pre-diluted solutions. Concentrates must be diluted before use (30-volume % minimum in good quality water) in order to meet low temperature operation requirements of the fluid; concentrates should never be installed as is. Pre-diluted formulas are ready to install as received. The recommended working temperature range for these products is -50°C to 150°C depending on dilution and product type.

Each product contains specially formulated inhibitor packages to help prevent corrosion and to extend the life of the fluid. RECOTHERM and RECOFREEZE LTHTFs are suitable for use in the following applications:

- HVAC system freeze/burst/corrosion protection
- Cold room dehumidifying
- Process and equipment deicing
- Process cooling and heating
- Ice skating rinks
- Air preheating
- Waste heat recovery
- Sidewalk and walkway snow melting and deicing
- Sprinkler systems
- Ground loop heating systems
- Solar and radiant heating systems
- Water chiller systems
- Central heating systems
- Aluminum boiler and heat exchanger systems – RECOFREEZE AL® only
- Natural gas compressor station coolants
- Natural gas well-head and pipeline heaters
- LNG vaporizers
- Pipeline tracing
- Drilling equipment
- Air compressor engines
- Standby generators / engines
- Marine engines

Rationale for using EG vs. PG based LTHTFs

Recochem is providing both EG and PG versions of its line of LTHTFs. This allows Recochem to meet the current and anticipate future product demands in the LTHTF market place.

For the majority of heat transfer applications, ethylene glycol based fluids are the first choice because of their higher heat transfer efficiency and better overall low temperature properties.

At the same concentration in water, solutions of EG based fluids are less viscous and have lower freezing points than their propylene glycol based counterparts, thus offering lower minimum operating temperatures.

The decision on which type of glycol to use, is based on the customer's needs and the specific application. While some people perceive that PG based fluids are "a more environmentally preferred" product, this is not true. It must be noted that:

- on an acute level, both EG and PG are considered practically non-toxic to aquatic life.
- in 20 days, EG will biodegrade completely (100%) whereas PGs biodegradation will only be 79%.
- EG has a chemical oxygen demand (COD) of 1.34, which is lower than that of PG at 1.68. As a consequence, when spilled in a stream, a PG based fluid will deplete the available oxygen more than an EG based fluid; hence the possibility of a fish kill is higher with PG than EG.

From a health and safety viewpoint, the difference between EG and PG based fluids resides in their respective acute toxicity by ingestion by animals and/or humans. PG is considered as non-toxic whereas EG is toxic.

Propylene glycol heat transfer fluids are most commonly used in applications where low acute oral toxicity is a requirement or when a potential exists for contact with food or potable water.

RECOTHERM and RECOFREEZE LTHTF Product Descriptions

RECOTHERM IG® is a corrosion inhibited EG based LTHTF. Solutions of this product provide:

- excellent freeze and burst protection
- appropriate corrosion protection for copper, brass, solder, cast iron, steel and aluminum, as per the ASTM D-1384 glassware corrosion test (see Table 2, Section 8). It should be noted that the product provides low temperature (up to 65°C) aluminum protection. The product formulation is not designed to protect aluminum at temperatures greater

than 65°C.

- extended product life
- appropriate heat transfer properties for the intended applications
- low vapour pressure, meaning minimum make-up requirements
- high boiling point
- appropriate low temperature properties for the intended applications
- readily biodegradable

Table 2A, Section 8 compares the corrosion performance of RECOTHERM IG® with that of some other EG based LTHTFs. The data shows that RECOTHERM IG® has comparable performance to LTHTFs from major competitors. RECOTHERM IG® and its solutions (30-60 volume % in 10% increments) are available throughout Canada. Recochem recommends that customers purchase pre-diluted solutions of RECOTHERM LTHTF. This eliminates potential product performance issues (such as scale build up, pitting, etc.) associated with the use of poor quality water when diluting the concentrate.

RECOFREEZE PG® is a corrosion inhibited PG based LTHTF. Solutions of this product provide:

- adequate freeze and burst protection
- appropriate corrosion protection for copper, brass, solder, cast iron, steel and aluminum, as per the ASTM D-1384 glassware corrosion test (see Table 2, Section 8). It should be noted that the product provides low temperature (up to 65°C) aluminum protection. The product formulation is not designed to protect aluminum at temperatures greater than 65°C.
- extended product life
- appropriate heat transfer properties for the intended applications
- low vapour pressure, meaning minimum make-up requirements
- high boiling point
- readily biodegradable

A comparison of the corrosion performance of RECOFREEZE PG® and some other PG based LTHTFs is provided in Table 2B, Section 8. As seen in this table, the performance of RECOFREEZE PG® and the other major competitor products is equivalent. RECOFREEZE PG® and its solutions (30-60 volume % in 10% increments) are available throughout Canada. Recochem recommends that customers purchase pre-diluted solutions of RECOFREEZE LTHTFs. This eliminates potential product performance issues (such as scale build up, pitting, etc.) associated with the use of poor quality water when diluting the concentrate.

