ThermoKey

Heat Exchange Solutions

TECHNICAL BULLETIN 2011-01

Good practice, tips & tricks for remote condensers installation

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A - DELIVERY AND POSITIONING

- As the condenser has been delivered at the desired location, carefully remove the packaging - handle it gently. Lift it following the lift instructions in the manual. Every lifting lug indicated has to used for the purpose.
  Do NOT push or pull or use as lifting point any pipe, return bend, manifold or piping part, fin, fan or even guard grill or any other part not specifically intended as a lifting point.
  Lift the condenser with a fork lift or any other device using the indicated lifting points ONLY.
  Pay attention to avoid contacts with the finned part: fins are very easy to get damaged.
  Whenever laying the condenser on the ground were momentarily needed, be sure the unit will touch the ground through its metal frame and NOT through any pipe or fin.

- Complete the assembly of the unit by mounting feet or supports.

- The packaging have to be adequately disposed.

- Level the unit so that the coil and the core pipes in horizontal position.
  This way correct flow of the condensing flow - and of any oil pulled by the fluid - is enabled.

- Prepare a unit base even and insulated from vibrations.
  The condenser have to be fixed to the base through screws, nuts & bolts, using the provided slots in the feet.
  Do NOT weld the feet.

- Put the condenser in a place with enough free room surrounding, so that fresh air could be effectively taken in.
  Carefully avoid short circuits between exaust - hot - air and fresh - cold - air.
  Typical “risky” locations are too close to walls, roofs, close rooms, 4 walls, any location were “hot air pool” can reasonably occur.
  Further indication may be found on the unit Manual; in case of doubt always get in touch with Thermo-key Application Dept.
  Air short circuits might significantly reduce performance of the unit.

- Do NOT install the unit in areas subject to flooding.

- External piping have to be provided so that the condenser coil is protected from mechanical stresses or temperature elongation - as described in the following.
  The condenser have to cope with its own elogation or mechanical stress - i.e.: internal pressure and temperature.

- The system designer shall design the system so that the condenser will NEVER be fully flooded by condensed refrigerant - as described in the following.

- When the location is subject to severely low ambient temperatures - below -15°C - the tips described in the following are MANDATORY to prevent damages.

- High pressure vapour line - condenser inlet line - avoid syphons, vessels, heat exchangers or any other liquid trap.
  When the system stops and ambient temperature is well below 0°C, those components would become liquid traps.

- As the condenser can’t be flooded, the external circuiting have to be designed both in shape and diameters so to empty the condenser by gravity.

- To avoid any burst risk, adequate safety devices shall be adopted - i.e. manostats stopping compressors and pop-off valves to discharge the extrapressure when above max pressure.

- **Outdoor installation:** once electrical connections have been finalized, check the junction boxes are perfectly sealed, in order to avoid water inlet and consequent electical short circuit.

