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First Cryomodule Delivered for LCLS-II | 28

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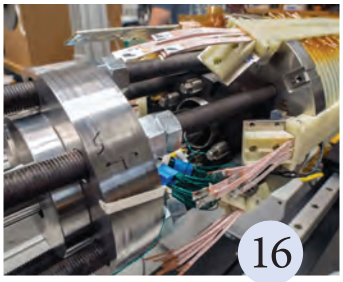

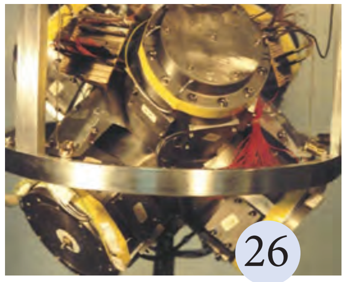

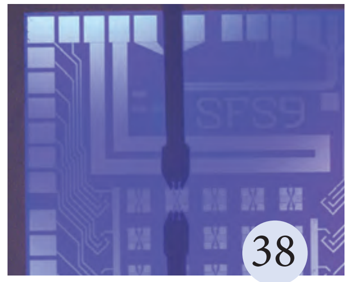

FEATURES

COLUMNS

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ON OUR COVER

The first of 37 new cryomodules has been delivered to SLAC National Accelerator Laboratory for its planned LCLS-II upgrade. The cover photo shows the unit at the Cryomodule Test Facility at Fermi National Accelerator Laboratory (CSA CSM), where 22 of the modules are under construction. Read more on page 28. ■

In all instances, "CSA CSM" indicates a Corporate Sustaining Member of CSA.

DID YOU KNOW?

Dr. Ray Radebaugh will return to the podium once again for CSA's Foundations of Cryocoolers Short Course, presented June 18 before ICC20. Joining Radebaugh is Dr. Peter Shirron. Register today: **http://2csa.us/shortcourses**.

CSA's Cryogenic Safety webinar series drew 329 registered attendees. Access archived sessions at **http://2csa.us/webinars**.

Dr. J.G. Weisend's new book "He is for Helium" is now available on CSA's website: **http://2csa.us/he**. It's an invaluable resource for anyone wishing to expand their knowledge of the "must know" terms for work in cryogenics. ■

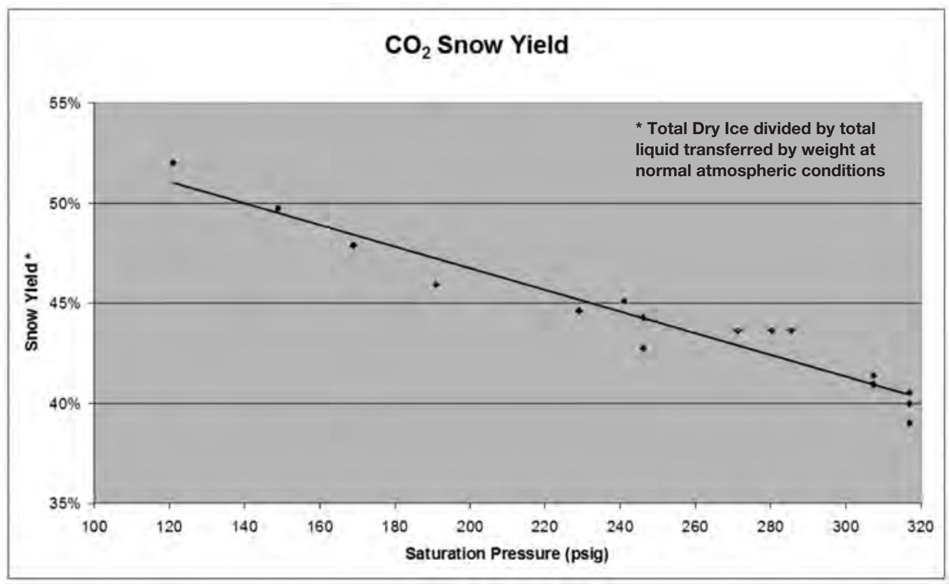
Creating a Competitive Advantage with Chillzilla CO_2

by Tim Neeser, VP marketing and customer service, Chart Industries, tim.neeser@chartindustries.com

Liquid carbon dioxide has become more abundant and readily available over the years, thanks to an increase in the production of ethanol and other chemical processes where CO_2 is a byproduct. Capturing CO_2 and processing it for applications like food chilling and food freezing is now an everyday global occurrence, and several advances have been made in recent years.

A good example involves the use of CO_2 for food chilling in the meat processing industry. For years, the standard process for chilling meat at sausage factories was to create a mixture of fresh meat and auger in mechanically frozen meat to get the right consistency for the sausage making process. A financial analysis conducted at one such company showed that it was more cost-effective to inject liquid CO_2 into the fresh meat, lowering its temperature as the liquid flashed to dry ice. With this method, the sausage company in question could now use 100 percent fresh meat, streamlining its processes and increasing productivity. The additional cost of the liquid CO_2 was offset by the energy savings and the material handling of the mechanically frozen meat.

