

Installation - Maintenance – Operation
(IU-0008-EN-200910)

**TANK FOR THE STORAGE
OF CHILLED WATER (CW)**

GLACEO Range

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FOREWORD

Dear Client,

Thank you for choosing a chilled water tank from the LACAZE ENERGIES GLACEO Range.

In your own interest, we ask you to observe and follow the instructions given in this operating manual and to carry out the maintenance scheduled, by qualified personnel, in order to ensure the maximum efficiency in the operation of the appliance.

We remind you that the non observation of the instructions contained in this notice will result in the non validity of the warranty.

In case of damage to persons, animals or objects arising from the non respect of the instructions contained in the operating manual supplied with the material, the manufacturer cannot, in any case, be held responsible.

ADVANTAGES OF A CHILLED WATER TANK

The advantages of the provision of a storage and production buffer tank in a domestic hot water installation (DHW) are well known, but those for a chilled water tank much less so. Nevertheless, the principles are virtually the same.

Despite the fact that cold storage (chilled water) does not generate any energy savings, it is an interesting solution from several points of view:

➤ **Reduction of electricity bills**

- The refrigeration kWh produced at night and/or outside peak hours is much less costly.
- If the cold reserve is used during the peak period, the compressors can be relieved, allowing real financial savings over peak costs.
- The power of the refrigeration unit falls to 60 % - 70 % of its nominal value during chilled water preparation. For example, for a unit of nominal power of 458 kW, the power during night time charging is reduced to 324 kW, being 71 % of the nominal value. The provision of a chilled water tank therefore allows the yield of the compressor to be improved (increase of duration of compressor operation).

➤ **Reduction of installed refrigeration power**

- For new installations, there will be a reduction of the installed refrigeration power by spreading the charge over time, so reducing the initial investment in refrigeration units and equipment.
- For existing installations, the refrigeration charge can be raised without raising the installed electric power (advantageous for buildings under renovation where an increase in the office equipment is desired, without the necessity of increasing the transformer power).

➤ **Reduction of the footprint of condensers/roof refrigeration towers**

- This is an advantage linked to the absence of placement of a supplementary refrigeration unit, although the storage space itself must be provided.
- Thermal storage is voluminous and must generally be limited to part of the daily consumption.

➤ **Strategic cold reserve in case of a breakdown in the refrigeration unit**

- Possibility of partial aid (several hours only) in case of breakdown of the refrigeration unit or interruption of electricity supply, the pumps only being supplied by the emergency generator. It is a safety feature sometimes looked for by computer or telecommunication rooms.



WARNING

Note concerning the elaboration and publication of this manual:

This manual was elaborated and published under the direction of LACAZE ENERGIES. It covers the most recent features and descriptions of the products. The manual content and the product features may be modified without prior notice.

The company LACAZE ENERGIES reserves the right to modify without prior notice the features and elements contained in the following pages. The company LACAZE ENERGIES will not be responsible for any damage (including consecutive damage) caused by reliance on the presented elements. This includes, but is not limited to, typing mistakes and other errors linked to the publication.

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Please read carefully.

This instruction manual is an integral part of the product and must be given to the final user.

- The appliance was manufactured for the storage of cold water, used in a closed circuit. Any other use shall be considered as inappropriate and dangerous.
- The appliance must not be installed in humid locations (H.R. \leq 80%). Protect the appliance from water or other liquid splashes to prevent damage to the components.
- Installation must be carried out in conformity with the rules, regulations and standards currently in force, respecting the instructions of the manufacturer, by a qualified professional.
- In the case of the equipment being sold or transferred to another user, this manual must accompany the equipment, so that the new user and the installer can consult it.
- If the equipment is not used during a period of below-freezing conditions, we request that it should be drained completely. The manufacturer declines all responsibility for any damage due to frost.
- We recommend that these instructions be read carefully, and advise the exclusive use of spare parts supplied by the manufacturer, in order to obtain the best service from the product and the acknowledgement of the appliance warranty.

CHARACTERISTICS

1. Tank

The GLACEO range of tanks in this manual extends from 300 to 6000 liters.

The tanks are made of 1st quality carbonized steel (S235JRG2 - E24), without interior coating. The design and fabrication respect the regulations in force (e.g. the CODAP: Code of Construction for Pressurized Appliances) and are validated by over 50 years of experience in the field.

The exterior of the tanks is protected by a single or double layer of zinc-rich anti-corrosion paint.

These tanks can only be used in pressurized closed circuits of water-cooling type with a maximum service pressure of 7 bars, without renewal of water (limited peak water). The circuits must be conditioned according to the regulations and recommendations in force.

⚠ N.B: The operating temperature must not be lower than -8°C ($T_{\text{mini}} = -8^{\circ}\text{C}$).