RECOFREEZE AL® is a NEW corrosion inhibited PG based LTHTF specifically designed for use in residential and commercial boiler systems with high aluminum content. Solutions of this product provide:

- adequate freeze and burst protection
- appropriate corrosion protection for copper, brass, solder, cast iron, steel and especially aluminum, as per the ASTM D-1384 glassware corrosion test (see Table 2, Section 8)
- protection of aluminum at operating temperatures up to 150°C
- extended product life
- appropriate heat transfer properties for the intended applications
- low vapour pressure, meaning minimum make-up requirements
- high boiling point
- readily biodegradable

A comparison of the corrosion performance of RECOFREEZE AL® and some other PG based LTHTFs is provided in Table 2B, Section 8. As seen in this table, the performance of RECOFREEZE AL® and the other major competitor products is equivalent. RECOFREEZE AL® is available in concentrate and pre-diluted 50/50 format. Recochem recommends that customers purchase pre-diluted version of RECOFREEZE LTHTFs. This eliminates potential product performance issues (such as scale build up, pitting, etc.) associated with the use of poor quality water when diluting the concentrate.

RECOTHERM GTE® and RECOFREEZE GTP® are ethylene glycol based (GTE) or propylene glycol based (GTP) LTHTFs designed to be used in applications where liner cavitation could be an issue, such as:

- compressor station coolants
- standby generators
- low and high speed stationary engines
- pipeline heaters



Properties of RECOTHERM and RECOFREEZE LTHTFs

Table 1 – Typical Physical Properties

TEST	Product Type				
	Recotherm IG®	Recotherm GTE®	Recofreeze PG®	Recofreeze GTP®	Recofreeze AL®
Composition: Glycol (wt. %) Inhibitors & water	92.0 min. 8.0 max.	92.0 min. 8.0 max.	92.0 min. 8.0 max.	92.0 min. 8.0 max.	92.0 min. 8.0 max.
Specific gravity (20°C)	1.125-1.140	1.125-1.140	1.045-1.065	1.045-1.065	1.045 - 1.065
pH (50/50 v/v)	8.5-9.5	8.5-9.5	9.5-10.5	9.5-10.5	7.8 - 8.6
Reserve alkalinity (mls min., N/10 HCL)	23.0 min.	23.0 min.	12.0 min.	12.0 min.	5.0 min.
Chloride (ppm)	25 ppm max.	25 ppm max.	25 ppm max.	25 ppm max.	25 ppm max.
Sulfate (ppm)	10 ppm max.	10 ppm max.	10 ppm max.	10 ppm max.	10 ppm max.
Colour	Clear	Clear	Yellow	Yellow	Yellow

All the above mentioned fluids have a characteristic glycol odour and contain less than 0.5 weight % of other glycols. The corrosion inhibitor package is nitrate, molybdate and silicate free and protects ferrous, copper and, to some degree, aluminum based systems. Product information including specific gravity, pH, reserve alkalinity, freeze point, chloride, sulfate and colour is provided in Table 1.

All RECOTHERM and RECOFREEZE LTHTFs contain sufficient amounts of corrosion inhibitors and buffers to allow the products to be used **as is** for initial fill. They all exhibit excellent freeze point and corrosion protection for low temperature heat transfer applications, while maintaining overall heat transfer performance. The fluids are hygroscopic at low temperatures, which means they readily pick up moisture from the atmosphere. This is an important characteristic in dehumidification applications.

