**COLD STORE IN RETAIL**

Refrigerated display, the final link in the commercial cold chain, is where the consumer purchases the product. The aim is to show the produce to the best advantage whilst maintaining it within prescribed temperature limits.

The **first refrigerator** for frozen foods was an integral type chest-freezer cabinet ice-cream conservator, a chest-freezer type of cabinet. The refrigeration system is in-built and the evaporator consisted of a coil of pipe in contact with the inner wall. These freezers are still commonly used for sale of ice-cream.

The **two major types of display** cabinet are those that operate from a remotely sited refrigeration plant (remote cabinets) and those that contain their own small refrigeration system, like a domestic refrigerator. The latter are sometimes termed **'integrals'** or '**plug-in units**'. Within each of these categories different types of cabinets exist. The most commonly used of these are; multi-deck, glass door, well and delicatessen. Additionally there are specialist designs for specific products and applications

**Multi-deck chill cabinets** rely on an air curtain to maintain the temperature of products on the shelves. This type of cabinet offers excellent product display, and it is a well-established principle that goods that can be seen are more likely to be purchased than those hidden from sight. However even with careful air management multi-deck cabinets tend to have a proportionately larger heat gain load than other types. Store managers will favour their use where the turnover of goods is rapid.

**Glass door displays and well types** are more economical to run and are widely adopted for frozen produce. Users accept that there is a need to reduce wastage of energy and are happy to shop for frozen goods from this type of display. Good lighting and door seal heaters are necessary.

**Open-top display** can gain considerable heat from air infiltration and radiant heat from lighting. Temporary covers are frequently used when the building is closed, to reduce these gains and help preserve the foodstuffs. This is of considerable importance where cut meats are displayed, since the radiant heat from lights and the loss of the cold air blanket lead to surface moisture loss with severe darkening of the appearance. It helps to have glass walls at the sides to reduce draughts, which would disturb the layer of cold air in the cabinet.

**Integral reach-in displays** are used for a variety of produce, and specialist designs are custom made for small retailers, hotels and restaurants. Evaporators need to be defrosted at regular intervals, usually every 6–8 hours. Build-up of frost on the evaporators can be limited by air conditioning the shop area and so reducing the amount of moisture in the surrounding air.

Energy consumption of cabinets is determined according to standard methods that account for both the direct power input to the cabinet for lighting, fans, heaters and defrost heaters and the power input required for heat extraction. Testing has revealed a wide variation in consumption, and 15–20% energy saving could be achieved by many users by choice of efficient products .

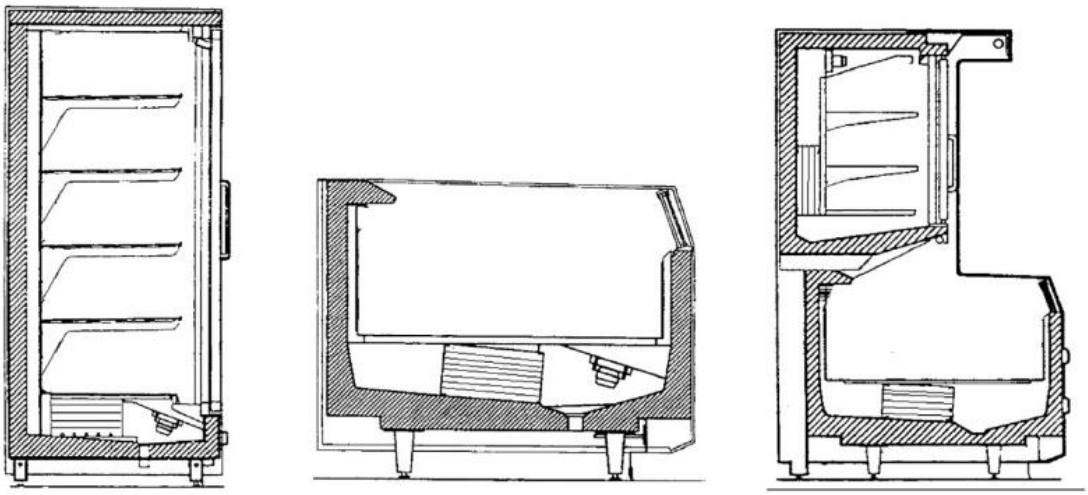
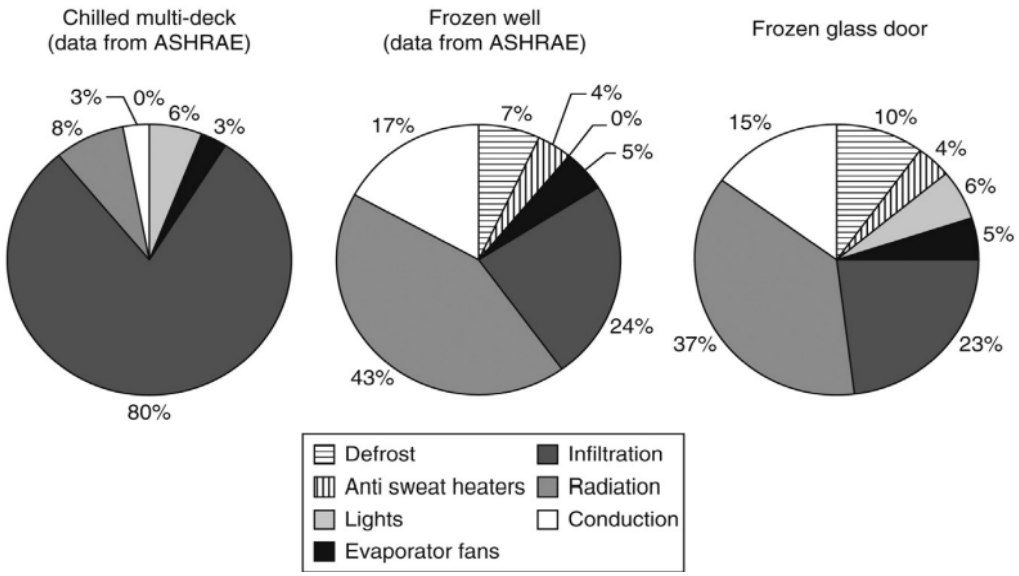