2. Thermal insulation:

GLACEO Range (chilled water)

- Polyurethane mousse C.F.C free, density 35 kg/m³, with a very high insulating power ($\lambda=0,0205 \text{ W/m.K}$), fire rating M1, standard thickness 40 mm.
- Metal sheet aluminum finish (quality 3105 or 3005), with protective film.

The whole of the tank is protected by closed cell polyurethane mousse, allowing storage of chilled water up to a minimum temperature of -8°C as standard.

In standard version, the bottom of the tank is not metal sheeted.

The performances of the insulation materials are illustrated below ([following page](#)).

⚠ Recommendations:

- The protective film on the metal sheet jacket must be removed as soon as possible once the equipment is delivered. In case of long exposure to ultra-violet rays, this protective film can become difficult to remove.

3. Options:

- Electric back-up : stainless steel armored electric element, with stainless steel pins, fixed to coupling 1"1/2 up to 12 kW or on tapped collar M77 from 15 to 35 kW
 - from 3 to 24 kW : tension 230 / 400 V (star coupling),
 - for 30 and 35 kW : tension 400V (triangular coupling).
- Safety and control thermostat ($-30 / +35^{\circ}\text{C}$).
- Inspection manhole $\Phi 400 \text{ mm}$; insulated (except 300 liters).
- Accessory kits (thermometer, valve, degasser, drainage valve, etc.
- Custom dimensions, service pressures.

Performances of the thermal insulation:

For hot water storage tanks, thermal losses through storage are calculated in relation to a cooling constant (**Cr**) measured in Watts.hour per liter per Kelvin and per day. For chilled water storage tanks, we propose here an increase constant (**Ca**) in Watts.hour per liter per Kelvin and per day which is calculated as follows:

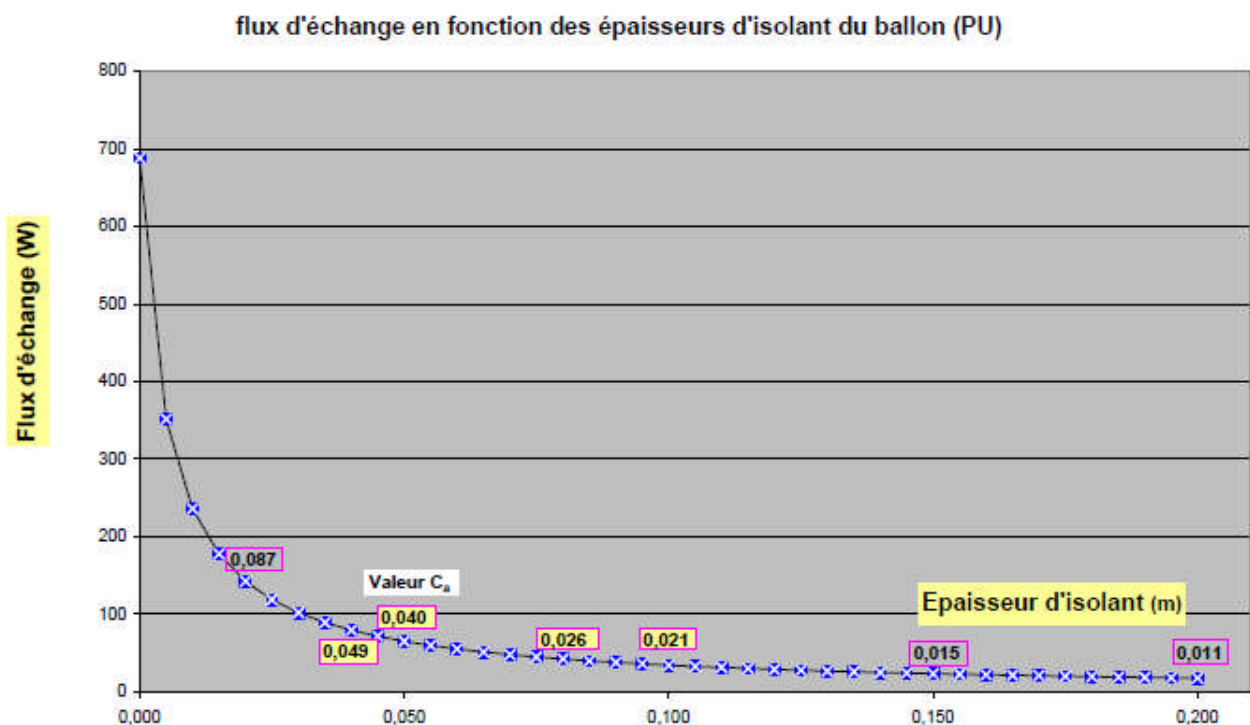
$$Ca = [\text{Exchange flux (W)}] \times 24 \text{ (h)} / [\Delta T \text{ (}^\circ\text{C)} \times V \text{ (L)}]$$