Inhibitor Concentrates for RECOTHERM and RECOFREEZE LTHTFs

All glycol based LTHTFs will experience corrosion inhibitor depletion as well as significant reductions in pH and reserve alkalinity over time. This is due to glycol degradation. Both EG and PG will slowly degrade in the presence of heat and oxygen. Recochem provides corrosion inhibitor concentrates that contain the appropriate amount of corrosion inhibitors and buffers to adequately restore product performance and thus extend the life of the product. The available corrosion inhibitor packages are:

- **RECOTHERM HTF-IC IG** for use with RECOTHERM IG®- a general corrosion inhibitor package that provides an overall performance boost for used RECOTHERM IG®
- **RECOFREEZE HTF-IC PG** for use with RECOFREEZE PG®- a general corrosion inhibitor package that provides an overall performance boost for used RECOFREEZE PG®

- **RECOFREEZE HTF-IC AL** for use with RECOFREEZE AL® - a general corrosion inhibitor package that provides an overall performance boost for used RECOFREEZE AL®
- **RECOTHERM HTF-IC GTE** for use with RECOTHERM GTE® - a general corrosion inhibitor package that provides an overall performance boost for used RECOTHERM GTE®
- **RECOFREEZE HTF-IC GTP** for use with RECOFREEZE GTP® - a general corrosion inhibitor package that provides an overall performance boost for used RECOFREEZE GTP®
- **HTF-IC YM** for use with all Recochem LTHTFs when the yellow metal inhibitor has depleted and the other components are still okay

These LTHTF corrosion inhibitor packages are designed to be used after a LTHTF's system has been sampled, the sample analyzed and the product found to have reduced performance. Recochem Technical Service personnel will discuss the results with the customer and then recommend a course of action based on appropriate use of one of the above listed corrosion inhibitor packages.

Preparing Systems for the Addition of RECOTHERM and RECOFREEZE LTHTFs

Existing Systems

In existing systems, all lines should be cleaned and flushed thoroughly before charging the systems with RECOTHERM and RECOFREEZE LTHTFs. This is especially important if the fluid in the systems is incompatible with the new, inhibited, glycol based fluid. A Recochem Technical Service Representative can help you determine the compatibility of

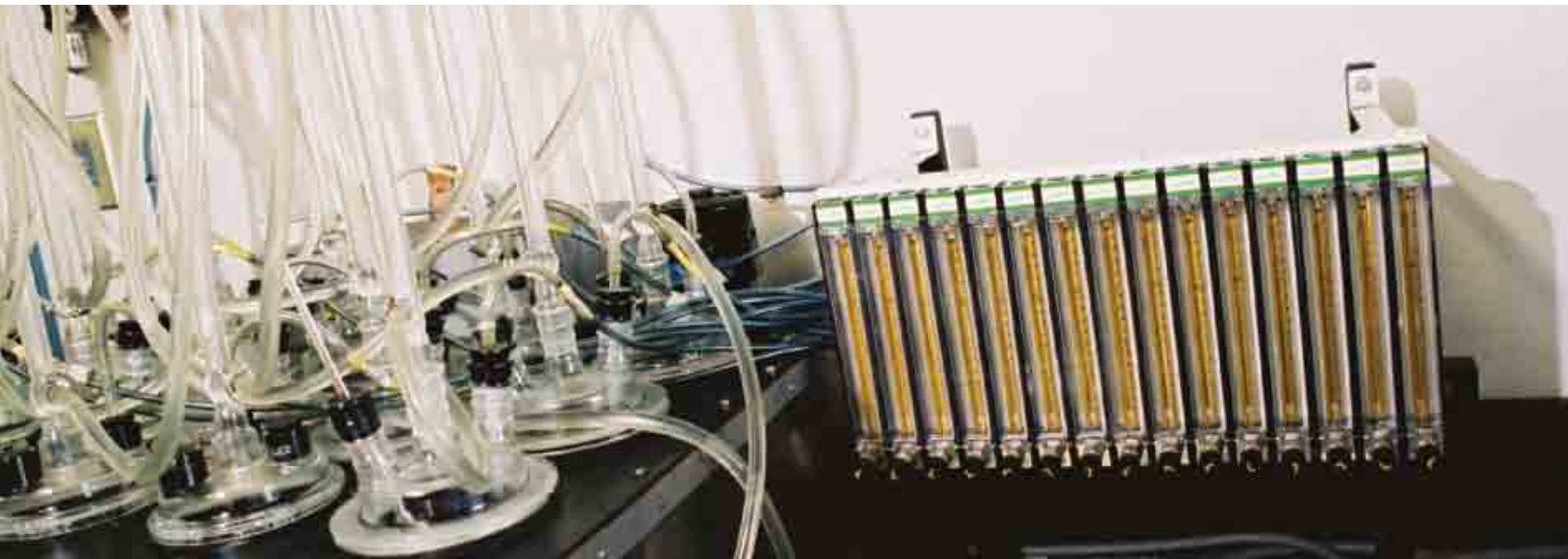
other fluids with RECOTHERM and RECOFREEZE LTHTFs.

