CRYOGEL

Ice Ball Thermal Storage

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A quick bulletin about our Airport projects. Airports demand and pay well for high quality equipment. We have systems in LA, San Francisco, Atlanta, Chicago, Miami, Ft. Lauderdale, Phoenix and Dallas Ft. Worth airports. In fact we are completing our sixth system at Miami International. They airports and engineers responsible keep repeating with Cryogel for good reason.

Project Bulletin

Repeat Installations - Since 1996
A Strong Indicator of Ice Ball Product Quality and Reliability

Below are photos of Cryogel's sixth installation since 1996 at just one well-known International Airport - currently under construction.

Cryogel Ice Balls have been operating at eight (8) major airports in the US since Cryogel introduced its thermal energy storage (TES) for this demanding application. Cooling loads at airports, especially those for aircraft, are highly cyclical as aircraft arrive and depart. This is one reason that airports demand the highest quality equipment available.

This latest project is 9,500 ton hours using six (6) ASME Code steel tanks.

During the past 15 years, Cryogel has shipped over 20 Million Ice Balls

Thermal Energy Storage - Airlines Reduce Operating Costs with Ice Balls

Repeat Installations Keep Design Costs Down and Reflect Operational Satisfaction

You are sitting in a wide-body aircraft on a hot, humid afternoon at Miami International Airport. You are shoulder to shoulder with a couple hundred people and the doors of the plane are open as the ground crew loads up the soft drinks and peanuts for the flight. Even though the plane is on time, you know it may be a while. Fortunately, that little nozzle above your head is blasting out cold air. How do they do that? How can they afford to keep so many people cool in a confined space with the doors open? The answers can be found in PCA (preconditioned air) and TES (thermal energy storage).

In the past, an airplane's auxiliary power unit (APU) was called upon to supply cooling. The APU is a small jet engine designed to provide cooling, electrical power and, in some cases, power to start the main engines. These engines consume between 35 and 120 gallons of jet fuel per hour. In addition to high fuel costs, the APU is subject to costly FAA approved maintenance based on hours of operation.

The economic and practical necessities of shifting air conditioning loads away from costly APU engines led to development of the PCA system. The economics of electrical power to run PCA chillers led to the addition of thermal energy storage.

PCA ducting under Jetway

As compared to typical air conditioning systems, these installations are designed for the most extreme demands. The most obvious extremes are those associated with high short-term loads imposed on the system while the aircraft is parked followed by no-load conditions when the plane departs. In addition to the "peaky" intermittent demands for cooling, PCA systems normally use 100% outside air for cooling and ventilation. Of course, this means high temperature air (and often very humid air) must be cooled without the benefit of recirculation - remember, the doors are open.

To accomplish the task of managing such extremes in an economical manner, water-cooled industrial grade chillers are combined with thermal energy storage in a low temperature glycol loop. The system supplies aircraft with a large volume of relatively high-pressure air (22 inches of water) at the low temperature of approximately 30°F. In order to meet such unusual conditions, cold fluid from the glycol based system is delivered at about 20°F. Thermal storage not only flattens the peak loads inherent with such an application but also allows the use of lower cost off-peak electricity to charge the system at night.

Cryogel Ice Ball Thermal Storage Tank

Exact details of the low temperature water-ice process are proprietary and both the key system components and Cryogel Ice Ball™ thermal storage media are protected by patents.

Since 1995, ten PCA systems using Cryogel Ice Balls have been installed for major airlines at the international airports in Atlanta, Miami, San Francisco, Los Angeles, Chicago, Phoenix, Ft. Lauderdale and Dallas/Ft. Worth. Miami International Airport alone has five Cryogel systems and is installing a 9,500 ton hour system for standard air conditioning service. The simple fact that airports continue to install these systems is the strongest single indicator of the economical operation and reliability of the combined PCA/TES concept.

By: Victor J. Ott, P.E.
President of Cryogel, San Diego, CA http://www.cryogel.com/

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Thermal Storage - Bulletin

Cryogel Ice Balls - Below Grade Thermal Storage

- Thermal energy storage tanks can be placed below grade to save money and valuable space and to preserve building aesthetics.

- Tank manways can be completely covered with concrete, asphalt or landscaping because the tanks are fully sealed and need not be vented to atmosphere as with concrete tanks or other thermal storage systems.

- Auto and truck traffic above tanks is acceptable. Tanks can be placed below parking lots, lawns, or playgrounds.

- Buried tanks and piping are not susceptible to vandalism or tampering and do not represent an "attractive nuisance" liability.