With:

- ΔT : Difference in temperatures between ambient air and the water stored in the tank
- **V** : Actual volume of tank in liters (completely full of chilled water)

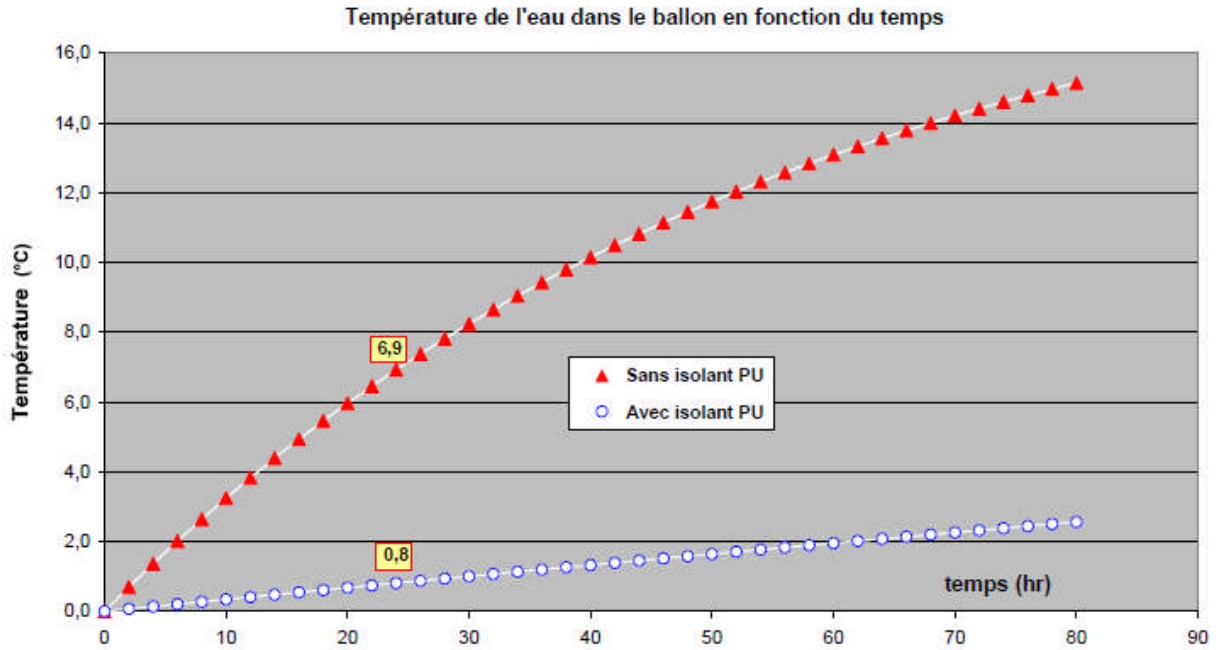
For the illustration, we have calculated * for a tank of model **2000H**:

- Exchange flux according to insulation thicknesses with several Ca values.
- Increase of the water temperature in the tank according to time (without drawing or addition of water).
- Increase of the water temperature in the tank according to its volume – reserve capacity (without drawing or addition of water).