If a fluid containing silicates (typical in automotive antifreeze) was previously present, it may be necessary to clean silicate residues from the system to restore the original level of heat transfer. It is important to remove all rust, scale and sediment from the system. Chloride, sulfate and "hard" ions (typically calcium and magnesium) should be removed, as these can cause corrosion or affect the stability of the new fluid. For larger systems, or systems where corrosion is already present, consult an established, professional industrial cleaning company.

For heavily corroded or fouled systems, an optimum cleaning procedure involves the use of an inhibited acid followed by neutralization and phosphatization. This procedure is quite involved and it may be better contracted to an organization experienced in industrial cleaning. If chemical cleaning is performed, it is important that all traces of the cleaning agent are removed and the system is thoroughly flushed with high quality water prior to use.

New Systems

New systems may be coated with oil, grease and/or a protective coating during manufacture, storage and installation. Dirt, solder flux, welding and pipe scale may also be present and require removal to avoid problems. Therefore, thorough cleaning of new systems is necessary. A 1–2 weight % solution of trisodium (or tripotassium) phosphate may be used with plenty of clean water to flush out the system after cleaning.



Dilution of RECOTHERM and RECOFREEZE LTHTFs

Water Quality

High quality water must be used to dilute RECOTHERM and RECOFREEZE LTHTFs. Dissolved impurities in the water can lead to an increased rate of metal corrosion, pitting of cast iron and mild steel components, reduced corrosion inhibitor efficiency and build up of scale and other deposits. This, in turn, will lower the heat transfer capacity and reduce the effective life of the fluid. The main impurities to avoid are chloride and sulfate, which increase the corrosion rate, and calcium and magnesium. Hard water ions like calcium and magnesium affect the corrosion inhibitors and lead to scale build up and deposits on metal surfaces. Table 1A summarizes the minimum dilution water requirements:

Table 1A – Dilution Water Requirements	
Impurity	Level, max. ppm
Chloride	25
Sulfate	25
Calcium	50
Magnesium	50
Heavy Metals	5
Silicate	25
Other pH	5.0 - 8.0

Distilled or deionized water should be used as the water of choice. If neither of these is available all RECOTHERM and RECOFREEZE LTHTFs are available as pre-diluted products and, as such, are ready for use.

Charging the Systems with RECOTHERM and RECOFREEZE LTHTFs

After cleaning and flushing the industrial heat transfer systems, meter in distilled or deionized water and then perform a pressure test on each system. Upon satisfactory completion of the pressure test(s), drain out enough water to allow the required volume of heat transfer fluid to be added to achieve the desired final concentration. When making system volume calculations, take the volume of the overflow tank into consideration and allow for expansion or contraction of the fluid at the operating temperature.

Most data in this brochure is given for volume dilutions. Circulate the fluid for at least 12 hours to ensure a homogeneous mixture has been achieved. Once the mixture is homogeneous, take samples from a low and high position within the system and then send to Recochem for analysis. This will serve as the baseline for what the system looked like when initially charged with either the RECOTHERM or RECOFREEZE LTHTF product.

Recochem recommends that the level of glycol present in the system be verified using:

- a hand held or bench type refractometer
- or by determining the difference in water content and glycol level using a Karl Fischer Reagent Method

If there are any questions regarding the determination of glycol level (or other components) present in a LTHTF system, please contact your local Recochem Technical Service Representative for assistance.

Increasing or Decreasing the Glycol Concentration

In certain circumstances, it may be desirable to reduce or increase the concentration of glycol in the system. For example, evaporation of water will lead to an increased glycol content, which leads to increased fluid viscosity, loss of freezing point and reduced heat transfer performance. In this case it is important to reduce the glycol concentration by the addition of high quality water. Operating at lower temperatures may require a lowering of the fluid freezing point and, hence, an increase in glycol content. Guidance on these adjustments can be obtained from Recochem Technical Service personnel.



