

# COLD STORAGE SYSTEMS

## **Introduction**

With this document *MGM Engineering & Contracting* wishes to provide a brief overview on the advantages that cold storage systems can offer.

As fossil fuels reserves keep decreasing, it becomes interesting to create cold storage systems which allow to reduce energy consumption in industrial and large size commercial and residential applications (like airports, for example).

This way the main machinery (i.e. chillers) could be sized to cover the base load, instead of the peak load. The peak load, which occurs for a short time during the day, could be sustained by cold storage systems.

Furthermore, exploiting the difference in electricity price between day and night, cold storage systems can be loaded during the night, when electricity price is low, and then discharged during the day, when peaks of refrigeration power occur. This grants optimal economic operation and substantial savings.

## **Storage systems**

Chilled water is used in cooling processes for industrial and HVAC applications and is commonly produced by compression and/or absorption cycle machines, which respectively require electrical and thermal energy.

The mainly used temperatures for chilled water required by the user are:

- Inlet 12°C
- Outlet 7°C

The right amount of chilled water at the desired temperature can also be obtained by means of cold storage systems.

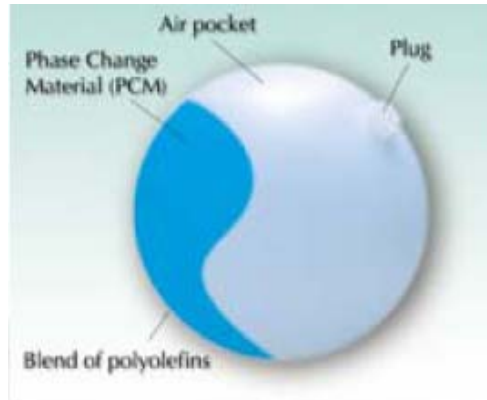
Cold storage systems operate in cyclical phases. They accumulate cold produced by chillers when users are low or off; stored cold is released when users demand exceeds production, or when chillers are turned off.

Two storage technologies are commercially available:

1. Cold storage through eutectic salts.
2. Cold storage through heat exchangers with ice formation.

## **Cold storage through eutectic salts**

*Cold storage through eutectic salts* allows to store cold by freezing nodules filled with eutectic salts (figure 1) and contained in a vessel (figure 2). The nodules also contain air beside eutectic salts. Vessel volume ranges between 2 and 100 m<sup>3</sup>, while modular solutions are possible to meet greater customer needs.



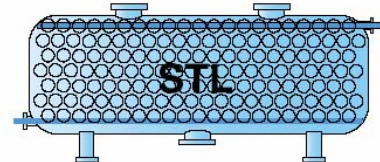
**Figure 1**

During the loading phase, refrigerated water flows through the vessel, cooling the eutectic salts nodules and thus storing the required amount of cold. The nodules freeze without increasing their volume (which would instead happen for water).

In the discharging phase, return water from the user will pass through the vessel melting the nodules and getting cooled.

The contact area between the water from the user (or refrigerated water) and the eutectic salts is given by the external surface of the nodules.

This system causes high pressure drops because of the tight packing of eutectic spheres in the vessel, as shown in figure 2. Therefore there is need for higher pumping power, compared to the other cold storage system.



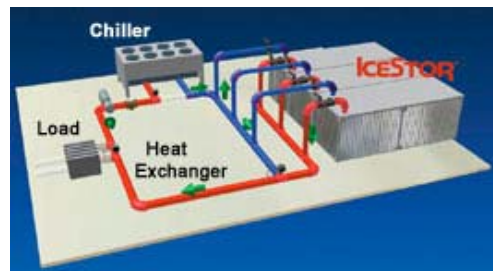
**Figure 2**

***Cold storage through heat exchanger with ice formation***

*Cold storage through heat exchangers with ice formation* makes use of thousands of little polymer tubes (figure 3) sunk in a tank filled with water.



**Figure 3**



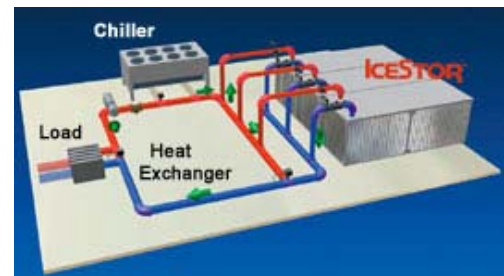
**Figure 4**

During the loading phase (figure 4) the tubes are filled with glycol water, cooling the water around the tubes, and therefore causing ice to form.

This way ice nucleation begins on the external surface of the polymer tube and extends until ice saturates the space in the tank.

During the discharge phase (figure 5) return water from the user passes through the tubes and cools by melting the surrounding ice.

This second solution allows lower pressure drops through the storage tank, since water flows through tubes rather than through a packed bed.



**Figure 5**

### **Conclusions**

Cold storage is useful in applications where high peak loads occur, compared to the mean load. In such cases the main equipment (compression and absorption chillers) would be oversized to cover the peaks, leading to higher investment, operating and maintenance costs.

Cold storage can also be used as an emergency back-up when the main chillers aren't available. In this case the main cold users would be covered for some time before stopping. This time depends on the installed capacity.

Therefore, correct storage system sizing depends on a technical and economic optimum, once the load curves of cold users are known.

***MGM  
experience and  
services***

Cold storage is a part of the know-how of ***MGM Engineering & Contracting***. Our experience in the field allows us perfectly tailoring investments on the customer's needs.

***MGM Engineering & Contracting*** can offer the customers complete projects and engineering services, thanks to managers and technicians with long time proven experience in the energy area.

Consulting, engineering and expert services can be provided to energy and utility companies, municipalities and power plant investors. Fields of expertise include, integrated or separately, the following:

- Technical and economical feasibility studies
- Investment cost definition
- Owner engineering
- Conceptual and basic design
- Front-end engineering
- Detail engineering, including all related technical disciplines
- Design review
- Procurement, including purchasing, sub-contracting, expediting, inspection and logistics
- Tender evaluation, negotiation and contract preparation
- Construction management, including field supervision and testing
- Plant commissioning and start-up, including personnel training
- Project management, planning and cost control
- Proposal management and bid document preparation
- Energy audit and services
- Permits, authorizations and certifications