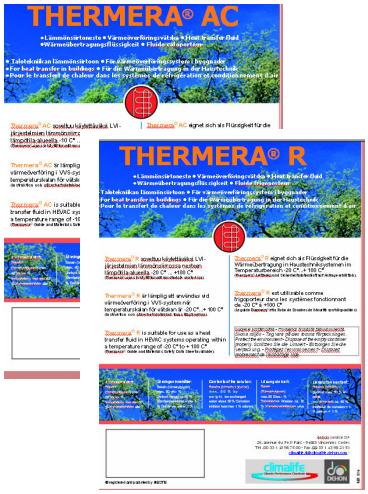
THERMERA® AC - THERMERA® R



Photos for informational purposes.

Thermera® is a new and extremely environmentally friendly heat transfer/ secondary refrigerant fluid. Made from natural ingredients (essentially nothing but water and betaine, a natural compound produced when manufacturing sugar), it is the natural solution for heat transfer in heating, ventilation, air conditioning (HVAC) and refrigeration systems.

Thermera® is non-toxic and ecological. It can be used in a truly vast range of applications, and is especially suited to those sectors where health and environmental issues are of particular importance.

Thermera® fluid is perfectly designed to meet the demands of its various applications, whether this be an HVAC system in a block of flats, or a food technology or refrigeration environment.

The excellent anti-corrosion properties of Thermera®, and its ability to remain in liquid form at low temperatures put it on a par with traditional fluids. It is designed for use in closed circuits where the working temperature is between -20°C and +100°C.

When used in an appropriate domain of application, Thermera® performs thermally as well as or better than traditional heat transfer fluids.

This product is always supplied in a ready-to-use format.

Available in 2 solutions :

- Thermera® AC provides frost protection up to -15°C and can be used in circuits with a minimum temperature of up to -10 °C.
- Thermera® R provides frost protection up to -35°C and can be used in circuits with a minimum temperature of up to -20 °C.

Available in :

- 20 litre cans
- 200 litre barrels
- 1,000 litre containers

1. PHYSICO-CHEMICAL PROPERTIES OF THERMERA®

1.1. Principal characteristics

Thermera® is soluble in water.

Appearance ..... : brown liquid, slight odour
Relative density at 25°C ..... : 1,050 at 1,100 kg/m^3
Boiling point (NF R 15-602-4) ..... : 105-110°C +/- 2 °C
pH ..... : between 7 and 9
Flash point ..... : /
Solubility ..... : soluble in 160g/100g H_2O

(The values shown above have been taken from the specification valid on the date of publication of this product data sheet.)

The maximum continuous operating temperature for all Thermera products is +100 °C. Above this temperature, betaine will slowly degrade, and above 150 °C, this process will accelerate. The degradation products of betaine are neither corrosive, nor harmful to man or the environment.

1.2. Table of properties

Freezing point of Thermera® AC ..... : -15°C
Minimum operating temperature -10 °C

Freezing point of Thermera® R ..... : -35°C
Minimum operating temperature -20°C

Density kg/m^3

Temperature [°C]	Thermera® AC	Thermera® R
-20	-	**1,110.0**
-15	-	1,108.0
-10	**1,076.9**	1,106.0
0	1,073.8	1,101.7
15	1,068.5	1,095.2
20	1,066.5	1,092.9
50	1,052.4	1,078.2

Cinematic viscosity (mm²/s)

Temperature [°C]	Thermera® AC	Thermera® R
-20	-	**43.0**
-15	-	31.7
-10	**9.4**	24.0
-5	7.5	18.6
0	6.2	14.7
5	5.2	11.9
20	3.2	6.8
40	2.0	3.8

Specific heat capacity (kJ/kgK)

Temperature [°C]	Thermera® AC	Thermera® R
-20	-	**2.80**
-15	-	2.82
-10	**3.11**	2.84
-5	3.12	2.86
0	3.13	2.88
5	3.14	2.90
20	3.17	2.95
40	3.21	3.01
60	3.24	3.07
80	3.26	3.12

Conductivity (W/m, °C)

Temperature [°C]	Thermera® AC	Thermera® R
-20	-	**0.349**
-15	-	0.351
-10	**0.404**	0.352
-5	0.406	0.354
0	0.408	0.355
5	0.410	0.357
20	0.416	0.361
40	0.424	0.367
60	0.432	0.373
80	0.440	0.379

1.3. Thermera® fluid and corrosion

The anti-corrosion protection offered by Thermera® is at least equal to that offered by traditional products. Corrosion may be defined as the wear visited on a material as the result of an electrochemical phenomenon. The rate at which the material is worn away is termed its “corrosion rate”, and is expressed in microns per year (µm/yr).

The corrosion rate of a material may be determined by measuring the electrical current generated by the corrosion, or, more directly, by measuring the wear visited on the raw material.