Corrosion Protection

All RECOTHERM and RECOFREEZE LTHTFs are formulated to protect the metals commonly used in the applications listed in Section 1. The corrosion inhibitors function in the following ways. First, they passivate the metal surface by reacting with it to form a surface layer that is only molecules thick. This surface layer protects the metal without interfering with its heat exchange function. Second, the corrosion inhibitors contain polyfunctional buffers that absorb any acids formed by the oxidation of glycol during the lifetime of the fluid. This prevents a gradual reduction of the fluid performance and pH, which, if left unchecked, would eventually lead to serious corrosion of the system. As a general guideline LTHTFs afford excellent corrosion protection at concentrations between 30 and 70 volume/volume % in distilled or deionized water.

The corrosion performance of both RECOTHERM and RECOFREEZE LTHTFs is obtained by running the ASTM D-1384 corrosion glassware test. This is a screening test that measures the relative corrosion protection of a specific solution on copper, solder, brass, steel, cast iron and aluminum under standard test conditions.

Table 2 provides typical corrosion test results for RECOTHERM IG®, RECOFREEZE PG®, RECOFREEZE AL®, RECOTHERM GTE® and RECOFREEZE GTP®. Tables 2A and 2B compare the performance of the RECOTHERM and RECOFREEZE product lines against some competitive products and uninhibited water, using EG and PG as baseline standards. As seen in Tables 2A and 2B the performance of the RECOTHERM and RECOFREEZE product lines is equivalent to the performance of its major competitors.

The use of automotive antifreeze should be avoided in LTHTF applications since automotive antifreeze generally contains silicates that can form deposits of gel on the heat exchange surface. These deposits can result in a significant loss of heat exchange efficiency.



Table 2 – ASTM D-1384 Performance Data for Recotherm/Recofreeze LTHTFs

Coupon Type	Product Test Results (weight loss in mg/coupon)					
	Recotherm IG®	Recotherm GTE®	Recofreeze PG®	Recofreeze AL®	Recofreeze GTP®	Max. allowed weight loss
Copper	0.2 (0.01)	0.3 (0.01)	0.2 (0.01)	+0.1 (0.00)	2.1 (0.09)	10 (0.42)
Solder	3.5 (0.12)	14.0 (0.46)	4.7 (0.16)	0.9 (0.03)	8.6 (0.29)	30 (0.99)
Brass	1.8 (0.08)	1.2 (0.05)	1.0 (0.04)	0.3 (0.01)	3.2 (0.14)	10 (0.44)
Cast Iron	2.4 (0.12)	+0.5 (+0.03)	+1.8 (+0.09)	2.8 (0.14)	+1.3 (0.06)	10 (0.49)
Steel	0.6 (0.03)	+1.1 (+0.05)	0.5 (0.02)	1.5 (0.07)	2.0 (0.10)	10 (0.48)
Aluminum	1.8 (0.23)	8.6 (1.10)	5.1 (0.65)	+0.5 (+0.06)	5.2 (0.66)	30 (3.83)

Notes:

1. Numbers in brackets are mils penetration per year (mpy).
2. Test run at 88°C for 14 days with air sparged into each test run at 100 ml/minute. The dilution water was standard ASTM corrosive water that included Chloride, Sulfate and Carbonate at 100 ppm each.

Table 2A – ASTM D-1384 Performance Data for Recotherm IG® Compared Against Competitive Products

Coupon Type	Product Test Results (weight loss in mg/coupon)					
	Recotherm IG®	Competitor A	Competitor B	Competitor C	Uninhibited EG®	Uninhibited Water
Copper	0.2 (0.01)	1.1 (0.05)	1.4 (0.06)	0.1 (0.00)	6.0 (0.25)	3.5 (0.15)
Solder	3.5 (0.12)	12.7 (0.42)	6.8 (0.23)	+ 0.1 (0.00)	216 (7.16)	72 (2.39)
Brass	1.8 (0.08)	1.9 (0.08)	2.0 (0.09)	+ 0.2 (+0.01)	9.3 (0.41)	5.3 (0.23)
Cast Iron	2.4 (0.12)	+1.3 (+0.06)	+6.4 (+0.32)	4.4 (0.22)	299 (14.78)	383 (18.94)
Steel	0.6 (0.03)	0.1 (0.01)	0.1(0.01)	0.2 (0.01)	421 (20.02)	289 (13.75)
Aluminum	1.8 (0.23)	6.4 (0.82)	8.4 (1.07)	16.4 (2.09)	97 (12.38)	122 (15.57)

Table 2B – ASTM D-1384 Performance Data for Recofreeze PG® / Recofreeze AL® Compared Against Competitive Products