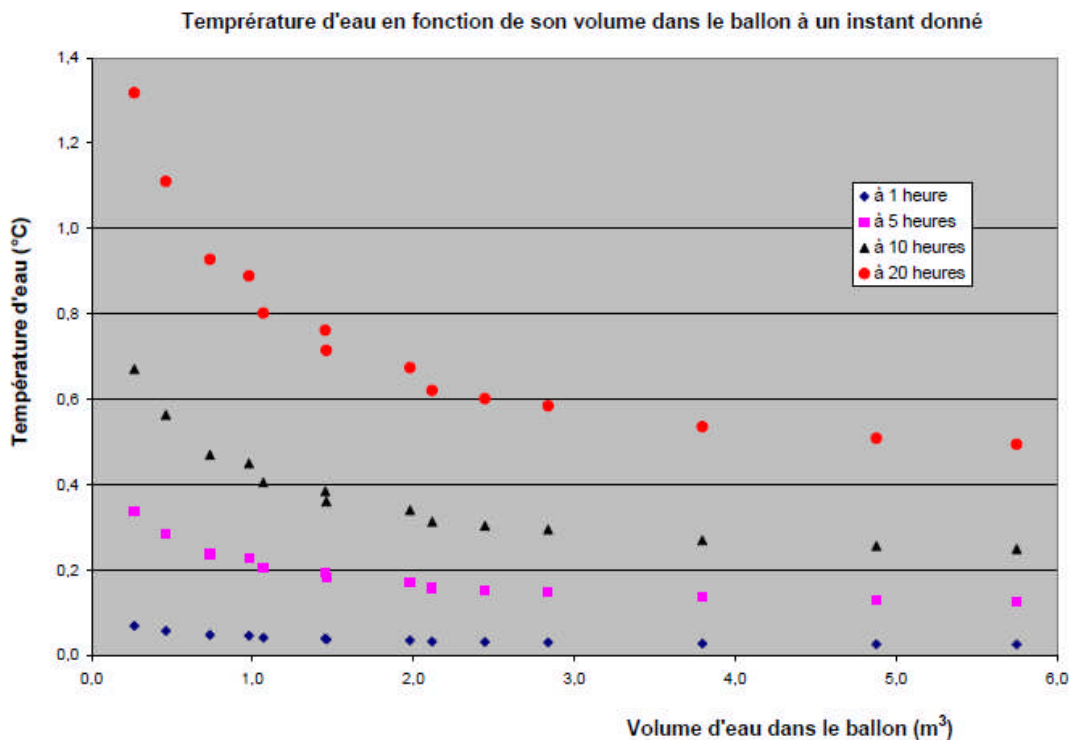


Note: From 40mm insulation thickness, the exchange flux is considerably reduced.

* Conditions of calculation: $T^\circ\text{C water} = 0^\circ\text{C}$ $T^\circ\text{C air} = 20^\circ\text{C}$

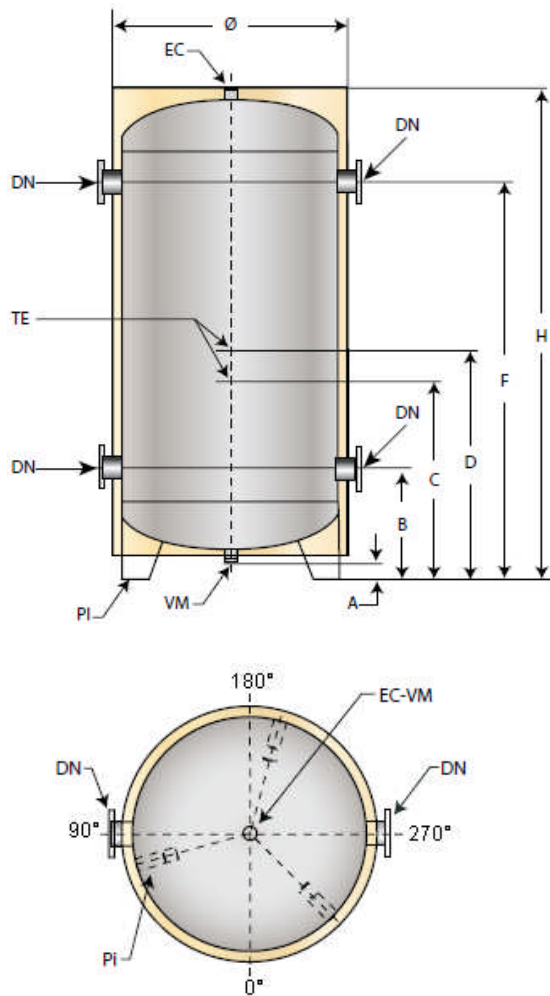


Note: For tanks without insulation, temperature rise over 24 h = **6,9°C**, whereas only **0,8°C** with an insulation thickness of 40 mm (standard).



Note: Rise in water temperature is according to the volume of water stored in the tank (**reserve capacity**) and to the type of tanks (**exchange surface**) [the case for insulation thickness of 40 mm (standard)].

4. Tank dimensions *(standard version)*



Key:

DN : Departure and return of loops
 - 50/60, 66/76 and 80/90 = threaded tapping
 - 100 and over = flat flange tapping
 PN16

TE : Tapping for thermometer and thermostat = threaded couplings 15/21

EC : Degassing or other = threaded coupling 50/60

VM : Drainage = threaded tapping 50/60

PI : Support legs

Capacité (litres)	Ø	A (mm)	B (mm)	C (mm)	D (mm)	F (mm)	H (mm)	EC VM	DN	TE
300	650	90	395	595	795	1.160	1.480	50/60	50/60	15/21
500	750	90	430	910	1.070	1.420	1.760	50/60	66/76	15/21
750	900	90	460	940	1.100	1.450	1.820	50/60	80/90	15/21
1.000 H*	900	90	460	940	1.100	2.000	2.370	50/60	80/90	15/21
1.000 B*	1.050	90	495	975	1.135	1.485	1.890	50/60	80/90	15/21
1.500 H*	1.050	90	495	975	1.135	2.035	2.440	50/60	80/90	15/21
1.500 B*	1.200	90	530	1.010	1.170	1.520	1.960	50/60	80/90	15/21
2.000 H*	1.200	90	570	1.010	1.170	2.030	2.510	50/60	100	15/21
2.000 B*	1.400	90	620	1.060	1.220	1.530	2.060	50/60	100	15/21
2.500	1.400	90	655	1.220	1.380	1.745	2.310	50/60	150	15/21
3.000	1.400	90	655	1.220	1.380	2.045	2.610	50/60	150	15/21
4.000	1.600	90	680	1.270	1.430	2.120	2.800	50/60	150	15/21
5.000	1.600	90	680	1.270	1.430	2.740	3.400	50/60	150	15/21
6.000	1.600	90	680	1.270	1.430	3.240	3.920	50/60	150	15/21