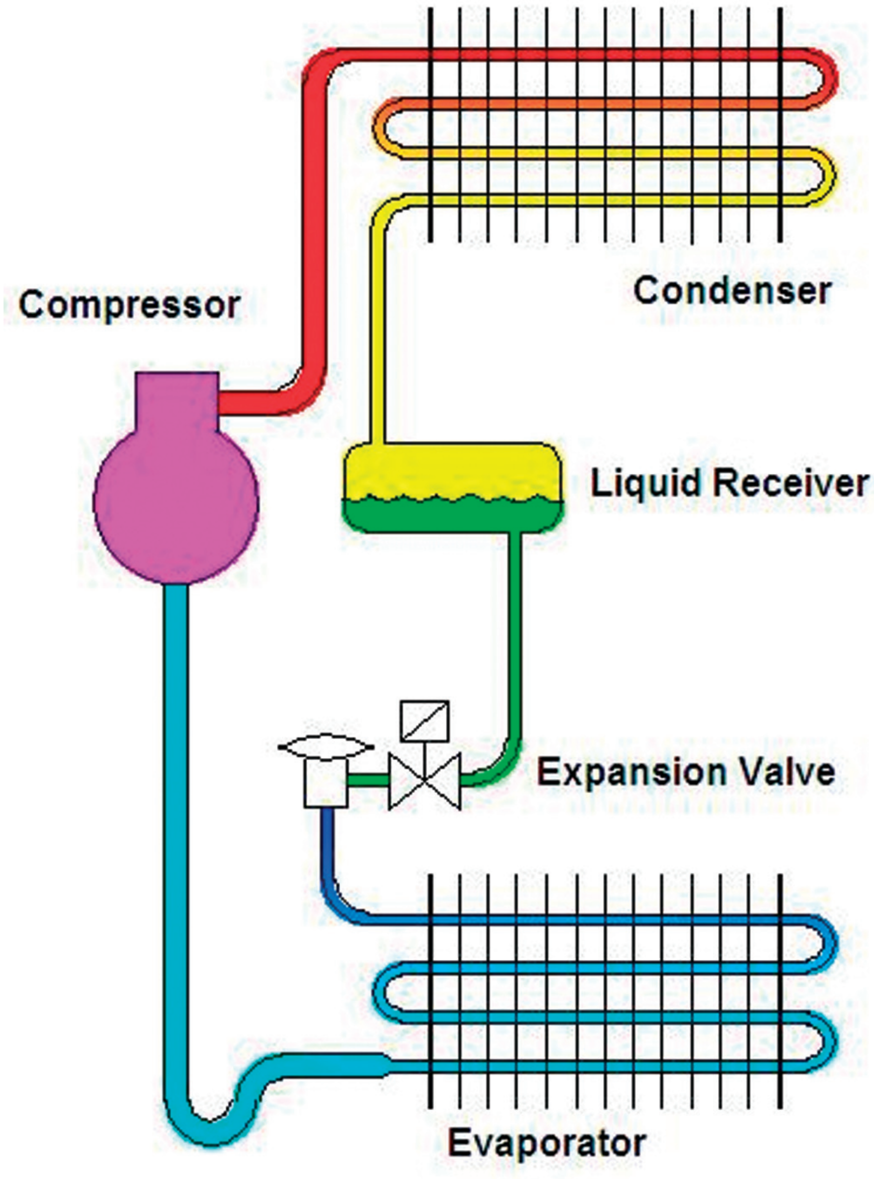
- **Maintainance plan:** put in place a periodic plan to remove dust & dirty from the finned surface.
Dust and dirty reduce the air flow through the coil, thus the condenser capacity.

- **Cleaning the finned pack:** compressed air or low pressure water can be used for the purpose.
The flow of the cleaning mean shall be adequately oriented, orthogonally to the front surface of the coil, in order to avoid accidental damage - bending - of the fins.

- Do NOT climb or walk on the condenser - unless specifically allowed by Thermokey.

B - DESIGN

Below a scheme of a refrigerating system during operation can be found.



The condensed fluid falls by gravity into the liquid receiver. This way the whole condenser coil can work in the correct way, without any extra stress which could compromise its tightness or functionality.

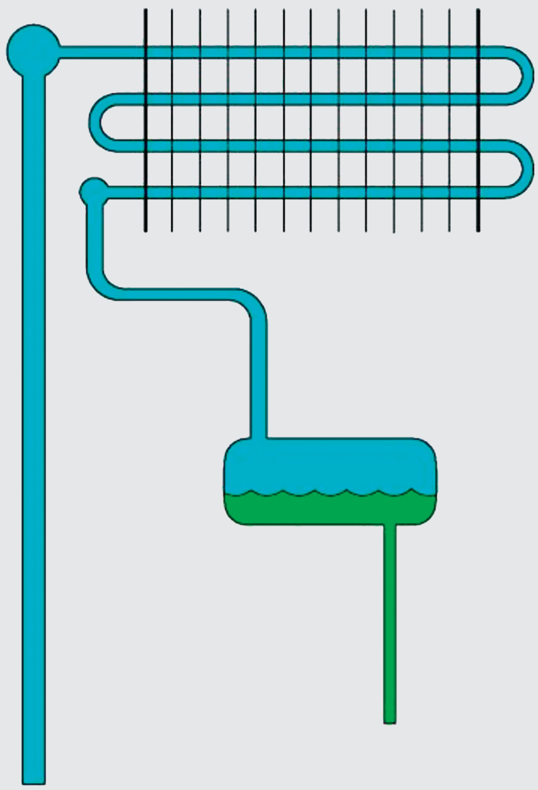
Anyway, several risks insist, during particular phases of the cooling system operation.
One of those is operation during low or very low ambient temperature.
In those conditions, the capacity of the cooling system rises very much - on the other hand the request for cooling sinks down.
Therefore the system operation is subject to long stops as the user gets the requested temperature.
In that phase of the operation - with the system stopped - migrations and flows of the refrigerant happens, i.e.: from the evaporators towards the condenser, through the compressor.
An alternative compressor can not stop the fluid flow, as its valves are basically simple no-return valves.