Coupon Type	Product Test Results (weight loss in mg/coupon)					
	Recofreeze PG®	Recofreeze AL®	Competitor A	Competitor B	Uninhibited PG®	Uninhibited Water
Copper	0.2 (0.01)	+0.1 (0.00)	1.6 (0.07)	3.9 (0.16)	7.7 (0.32)	3.5 (0.15)
Solder	4.7 (0.16)	0.9 (0.03)	2.6 (0.09)	0.5 (0.02)	209 (6.92)	72 (2.39)
Brass	1.0 (0.04)	0.3 (0.01)	2.4 (0.11)	0.2 (0.01)	13.2 (0.58)	5.3 (0.23)
Cast Iron	+1.8 (+0.09)	2.8 (0.14)	+5.8 (+0.29)	+ 6.1 (+0.30)	351 (17.35)	383 (18.94)
Steel	0.5 (0.02)	1.5 (0.07)	+0.1 (+0.01)	0.8 (0.04)	469 (22.31)	289 (13.75)
Aluminum	5.1 (0.65)	+0.5 (+0.06)	+1.3 (+0.17)	5.3 (0.68)	77 (9.83)	122 (15.57)

Materials of Construction

Traditional materials of construction can be used with all RECOTHERM and RECOFREEZE LTHTFs. Steel, copper, brass, cast iron, solder, bronze, aluminum and most plastic piping materials are acceptable. In the case of aluminum, the operating temperature should be below 65°C. For aluminum systems with operating temperatures above 65°C, Recofreeze AL® is recommended and will provide protection up to 150°C.

Galvanized steel is not suitable because the zinc content will react with inhibitors causing precipitation, premature inhibitor depletion and stripping of the protective zinc coating. The use of dissimilar metals in the same system is not recommended because of the likelihood of galvanic corrosion.

Centrifugal pumps are commonly used with glycol based heat transfer fluids. In cases where high head pressures are required, reciprocating pumps are appropriate. No special

materials of construction are required; steel and cast iron components are acceptable since the fluid is already fully inhibited. Pump packing or seal materials may be the same as those used with water, provided that these are compatible with the rest of the system's operating parameters.

RECOTHERM and RECOFREEZE LTHTFs and their solutions in water are compatible with most plastic materials and elastomers. Generally the same materials used with uninhibited ethylene and propylene glycols may be used.

If in doubt about the corrosion resistance of a material under system operating conditions, ask the manufacturer about the suitability of use with ethylene or propylene glycol. Always quote the operating temperatures and pressures.

In vapour spaces and the expansion tanks, coatings maybe used to protect the exposed metal surface. Most vinyl ester or phenolic resins are suitable. Alternatively, the expansion tank may be constructed of polypropylene to eliminate corrosion. In the case of coatings, the customer should check the suitability for use in conjunction with glycol at whatever the operating temperature would be.

Even with the use of deionized or distilled water as a dilutant, some sediment may form over a period of time. This may lead to local corrosion or reduced fluid flow in a critical area of the system and it must, therefore, be removed. Fiber or cellulose bypass filters are suitable for this purpose.

Glycol Concentration and Freeze/Burst Protection

RECOTHERM and RECOFREEZE LTHTFs are always used as solutions in water. The desired properties of the resultant solution determine the concentration at which the heat transfer fluid is used. The four primary characteristics to consider are freezing (or burst) protection, corrosion protection, heat transfer and the targeted temperature range (-50°C to 135°C). Corrosion protection characteristics were discussed in Section 8.

Closed loop, water-based heat transfer systems are particularly prone to freeze up in cold weather. Solutions of RECOTHERM and RECOFREEZE LTHTFs offer both freeze and burst protection. When a plant is not operating for long periods of time in cold weather, a glycol concentration sufficient to prevent bursting, but not necessarily high enough to maintain the fluid in a free flowing state is required.

Conversely, if the plant is to remain operational during cold weather, or if a cold weather start up is required, a glycol concentration should be selected that offers adequate freeze protection. This will prevent the formation of ice crystals in the fluid and an undesirable increase in viscosity, which in turn would lead to loss of heat transfer efficiency.

In cases where the fluid concentration selected is below 30-volume %, contact Recochem Technical Service personnel to assess whether or not the corrosion inhibitor concentration will be sufficient to adequately protect your system.

Table 3 gives the freezing and burst protection afforded by RECOTHERM and RECOFREEZE LTHTFs at a range of volume % fluid concentrations. When selecting a particular concentration, it is advisable to take the desired freeze or burst protection that is at least 5 degrees lower than the coldest expected winter temperature. This gives an added safety margin in case of unexpected severe conditions.