General tolerances ± 30 Tolerance on H: [± 60]

INSTALLATION

General recommendations:

During installation, you are reminded to respect and follow the following recommendations:


- The tank must be installed vertically (except specific version).
- On the upper part, provide an air vent and a degasser (on EC).
- On the lower part, connect the drainage orifice VM to a waste water drain.
- Use the orifices reference DN to make the cold water circulation loop(s).
- Use the two orifices reference TE for implantation of the thermometer or thermostat, or other means of control and measurement of temperature.
- The tanks must only be used in closed circuits with water under pressure. It is indispensable to equip the tank and the system with safety devices, particularly safety valves, calibrated to the operating pressure of the tank.
- It is equally necessary to provide a pressure holding or expansion system, to compensate for variations in water density according to temperature.
- Do not use adjustable safety valves. Use valves of dimensions adapted to the installed power and/or flow.
- The evacuation of the safety valve must not be impeded. This implies that the drainage tube has a continuous and adequate slope and is of a diameter appropriate to the system.

Connection to a «funnel type» evacuation circuit is strongly advised for visualizing the operation of the valve.

- Trade practices must be respected, particularly the assembly of the dielectric coupling to the hot water departure between the tank and the system, to avoid any « iron-copper » galvanic corrosion.
- Avoid all mechanical shocks to the tank during transport and/or handling, particularly if the ambient temperature is close to 0 °C.
- The heating elements, designed for total immersion, must never operate without water, under penalty of the immediate destruction of the tank.

Electrical connections must be made according the rules, regulations and standards currently in force at the place of installation (NF C15-100 etc.). Earthing of the tank is compulsory. The installation must include a cut-off and protection device uphill of the water heater.

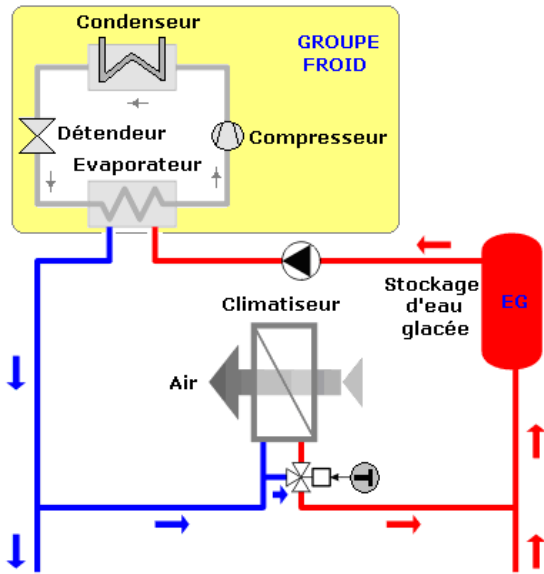
If the tank must remain out of function during the winter in a place where there is a risk of freezing, it must be drained. Disconnect the electric connection if the appliance is electrically equipped. Close the cold water inlet. Place the lever of the safety unit on the position « VIDANGE » (DRAINAGE) and open a soak-away point for the drainage.

 **N.B:** Unless otherwise specified, valves must be rated at 7 bar maximum.

Installation diagrams

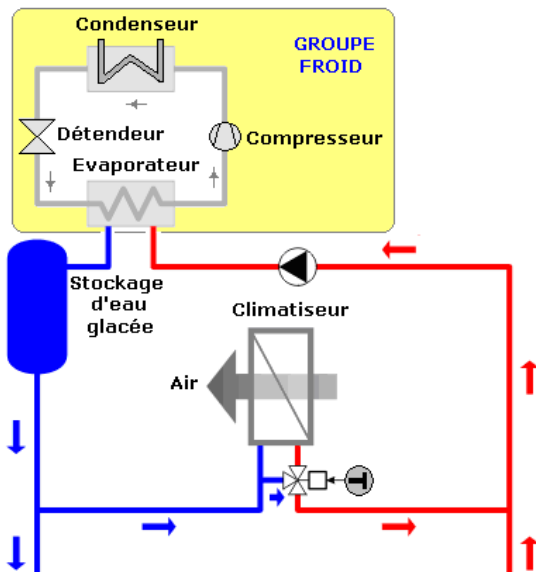
Three types of installation diagram can generally be recognized:

- a) **Storage upstream of the evaporator:** the storage tank is placed **in series** on the **return** of the chilled water (EG) from cold batteries.