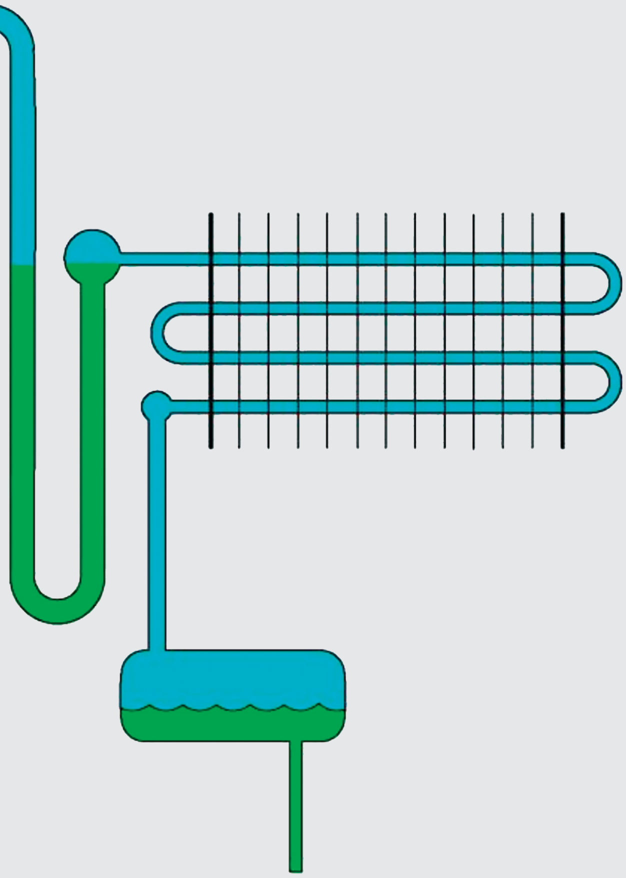
When the temperature of the evaporator is around-10°C while outdoor temperature is around -15°C, in a short time all the available vapour will migrate and will be condensed in the coldest - and thus lowest pressure - part of the system, which will be the remote condenser, located outdoors.
That liquid mass of refrigerant is not compressible and can cause severe damages to the components of the cooling system.
Those damages occur when the cooling system restarts and takes the liquid through the condenser - in the so called “slug flow” - generating severe vibrations to the core pipes and series of “water hammers” due mainly to compressor pulses - either screw, piston alternative or scroll.
Whenever on vapour line any vessel, equipment, oil separator, heat exchanger were required, then a solution to avoid fluid liquid trap occurrency is MANDATORY.

Below please find pictures of typical cooling installation.
Some of them reccomended or acceptable, the others are “risky” - by means that can cause severe trouble to the system components.

RIGHT

In the vapour pipe - condenser inlet - there are NO liquid traps.
NO liquid can be taken through the condenser when the system starts operation.



