



The 500 m² cold storage room at Malati Dairy in Limpopo

How to win the **cold war**

by Liza Burger

Proper cold storage of dairy products revolutionised the industry a century ago. The technological advances since then have extended the shelf life of fresh dairy products by several days.

Refrigeration in itself is a rather simple tool in preserving perishables such as dairy.

The economic importance of keeping the cold chain intact is obvious; therefore, the processor or distributor as well as retail outlets should pay enough attention to the design, building and upkeep of their cold storage facilities.

Understanding the cold chain principle is simple: A cold chain is the specific supply line, which is maintained at a low temperature environment to maintain safety, minimise deterioration, and prevent pollution of products, including manufacturing, transportation, storage, distribution, and retail, to the end user.

The three-T principle for cold chain management includes the products' reaction to:

- Time spent on transportation
- Temperature
- Tolerance to higher temperatures.

Cut on cold costs

Apart from the initial capital outlay to construct or install the cold room, the biggest expense will be the energy bill associated with keeping a large room cold. In his paper, *Energy saving opportunities in food cold chain*, Dr Zhongjie Huan, a mechanical engineer and professor at the Vaal University of Technology, points out that large amounts of energy are consumed by cold storage facilities. The energy consumption of these facilities range between 370 and 560 kWh per square metre annually and between 8 and 120 kWh per cubic metre annually for cold stores of sizes between 900 and 2 500 m².

The size of the cold-store room is of great significance in relation to the energy consumption for different sizes of cold stores. The rule of thumb is:

Room size (m ³)	Energy consumption (kWh/m ³ /year)
10 000	100
1 000	200
100	600
10	1 500

The selection of a basic refrigeration and compressor system for a specific purpose is essential. The coefficient of performance for the split and central systems with one or two stages may vary from 1,15 to 2,05 for a cold store operating at the temperature range from -25 to -30°C.

Although dairy storage facilities needn't be this cold, this indicates the significance of selecting the right equipment to do the job right. The same goes for using reputable companies, engineers and technicians in constructing and maintaining of a cold-room facility.

Control cool air

As with any refrigerator, cold air escapes through open doors. If the traffic through the cold room door is not controlled, the refrigeration load can increase by as much as 15%. Enclosed or chilled loading bays can decrease the energy demand, but basic door discipline remains the first priority of all staff. The automated opening and closing of doors is still the most efficient way of preventing cold-air losses.

Maintaining a cold room facility in the 40°C summers of Gravelotte, in Limpopo, is one of the challenges Malati Dairy faces. Leon Thom, milk producer, processor and distributor of dairy products enlarged the Malati cold room to 500 m² in 2008 owing to improved sales and a greater need for their products.

The new storage facility was built over the two previous cold rooms and the floor was levelled. "This makes it easier to move pallets and products, since the whole room is now on one level," says Thom. The cold room is now 25 m long and 20 m wide and has six loading bays.

"These doors are small to prevent cold air from escaping and we only have one large sliding door for bigger forklift loads on pallets."

Keeping the cold chain stable from the onset is one of Malati's secrets. First, the milk is cooled, then bottled and then stored in the cold room, entering the storage space at 3°C. Yoghurt and drinking yoghurt follow the same route. Amasi is bottled and after 14 hours at 25°C, packed in the cold room where it is cooled down to 2°C. About two tonnes of Amasi is packed every day.

Getting the dairy products to the cold room is done by a series of bottling, package and wrapping sequences and finally a trip on a conveyor directly to the cold room through a hole in the wall. "We aim to distribute our fresh milk products to retailers daily. Products with a longer shelf life are not kept for longer than a week. We have found that a cold room filled with cold products stays colder for longer compared to a half full room that isn't used to its potential."

When products are loaded from the cold room, it is done through the smaller loading bay openings. This is done in the mornings when the outside air temperature is cooler. "We also switch off the cooling fans to help prevent the cold air from rushing out."

According to Huan's article, plastic strips in doorways are useful if properly maintained. Air curtains in doorways are of less value for cold storage rooms.

Save on the right systems

Insulation is another obvious aspect to keep in check to avoid steep electricity bills and maintain a steady, cool temperature. Increasing energy prices have led to the use of increased insulation thickness or at least improved insulation material.



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Compressors consume the most energy in cold chain sectors. Without proper and regular maintenance, you might be faced with insufficient cooling or a compressor that seizes completely – leaving you in hot water. Using compressors economically may mean running one compressor for 20 hours, rather than two for 10 hours with 10 hours standby, provided fans and pumps are controlled by thermostats.

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“Loading products on pallets is an effective way of allowing cool air to surround a load of dairy products,” suggests Thom.

Malati’s cold room has a roof that is 3,2 m high. “The bigger the surface area to cool, the higher the roof structure must be to allow for proper air flow to the middle of the cold room,” says Thom. “The blowers you choose should not be too small but should also suit the compressor. If a compressor can operate a 500 to 700 mm blower fan, go for the 700 mm fan. This will improve air flow. In this warm climate, we prefer to use a stronger compressor to prevent it from running at full capacity most of the time,” Thom explains.

Achieving the correct evaporation temperature can also affect the electricity consumption, as each degree by which the evaporation temperature is reduced more energy is required to maintain that temperature. Evaporators should be carefully controlled during maintenance such as defrosting and oil drainage. Defrosting is often also an effective energy saver.

Servicing other parts such as the condenser includes the maintenance of evaporative and tube condensers with cooling towers. The system must be kept free of scale and dust and spray nozzles should be cleaned regularly. **M&J**