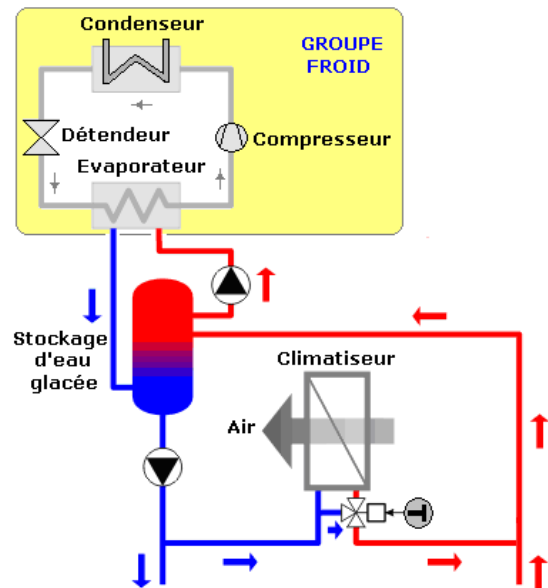
- the operation of the refrigeration unit is stable.

- b) **Storage downstream of the evaporator:** the storage tank is placed **in series** on the **departure** of the chilled water towards the cold batteries.



- the temperature of the supply water for the cold batteries is stable

- c) **Storage in intermediate position:** the storage tank is an **intermediate buffer** element, separating the chilled water production circuit from the circuit of use.



- the two circuits are hydraulically decoupled, each having its own pump. The tank behaves like a hydraulic decoupling cylinder (pressure breaker).

Tightening of the bolting of the manhole

Fixation of the inspection manhole covers (plate/companion flange) and the assembly of the bolting are completed in the factory according to an exact procedure.

However, during transport and/or handling, there is a risk of the bolting becoming loose due to the effect of vibration or other causes (e.g. temperature, pressure). The following safety procedures are therefore recommended:

- Ensure that the bolts are tightened to the recommended torque after installation of the material on site, as they may become loose during storage and/or transport.
- At the first water filling, ensure there are no leaks.
- After one month of use, ensure torque tightening and absence of leaks.

As an example, here are some recommended torques ($\mu = 0,2$):

Type TH	TH400	TH400	TH400	TH500	TH500
Joint (3 mm)	m=2,5 ; y=12	m=2,5 ; y=12	m=2,5 ; y=12	m=2,5 ; y=12	m=2,5 ; y=12
Ps (bar)	7	6	4	7	4
*Cs (Nm)	150	150	150	180	180
**Csm (Nm)	155	155	155	232	232

* Cs : *recommended torque (washer nut side + dry assembly)*

** Csm : *maximum torque (washer nut side + dry assembly)*



Warning !

The use of a new joint is strongly advised (replacement of the used joint) during the reassembly of the manhole after every opening of the tank.

WATER TREATMENT

The provision of a water treatment system against scaling and corrosion for the make-up water for the cooling circuit is necessary in order to control water quality in the circuit. Essential to correct operation, it must be determined according to the physico-chemical properties of the water used, and the operating conditions of the installation. In addition to good filtration, an open circuit water treatment must include a system for the introduction of algacide, bactericide and anti-corrosion products, an automatic de-concentration system and a possible softener. The separation of the different treatments is a requirement of controlling the operating costs and the efficacy of the treatment.

As it is a chilled water circuit (or hot water), whatever the expected production, the treatment only concerns the water introduced (**make up water**) during filling (pH neutral). An expansion system allows for the dilation of fluid.

Due to the low temperatures any corrosive reactions are much slower than in the case of heating. Nevertheless the characteristics to be maintained are identical to those of a **HWLT** « hot water at low temperature » circuit if only the water softening is not sufficient.

Effectively, even if the fill water is lightly scaling when cold (at the temperature of distribution of the mains water supply – which must systematically be the case in order to comply with local regulations) the circuit is closed; and if the inputs are none existent, the little amount of scaling likely to occur will not cause a problem because the water will be at lower temperature.

Likewise, continuous treatments with an oxygen reducer can be avoided which may always be the case if the inputs are minimal and even better non existent.

On the other hand, maintaining a pH superior to 9,5 allows acid corrosion to be combated; maintaining an excess of corrosion inhibitor must also be envisaged in the case of the presence of different materials.