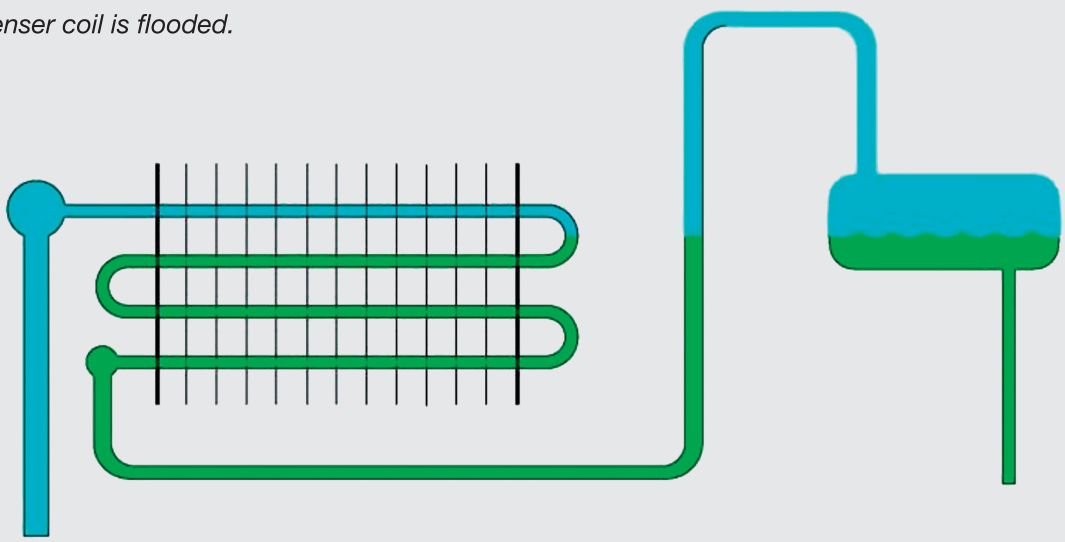


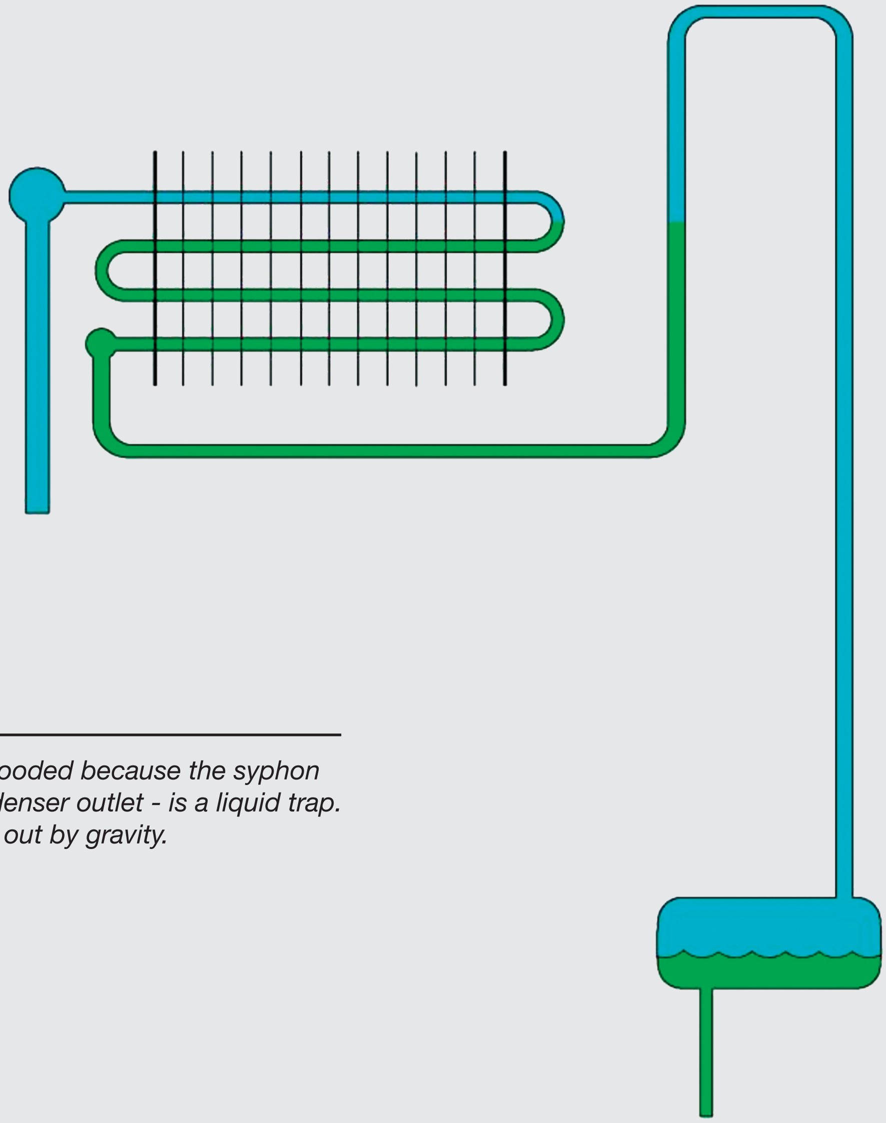
WRONG

The syphon is flooded.
When the system starts operation, the liquid will be taken through the condenser coil.
Consequent "slug flow" will stress the coil piping with vibration and "water hammer".

WRONG

The condenser coil is flooded.





WRONG

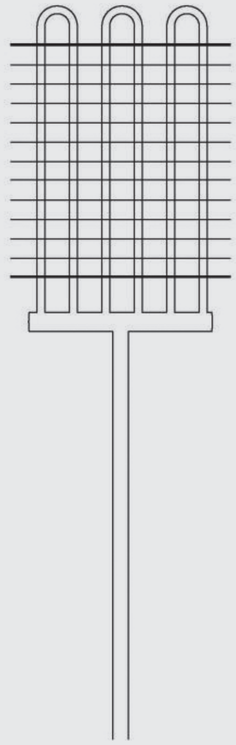
The condenser coil is flooded because the syphon on the liquid line - condenser outlet - is a liquid trap. Liquid can't be drained out by gravity.

Thus every layout that could lead to rise or entrapment of condensed cooling fluid - liquid - inside the system, with the obvious exception of the liquid receiver.
The system designer have to implement every needed tip to avoid the issue.

Other issues that could compromise the life of a condenser are stresses - mechanical, termical by dilatation and vibrational - given by external piping.

WRONG

Dilatation stress and vibrations are transmitted straight by the external piping to the coil.

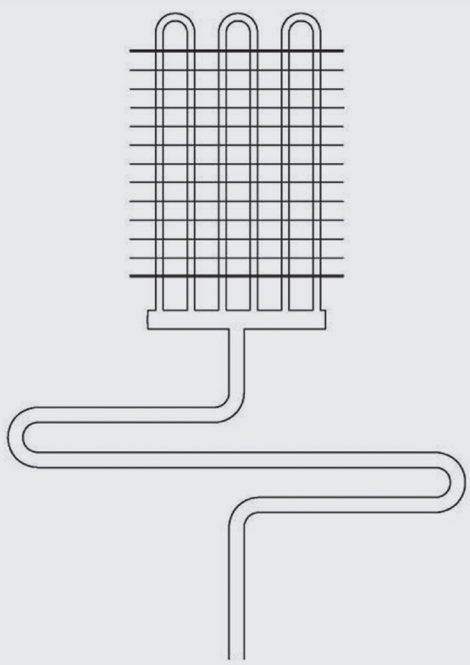


It is good practice to provide the installations with mufflers - vibration dumpers - which can assure a good dump of vibration and pulses.
In any case the external piping should have proper design in order to break the pressure waves as much as possible - i.e.: by adding changes of directions in the pipe line.

In the picture below a simple junction made to reduce the stress given by dilatations and vibrations to the condenser coil is depicted.

RIGHT

Dilatation stresses and vibrations are dumped by the external piping.



Particular attention have to be payed in the design of the external piping brackets.
Sometimes fixed points are required, in other cases the external piping will be allowed to dilatate.
About brackets points, no fix rule can be assessed because of the different location for installation.
Time to time the system designer will have to design the bracket position in order to minimize the stress to the condenser and discharge it on dedicated points.

A further danger to the lifetime of the condensers comes from eddy currents. Usually remote condensers are located outside , directly exposed to external agents. Thus are good receivers for electrical currents.
The grounding net have to be built in such a way that no electrical difference of potential sussist between the condenser casing and the core piping, even in the occurrence of a close lightning, of a dispersion from a unit component , or of induced currents.
The metal components of the coil - when conducing current - could get weakened or corroded very quickly. Current passing from the casing to the pipe and then to the ground or viceversa can result very harmful towards the condenser lifetime.