Table 3 – Freezing and Burst Protection vs. Glycol Concentration

Temperature (°C/°F)	Freeze Protection		Burst Protection	
	EG Fluids	PG Fluids	EG Fluids	PG Fluids
- 7°C / 20°F	15	18	10	12
- 12°C / 10°F	25	28	18	21
- 18°C / 0°F	33	36	22	24
- 23°C / - 10°F	40	42	25	28
- 29°C / - 20°F	45	47	30	30
- 34°C / - 30°F	48	50	30	33
- 40°C / - 40°F	53	55	30	33
- 46°C / - 50°F	56	58	30	35
- 51°C / - 60°F	60	62	30	35



Heat Transfer Characteristics

Calculation of fluid flow rates and the necessary operating temperatures to maintain the desired rate of heat transfer can be complex. The engineering data required to carry out these calculations is available on request from Recochem's Technical Service Department. Table 4 gives examples of key parameters for different solutions of RECOTHERM and RECOFREEZE LTHTFs in distilled or deionized water.

Table 4 – Typical Engineering Data for 50/50 Recochem/Recofreeze LTHTFs

	Recochem IG® 50	Recochem PG® 50	Recofreeze AL® 50
Maximum Operating Temp, °C	135	135	150
Freezing Point, °C	-37	-34	-34
Burst Protection, -70°C	-70	-70	-70
Thermal Conductivity @			
5°C, W/(m)(K)	0.368	0.353	0.353
80°C, W/(m)(K)	0.411	0.382	0.382
120°C, W/(m)(K)	0.417	0.379	0.379
Specific Heat @			
5°C, kJ/(kg)(K)	3.24	3.50	3.50
80°C, kJ/(kg)(K)	3.54	3.79	3.79
120°C, kJ/(kg)(K)	3.70	3.94	3.94
Kinematic Viscosity @			
5°C, mPa(s)	6.7	13.9	13.9
80°C, mPa(s)	0.99	1.13	1.13
120°C, mPa(s)	0.55	0.61	0.61
Density @			
5°C, kg/m3	1075	1050	1050
80°C, kg/m3	1035	1001	1001
120°C, kg/m3	1002	963	963

Fluid Maintenance

Regular system and fluid maintenance will extend the effective life of your RECOTHERM and RECOFREEZE glycol based heat transfer fluids. A properly maintained fluid will provide several years of service. The fluid must be sampled and analyzed to establish the need for and type of maintenance required. Fluid inspection and the measurement of a few key parameters will provide a measure of its condition and whether or not some remedial action is required. Recochem will provide a fluid testing service to customers, as well as provide guidelines on the availability and use of simple test equipment that can measure glycol content and product pH at the site. Contact your local Recochem Technical Service Representative to get more details.

Using Recochem's extensive analytical lab, Recochem Technical Service personnel can provide analysis and interpretation of the current condition of the RECOTHERM and RECOFREEZE LTHTFs. A confidential analytical database is kept on all customers using this service. This allows for recommendations that maximize the life of both the RECOTHERM and RECOFREEZE LTHTFs and the equipment in which they are used.

For each new customer site, Recochem Technical Service personnel will offer the following service:

- inspection of the condition of LTHTF system to check for scale build up and determine if system cleaning is required
- analysis of a pre-fill sample explaining the current condition of the LTHTF system and provide recommendations on proper disposition of said material
- analysis of the initial fill after proper recirculation of the initial fill material
- subsequent analysis as required to maximize the life of both the LTHTF and the equipment in which it is used

The analysis offered consists of some basic tests that include pH, reserve alkalinity, water content, freeze point, colour and clarity. If one or more of these tests indicate a possible product performance issue then a more detailed analysis is recommended. This more detailed analysis includes:

- the basic tests
- inhibitor levels
- corrosion by-products
- level of glycol decomposition
- contaminants

Based on the results of this analysis, Recochem Technical Service personnel will provide guidance on how to handle the LTHTF. This includes recommendations for product adjustment or product disposal, depending on the condition of the fluid tested. If product adjustment is required this can be accomplished using one of Recochem's LTHTF inhibitor concentrates as mentioned in Section 5.