- Thermal storage is possible in situations where there is simply no room for above grade storage tanks and exposed piping.

- Steel ASME Code tanks do not require plastic liners as are necessary with concrete tanks. Proper external insulation and vapor barriers are standard and less complicated than that required for buried concrete tanks. Concrete settlement or crackings due to seismic activity are eliminated.

- Overall costs for below grade pressure vessels are now coming in lower than for buried concrete tanks.

- Recent quotes on a 2,000 ton hour system for a grade school show pressure vessels to be nearly $100,000 less expensive than a concrete tank installation with similar storage capacity. Schedule delays associated with curing time for concrete tanks and foundations are eliminated.

Below is an example of a campus type district cooling system installed in 1992.

Pressure Vessels

Below Grade

Approx. 10,000 Ton Hours

Four (4) Tanks

12 Feet in Diameter by 60 Feet Long - Each

First of four tanks set on sand base.

Notice tank manways and Insulation

Completed Installation.

All that is visible are the manway covers.

Manways can be completely covered and hidden with concrete or asphalt if desirable.

Driveway and parking area are rated for truck traffic.

Thermal Storage System Project Bulletin

This system was installed in 1997. As you may know, the US Dept. of Health has also installed other competitive equipment. We were told that Cryogel was the most successful.

Engineered Systems Magazine (ES) has picked up this article. In the ES article, the U.S. Department of Health and Human Services project manager, identifies this Cryogel system installed in 1997 as, " his agency's most successful thermal storage project to date". Their article can be found at:

http://www.esmagazine.com/CDA/Article_Information/Case_Item/0,2534,64212,00.html

Thermal Storage Retrofit - Existing Storage Tanks Converted for Ice

Federal Office Building shifts peak demand and gains emergency cooling for computers.

Chicago, IL .... Citing nearly 5 years of reliable, trouble-free operation, a Federal project officer has identified this system as his agency's most successful thermal storage project to date. The system stores cool energy in the form of ice during the night when the price of electricity is low. The ice is used the next day to provide air conditioning and to act as emergency back-up cooling for computers at the Harold Washington Building on Madison St. in Chicago.

The most unique feature of this system is that existing water storage tanks were converted to ice thermal storage. Significant cost savings were achieved by altering four 8,400 gallon tanks measuring 6.5 feet in diameter and 36 feet long.

Midwesco Mechanical fitted the existing steel tanks with internal distribution piping and then loaded the tanks with Ice Balls manufactured by Cryogel in San Diego, CA. http://www.cryogel.com/

By converting to ice, the system is capable of 1,960 ton hours of storage capacity as compared to about 400 ton hours as would be possible from chilled water storage.

Ice is produced over a period of 8 hours during off-peak night hours. Chillers operating at a capacity of 250 tons, cool Wintrex heat transfer fluid supplied by Houghton Chemical of Boston to an average temperature of 22.2°F. That cold fluid is then circulated through the storage tanks and Ice Balls to make ice and store energy until it is needed during the afternoon when air conditioning loads peak.

Mr. Bill Davis, P.E., Midwesco Project Manager, noted that, "thermal storage allowed us to eliminate two 25 ton chillers and reduce maintenance costs by $4,000 per year while maintaining the cooling redundancy required by the government". "Retrofitting existing tanks and upgrading the storage capacity of chilled water systems is an increasingly popular approach to thermal storage because of the obvious cost savings on tanks", according to Cryogel sales manager, Bruce McDavid. McDavid points out that, "in the case of chilled water thermal storage, a relatively simple retrofit to ice allows for storage capacities to be increased by as much as 4 to 5 times".

Ice Ball is a trade name of Cryogel, San Diego, CA http://www.cryogel.com/ tes@cryogel.com

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Thermal Storage System Project Bulletin

This is an older project near LA. We won against a competitor who installs small, multiple tank systems. In this case, you can see that a "tank farm" would not fit in the enclosure.

Thermal Energy Storage
Cryogel Press Release

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Project Bulletin - August, 2004
College Campus Thermal Energy Storage - 8 Years Old

This Cryogel Ice Ball thermal energy storage system was installed in 1996. High quality tanks resist effects of sun and weather.

This tank is 36 feet tall and shows the value of using tall atmospheric tanks to minimize storage tank space requirements. This single tank approach minimizes piping and balancing costs and complexity.