Corrosion rates of Thermera® for different materials:

Materials	Thermera®	Water	Unit
Copper	0.3	1.6	µm/yr
Carbon steel Fe37	0.3	68.0	µm/yr
Brass	0.3	0.9	µm/yr
Bronze	0.3	1.7	µm/yr
Cast iron	22.0	95.0	µm/yr
Aluminium	2.4	18.0	µm/yr
Zinc	4.0	Not tested	µm/yr

Test carried out using a Thermera® product with a minimum betaine concentration of 35 %. The test method used was method ASTM 1384, at a temperature of 50 °C.

Additives

Thermera® requires far fewer additives than traditional products. Additive durability and toxicity are therefore not serious concerns when using this fluid.
Unlike traditional products, the disintegration products of betaine (the principal ingredient) are non-corrosive. A Thermera® product without any additives is less corrosive than water. Moreover, betaine is a natural anti-corrosion agent.

Thermera® fluid is lightly perfumed with a scented substance used in the food industry (less than 1 %).

Because Thermera® has such excellent anti-corrosion properties, only a very small quantity of corrosion inhibitors has been added to the product (less than 1 % - total active ingredients make up less than 0.1 % of the final product).

The additives used do not have any effect on the toxicity of Thermera®.

Since Thermera® fluids are always supplied in a ready-to-use format, each Thermera® product will always contain the appropriate additives, whatever its betaine concentration

The anti-corrosion protection provided by Thermera® AC is equal in every respect to that provided by Thermera® R

2. RECOMMENDATIONS FOR IMPLEMENTING AND USING THERMERA®

2.1. Usage characteristics

Thermera® is a solution of betaine entirely dissolved in water. This product is primarily designed for closed circuits and systems. In an open system, some of the water in the Thermera® fluid could potentially evaporate and alter the concentration of the product. Oxygen could also dissolve in the solution, which could make preventing corrosion more difficult (as with all heat transfer fluids.) Therefore, while it is technically possible to use Thermera® in an open system, it is extremely important that its condition is monitored.

The maximum recommended operating temperature for Thermera® products is 100 °C. Above this temperature, betaine begins to become unstable, and certain alterations may take place.

Betaine, which is the principal component of Thermera®, prevents the development of microbes in any fluid where its concentration is greater than 20%.

Since Thermera® offers excellent thermal and microbiological stability, and contains very few inhibitors, its durability in use is generally better than that of traditional heat transfer fluids.

2.2. Compatibility with other materials

Thermera® is fully compatible with all materials used both in pipe work and elsewhere in installations: copper, carbon steel, brass, tin, cast iron and stainless steel.

It is also compatible with all elastomers and sealing joints used in glycol systems. Thermera® products may be used in direct replacement of glycols in existing systems without any risk of incompatibility.

We recommend that you use “pressurised” air vent valves (or a gas purger), at least one manual air vent valve, valves with spherical bodies, and welded and flanged joints. If the system includes filters, these must be cleanable.

Thermera® is compatible with all traditional pumps designed for heat transfer fluids, as long as their joints are glycol-resistant.

2.3. Cleaning the installation

It is sufficient to rinse the system with plenty of water, and empty it fully.

Since Thermera® is a natural, non-toxic and ecological product, it may be disposed of using your normal waste water system. If the quantities to be disposed of are particularly large, you should consult your local water treatment plant or council for information on the procedure to be followed.

2.4. Introducing Thermera® into the installation

Because Thermera® products are always supplied in a ready-to-use format, you do not need to add water or any other product when filling the system.

It is advisable to make a note of the name of the Thermera® product used in the system, and to keep a can of the product nearby. This will enable you to make sure that the same anti-freeze properties and fluid concentrations are used each time it is filled.

The system must be filled using the lower entry valve so as to best utilise the de-aerating system. The personnel working the installation must know the theoretical volume of the system. If the volume of fluid introduced is much less than the theoretical volume, it is possible that an air bubble, for example, might be found in the system.

First test that the system is working properly and then check the volume of heat transfer fluid.

If there is air in the system, you may need to add more fluid.

If you need to check the condition of the fluid during operation, you should draw the first sample at this point. Any subsequent samples can then be compared to this one.

2.5. Installation controls

Thermera® has done its job correctly and retained the same condition on all sites. To check that the condition of the fluid has not changed, simply draw samples at regular intervals, beginning with one immediately after the installation has been filled, and compare all with the first sample. You should check anti-freeze properties, pH and the condition of any additives.

You should also check for any leakages as part of your follow-up controls. If there has been any leakage of Thermera®, you will see little white deposits where the leakage has occurred.

These deposits are crystals of betaine which form when the water in the fluid evaporates. They are non-toxic.

It is therefore very easy to detect leakages. The deposits are not at all dangerous, and may be wiped off with a damp cloth.

If the system needs to be refilled, simply add the appropriate Thermera® product. Only use product which has been stored in a hermetically sealed container.

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