And now, advances in bulk storage can not only increase this productivity and savings, but also reduce CO_2 emissions per unit of food processed. One such advancement is ChillZilla CO_2, a new product from Chart Industries that incorporates key features to subcool the liquid to 120 psig (8.3 barg) before it is dispensed to atmosphere. The system maintains the tank top head pressure at 300 psig (20.7 barg) so the downstream equipment does not need flow rate adjustments.



Dry ice snow yield at atmospheric conditions as a function of saturation pressure for liquid CO_2. Image: Chart

It is a thermodynamic fact that dry ice yield increases if liquid CO_2 is cooled to a lower pressure and temperature. For example, at a saturation pressure of 120 psig (8.3 barg, -44°F/-42°C), the amount of dry ice produced when flashed to atmosphere increases to 51 lbs. (23.1 kg) per 100 lbs. (45.4 kg) of liquid.

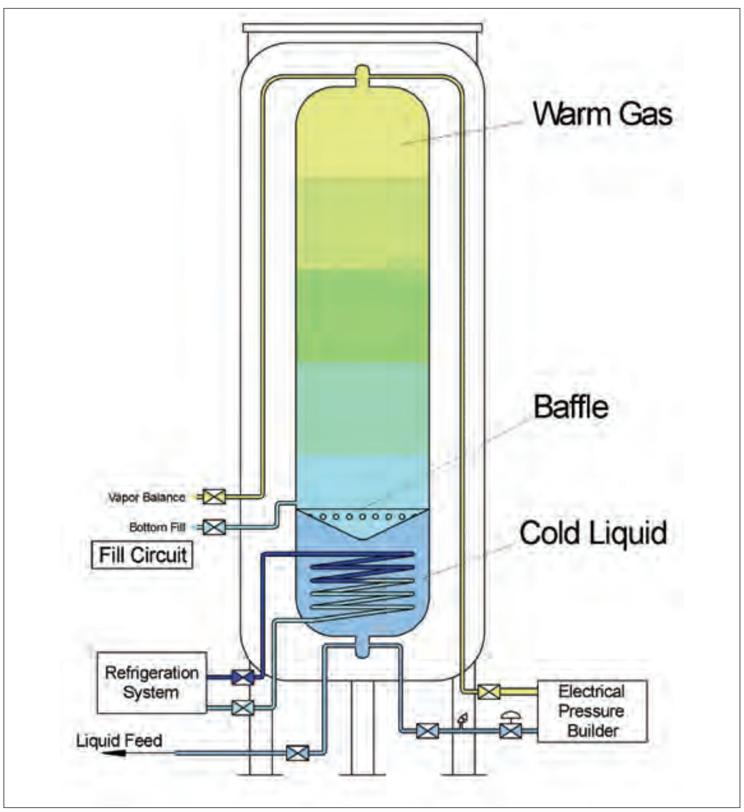
By chilling the liquid in the tank bottom with an internal heat exchanger and an external high-performance refrigeration system, the ChillZilla CO_2 system effectively yields up to 24 percent more dry ice than traditional storage systems.

The equipment historically used for storage includes a foam or vacuum insulated bulk tank with a high-grade carbon steel inner material. For example, an SA-612 inner pressure vessel material is used for liquid CO_2 storage under the provisions of ASME section VIII, division 1, part UCS; and safe management of a depressurized tank is achieved using the guidelines described in

CGA pamphlet G-6.7. Along with the storage tank, an installation like this should include high pressure vacuum insulated pipe to deliver the liquid to the application. In this typical set-up, the dry ice yield is about 41 lbs. (18.6 kg) per 100 lbs. (45.4 kg) of liquid when dispensed at 300 psig (20.7 barg, 0°F/-18°C) to atmosphere.

At a usage rate of one truckload of liquid CO_2 per day, a sausage company could not only increase dry ice yield by 10 lbs. per 100, but also could enjoy a net savings of $5,000 per month if it chose to use a ChillZilla system instead of traditional storage equipment. This calculation assumes 21 tons per day with a liquid CO_2 cost of $75 per ton, plus $.10 per kWh for electricity to run the chiller and pressure builder and an extra few dollars for chiller maintenance.

Several key features help drive the production increases and savings, including the internal liquid temperature sensor that controls the chiller functions to maintain the liquid at a lower subcooled pressure. Others include an internal baffle, located above the heat exchanger but below the bottom fill line, designed to keep the CO_2 truckload refill (typically hot at 250 psig/17.2 barg) from mixing with the chilled liquid that is staged for use to the application. The system also includes Chart's Python VIP liquid feed line and a stainless steel electric pressure builder designed for low temperature input, making the ChillZilla system installation ready. And finally, because the inner vessel will see low temperatures beyond the traditional carbon steel material limits, the ChillZilla is built with a pressure-strengthened T304 stainless steel inner pressure vessel. The corrosion resistant stainless inner vessel offers purity advantages over the life of the tank in food applications. **www.chillzillaco2.com** ■



ChillZilla CO_2 principle operating schematic. *Image: Chart*