**Figure 17.10** *Sectional views of typical glass door and well-type cabinets for frozen food display (RD&T).*

## RETAIL REFRIGERATION

A supermarket has a large number separate food storage areas – cold rooms and display cabinets, all of which require refrigeration. The original method was, as with the domestic food freezer, to have a condensing unit as part of each cabinet. Using ‘plug-ins’ in this way can cause excessive temperatures in the shopping areas where condenser heat is being injected. This places extra demands on the air-conditioning system. To avoid this, remote-condensing units, usually sited in a central plant room, became a widely accepted solution.




With a continuing rise in cooling loads, and difficulty of providing sufficient space for condensing unit air circulation, the concept of a compressor pack (see Fig. 13.4) working in conjunction with remote condensers was developed. A bank of compressors provides for each evaporating temperature, with a common condensing pressure. These centralised systems are

very flexible, with the compressors switched by a logic controller to maintain correct conditions, regardless of the number of coolers working at any one time. The grouped condensers give the opportunity to recover heat from the discharge gas for water heating, and in winter for heating the building.

Several defrost methods are possible. Off-cycle defrost does not use any form of artificial defrosting. The ice build-up that may occur on the evaporator heat transfer surface is removed during the off cycle of the equipment. This method is mainly used for chill cabinets. Electric defrost is simple to operate and control, and does not rely on any external service for the supply of heat. This method is used for frozen displays. Hot-gas defrost is a method in which the discharge gas from the compressors is taken to the evaporator to provide defrost heat. Many hot gas defrost systems have been installed, but reliability problems have led to the adoption of electric defrost in most installations today.

There is no ‘one size fits all’ for supermarket applications. There are situations where integral plug-ins or condensing units are a good solution. This is particularly true for smaller stores and filling station forecourt stores. With the increasing emphasis on refrigerant containment there has been a move towards use of small, localised compressor packs in preference to a single remote plant room. This type of installation uses less refrigerant charge and reduces so called parasitic losses, that is pressure drops and heat gains in long suction lines connecting remote plant rooms. It is best suited to a building where roof or wall space is available for the units, but this may not always be the case.

The requirement to provide adequate and unobtrusive refrigeration on a densely packed sales floor space remains a challenge for engineers, and the transport of HFC refrigerant through long pipe runs with many joints remains susceptible to leakage losses. Recognition of this problem over a period of time, and more recently with the introduction of the European F-Gas regulation, has driven innovations. These have included indirect systems, where brine rather than refrigerant is circulated to the display cabinets. This is an effective but a costly solution and potentially more energy-intensive when the pump power and extra heat transfer losses are accounted.