In order to eliminate the risk of freezing, the addition of an anti-freeze compatible to the usage (Monoethylene glycol (MEG) is toxic*, as against monopropylene glycol) will be accompanied by a regular control:

- **Of the antifreeze content, with the aid of a refractometer ;**
- **Of the pH of the water.**

In any case, it is strongly recommended to use the water treatment procedures having the technical recommendations of CSTB (Centre Scientifique et Technique du Bâtiment: Scientific and Technical Centre for Building). Here is a link for consulting the latest publications: <http://www.cstb.fr/evaluations/atec-et-dta/derniers-atec-publies.html>

*** The average estimated lethal dose is 100 mg/kg.**

MAINTENANCE AND OPERATION ADVICE

- Do not exceed the operational and material limits mentioned in the chapter « Characteristics » (temperature, pressure, etc.)
- Use the tank exclusively in a hot or cold closed water circuit, under pressure.
- Ensure correct operation of the safety valve(s) (once a month).
- Check the functioning of the degasser (once a month).
- Check the water quality (once every 3 months).
- Examine and clean the heating elements as necessary (1 to 2 times a year).
- Ensure the water tightness of the closed circuit under pressure.
- Monitor the variation in pressure upstream and/or downstream of the tank. Ensure that the pressure is constant and there is no strong variation ($\Delta P < 1,0$ bar). Do not exceed the maximum indicated operating pressure. Check that you have followed the hydraulic connection diagram shown below.



Eventual anomalies:

Continuous water running from the safety device (valve):

- Check the pressure in the system. If this is superior to the specified operating pressure, install a pressure reducer on the main water supply.

If the pressure is correct, clean the safety valve of the safety device.

Loss of pressure in the system or at the tap:

- Important scaling. Drain the appliance, then descale and check the safety devices.

WARRANTY

Our «**GLACEO range** » of tanks from LACAZE ENERGIES is guaranteed, from the date of delivery, against perforations in continental climatic conditions and for the following duration:

- **Standard shell:** **2 years**
- **Equipment + accessories:** **1 year**

This warranty is limited to the exchange, repair or replacement (supply) in or from our factory at Leyme (46), France, of parts recognized to be defective by our technical services, in conformity with our general sales conditions. All other damage, displacement or labor costs which may result are excluded.

The replacement, repair or modification of parts during the warranty period cannot result in the prolongation of the warranty and cannot give rise to any indemnity for diverse costs or any such prejudice whatsoever.

Excluded from the appliance warranties are any deterioration due to:

- Bad electrical connection, and in particular:
 - Absence of or insufficient circuit breaking power.
 - Incorrect wiring of remote controls and operating switches.
 - Power surges.
 - Incorrect earthing of the tank and/or faults or absence of insulation.
- Supply water pressure superior to nominal pressure and/or excessive variation of pressure ($\Delta P > 1 \text{ bar}$).
- Bad handling during assembly and installation (in particular, connecting to electricity without prior filling of the hydraulic circuit; mechanical shocks).
- Overpressure resulting from the use of safety devices of which the rating is superior to the operating pressure.
- Overpressure due to the absence, or insufficiency, or bad functioning or incorrect assembly, of the safety devices, particularly the valve(s).
- Depression resulting from the absence of sufficient air during draining.
- Depression in functioning $> 0,1 \text{ bar}$ or 100 mbar .
- Faults in maintenance of the heating elements or the safety devices.
- Water treatment found to be inappropriate.
- Corrosion due to absent or insufficient degassing.
- Corrosion due to organic and/or metallic deposits coming from the make-up water system.
- Generally, failure to comply with the instructions in this manual.

PRACTICAL ADVICE

The volume of water in the system varies with the temperature. In the absence of an expansion system, this phenomenon provokes a rise in pressure until the safety devices are opened. During cooling, the pressure falls. This is why it is indispensable to provide an expansion system.

In general terms, every installation must have a hydraulic safety system against:

- Overpressure in the distribution system.
- Overpressure due to a rise in temperature (expansion during heating).
- Overpressure due to failure of a thermostat or relay contactor.

During filling, it is necessary to ensure that the air is entirely dispelled by the water. The heating elements, designed for total immersion, must never operate without water, under the penalty of immediate destruction.

The eventual electrical connections must be made according to the rules, regulations and norms in vigor at the place of installation.

On commissioning, check that :

- The drainage tap operates correctly.
- Electrical connections are correctly tightened.
- Connection characteristics are in conformity with those of the mains.
- The water tightness of the hydraulic circuit is correct. Retighten reasonably if necessary.

The set values shown on the thermostats are indicative. It may be necessary, if an exact temperature is required, to correct the settings until the desired temperature is obtained.

When draining the water heater, particularly for regular maintenance, ensure there is sufficient air entry at the top to avoid implosion of the tank due to depression.

ANNEX

Technical instructions relative to the tightening of the bolting

It is to be noted that the drafting of these procedures is based on a publication entitled « **Directives concerning the safe use of waterproof joints – Flanges and Seals** » by the **European Sealing Association (ESA)**.