Storage and Handling

RECOTHERM and RECOFREEZE LTHTFs are fully corrosion inhibited and as such present no unusual problems regarding product storage in tanks or drums. Carbon steel, epoxy/phenolic lined, polyethylene and polypropylene are all suitable storage containers. Extended storage in carbon steel may result in slight discoloration of the product due to iron contamination. This can occur in the headspace of the tank when condensate collects on the walls in the presence of oxygen (air), and can be minimized by restricting the exposure of the product to air or eliminated by storing the product in a lined tank.

Handling of the products poses no significant health risks. Glycols can burn but, even pure, do not represent a fire hazard. Concentrated solutions of these products are hygroscopic and, as such, it is important to reduce contact with air to prevent moisture absorption. It is also important to keep the concentrated solutions warm to prevent freezing. To eliminate these issues associated with handling concentrated solutions of LTHTFs, Recochem recommends the purchase of a solution of LTHTFs that is pre-diluted for the intended application.

Storage of pre-diluted solutions of these products will eliminate or significantly reduce freezing and viscosity related issues. In temperatures above the freeze point, the product can be stored for a minimum of two years. During this time the product will not precipitate or undergo any non-reversible change in properties. If you have a product that has been sitting in storage for longer than two years, the product should be tested to ensure it still meets initial specifications prior to use.





Environmental Aspects

RECOTHERM and RECOFREEZE LTHTFs are readily biodegradable and will not concentrate in water systems. Spills of any size should be avoided, especially where there is a possibility to contaminate lakes or rivers. Spills could cause rapid oxygen depletion that could have harmful effects on aquatic organisms. Spills of RECOTHERM and RECOFREEZE LTHTFs must be cleaned up immediately to prevent possible ingestion by wildlife and domesticated animals. Spill control and waste disposal must comply with federal, provincial and local legislation.

Material Safety Data Sheets (MSDSs) are available for all RECOTHERM and RECOFREEZE LTHTFs, as well as the concentrates available to restore these fluids. Please read the label, MSDS and review this literature prior to use.

Environmental Commitment

Responsible corporate citizenship must make profitability and sustainable development a by-product of care for the welfare of our planet, our employees and all who share in our business ventures.

THE MANAGEMENT AND STAFF OF RECOCHEM GROUP OF COMPANIES HAVE AGREED WITH THIS ETHIC AND:

1. We resolve to manage chemical products in a manner that protects the environment and the health and safety of people.
2. We resolve to continuously evaluate raw materials and end products with the goal of reducing risks to people and the environment, while still maintaining the effectiveness and competitive position of the product.
3. We resolve to continue to reduce our packaging and materials used to minimize generation of waste, both during production and through the life of the product.
4. We resolve to increase our use of recycled materials to the optimum that is technically feasible without sacrificing the integrity of our products and containers, while meeting the demands of the marketplace.
5. We resolve to transport and present our products in a manner that reduces risk throughout the chain to the end users.



WE ARE GUIDED TOWARDS ENVIRONMENTAL, SOCIETAL AND ECONOMIC SUSTAINABILITY, RECOGNIZING THAT WE ARE STEWARDS OF OUR PRODUCTS AND SERVICES DURING THEIR LIFE CYCLES IN ORDER TO PROTECT PEOPLE AND THE ENVIRONMENT.

Product Development and Stewardship

Our highly specialized development labs concentrate on new formulations, life cycle assessment and efficacy testing to ensure continuous improvement.

- A specialized laboratory in Edmonton, Alberta is devoted to the development and testing of innovative automotive coolants technology. This features ASTM-approved state-of-the-art equipment that allows us to develop new coolant products for today's demanding market needs, and offer unparalleled technical support to our worldwide customer base.
- A product development lab in Ontario works closely with our marketing team to test and develop cleaning and paint sundry products to meet the needs of our hardware customers.

Continuous improvements and an eye on environmental responsibility assure maximum recyclability, minimum waste and effective marketability of all products created for our private label customers. We monitor and target reductions in our carbon footprint as well as waste generation.

Quality systems are in place in each one of our facilities – **Recochem is ISO 9001:2008 certified.**

NOTICE: Because use conditions and applicable laws may differ from one location to another and may change with time, the customer is responsible for determining whether products and the information in this document is appropriate for the customer's use and for ensuring that the customer's workplace and disposal practices are in compliance with applicable laws and government enactments. Recochem's warranty is limited to the claims of product meeting stated specifications. It is the responsibility of the end user to determine product suitability as recommended in the plant-operating manual and to follow plant manufacturer's instructions.

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