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Thermal Energy Storage - Dodging the Energy Crisis

Engineering Foresight and Thermal Storage - Looking Back After 10 Years

In 1990, construction began on a 24 story, 430,000 square foot office building known as 801 Towers in downtown Los Angeles. As means of shifting peak loads and qualifying for incentives and off-peak rates offered by the Los Angeles Department of Water and Power (LADWP), the building was designed to include 8,300 ton hours of thermal energy storage (TES). As installed, the system is actually capable of approximately 11,000 ton hours of capacity, which in hindsight, was a stroke of engineering prudence that has paid off as the California energy crisis drags on.

Flack and Kurtz of San Francisco, the principal engineer, and the Los Angeles Department of Water and Power (LADWP) may not have seen the current crisis coming. Looking back today, however, this system has proven to be a prime example of engineering foresight. The engineer, building owner and local utility designed in flexibility to deal with the uncertainties in electrical supplies that are now exacerbated by deregulation of electricity markets. Leadership shown by LADWP with incentives and off-peak rates was part of an overall business plan that has shielded customers in that service territory from many of the problems faced today by ratepayers elsewhere in the State. Energy supply uncertainties and the need for design foresight have become the norm in California and promise to spread nationwide and to continue for some time to come.
http://www.cryogel.com/

801 Towers during construction

After incentive payments from the LADWP, the system cost approximately $640,000 more than a non-storage air conditioning system. With the capability to shift approximately 2,000 kW of electrical demand to off-peak periods, the additional costs amount to approximately $320 per kW of peak electrical demand reduction. The net installed cost was approximately $58 per ton hour of actual thermal storage capacity. This cost per kW represents a bargain compared to the cost of new generation capacity currently under consideration by electricity suppliers in the U.S. and in developing international energy markets.

Inside the storage tank before filling with Ice Balls

The system includes a 180,000 gallon concrete tank with a polyethylene liner and approximately 750,000 spherical ice containers (Cryogel Ice Balls™) as well as two 700 ton, Trane three-stage centrifugal chillers. The tank is located three levels below the street and adjacent to the underground parking garage. The roof of the concrete tank is formed by a ramp that connects two garage levels. As with most civic centers, parking is a premium in downtown L.A. This tank configuration and ice storage technology was chosen because the tank could be installed in a manner that would not consume parking spaces in the garage. Eight years after initial start-up in 1993, the system functions virtually unknown and invisible to visitors and tenants of the building.

The concrete tank was fitted with a one-eighth inch thick polyethylene liner to prevent leaks in the underground concrete tank due to normal thermal expansion and contraction. The liner also allowed for one and one-half inches of Styrofoam board insulation between the liner and the internal tank wall. This unique solution to insulating an underground tank offers double-wall leak security as well as a vapor barrier for the insulation.

Today, engineers and utilities across the country have seen the effects of deregulation in California. They have the benefit of studies done by the California Energy Commission which show thermal storage as both a conservation tool and an environmentally friendly and economically attractive alternative to new generation capacity. Today's designers also have the benefit of years of proven success with TES systems and equipment. Designing in the flexibility to deal with future uncertainties in electrical supply and prices is not only a prudent HVAC engineering decision, it is also prudent energy policy. Time-of-use rates, real-time-pricing, time sensitive meters and thermal energy storage have proven benefits and deserve greater attention as policy makers search for solutions to the energy crisis.

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Cryogel Ice Ball System Advantages

Flexibility and simplicity:
Atmospheric or pressurized tanks. Steel or concrete tanks. Tanks may be nearly any size or shape to fit site constraints - cylindrical, rectangular, horizontal or vertical.

Direct burial option:
Allows for installation in areas where space is expensive. Installations will support overhead traffic.

No possibility of over-charging when making ice:
No ice caps, no ice bridging, no flow channeling, no tank deformation, no extra ice-limiting controls.

Single tanks vs. tank farms:
Smaller foot print - reduced balancing or multiple tank piping costs - positive air purge from glycol loop.

High heat transfer surface:
For more efficient ice making or melting. More than 22 sq ft per ton hour for Cryogel as compared to significantly lower surface area for most ice-on-coil equipment

Low pressure drop:
Typically less than 5 psi total. Allows the use of ethylene glycol or more viscous, non-toxic propylene glycol while minimizing pumping costs.

Retrofit applications with existing tanks:
Cryogel Balls may be installed in old chilled water tanks to increase capacity - or in other existing tanks.

Redundancy and reliability:
Ice Balls are independent storage units - no tubing, fittings or possibility of a single internal tube leak causing system shutdown. No biocide requirements.

Installed cost savings and simplicity:
Less cost for piping, balancing, valves, controls, real estate, concrete pads, foundations, etc. No air compressors or bubblers with associated parasitic power costs.