Reminder of some fundamental principals

The ideal tightening of the « flange/bolting/joint » assembly is the application of a correct mounting pressure on the joint, a pressure low enough to avoid damage to the joint but sufficiently strong to avoid a leak. A precise control of the effort applied to the arrangement of a particular flange is of vital importance.

The order in which the bolts or threaded rods are tightened weighs considerably on the repartition of the pressure of the assembly on the joint. Incorrect tightening of the bolts can alter the parallelism of the flange. A joint will generally be capable of compensating for a feeble deformation of this type, but serious difficulties may be encountered if the parallelism of the flanges is very much affected.

The nuts must be tightened, whatever the tool used or by hand, **according to a CROSS tightening diagram**.

For most of the materials which make up the flange arrangement (including the joints, fixings, nuts, washers), the relaxation stabilizes after a short period. For the materials used for

supple joints, one of the principal factors is generally the phenomenon of distortion - relaxation of the joint. These effects are accentuated at high temperatures and have as a clear result a reduction of the compression pressure on the joint, which increases the possibility of a leak. Retightening of the fixings to the nominal torque at least once 24h after the initial mounting or before delivery is recommended.

Do not retighten an elastomer joint after it has been exposed to high temperatures.

Simplified tightening procedures in 3 phases (Minimum)

- Phase 1: First of all turn the nuts by hand. This allows you to check that the fillets are correct. Next tighten the nuts uniformly by hand according to the CROSS tightening diagram, at least respecting the order indicated by the figures in RED (see diagrams below).
- Phase 2 : With the aid of a ratchet wrench, tighten by hand up to 70% of the torque recommended according to the cross tightening diagram, at least respecting the order indicated by the figures in RED. Check that the flange rests uniformly on the joint [the thicknesses of the joint must be (relatively) homogenous after compression].
- Phase 3: With the aid of a dynamometric spanner, tighten to the full torque defined according to the cross tightening diagram, at least respecting the order indicated by the figures in RED.

Tightening procedure in 5 phases recommended by the ESA

- Phase 1: First of all sink the nuts by hand. This allows you to check that the fillets are correct; (if the nuts cannot be sunk by hand, there is probably a defective thread: try again and replace the defective pieces if necessary). Then tighten the nuts uniformly by hand according to the CROSS tightening diagram (see below).
- Phase 2: With the aid of a dynamometric spanner, tighten to 30% maximum recommended torque once all round according to the cross tightening diagram. Check that the flange rests uniformly on the joint.

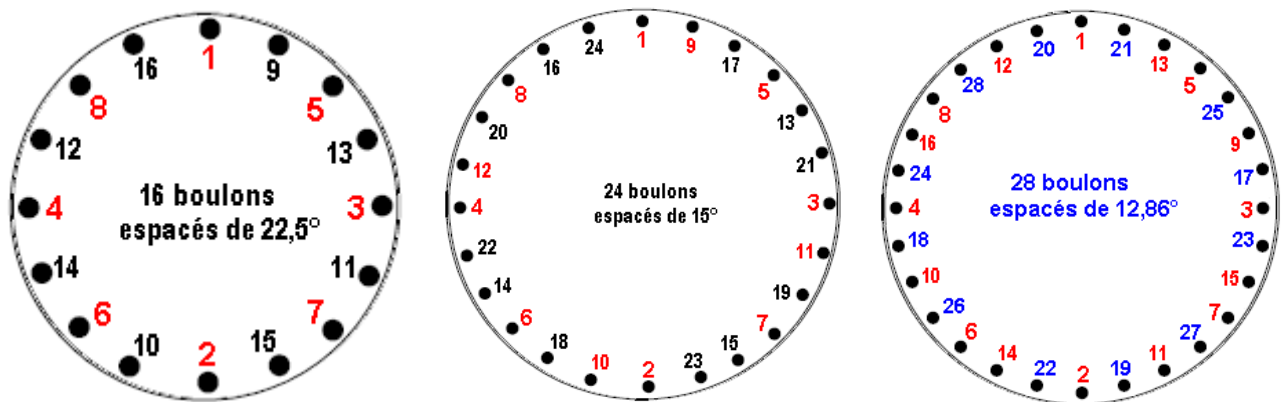
- Phase 3: Tighten to 60% maximum recommended torque once all round according to the cross tightening diagram.

- Phase 4: Tighten to the full torque recommended according to the cross tightening diagram.

- Phase 5: Final pass at full torque clockwise on the adjacent fixings.

After the five passes of basic tightening, pass 5 should be repeated until no further rotation of the nut can be observed. The final tightening must be uniform, each of the bolts taking the same load.

CROSS tightening diagram (examples)



Figures representing the order of tightening to be respected

- 16 bolts spaced at 22.5°
- 24 bolts spaced at 15°
- 28 bolts spaced at 12.86°

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