

Effective Supermarket HVAC Design

Reduce Energy and Improve Product Display with Dehumidification



Overcome the supermarket HVAC application challenge



Supermarket HVAC Load Characteristics

- Refrigerated Cases
- Produce Misters
- Bakery/Deli
- Pharmacy
- Vestibule

Supermarkets use five times more energy per square foot than any other commercial building and are considered complex applications for heating, ventilating and air conditioning systems. If indoor air conditions are too hot—products spoil, too dry—products shrink, too wet—products mold, too cold—customers complain. Munters systems cut energy costs, ensure food and customer safety, and provide the proper amount of fresh, healthy outdoor air at the precise temperature and humidity necessary for the space. With Munters, stores realize higher sales, lower operating costs and better indoor air quality for all occupants.

Supermarkets have a unique mix of applications housed under one roof. Each application may have specific HVAC requirements to heat and cool the space as well as provide the required amount of ventilation air. In one part of the store, refrigerated cases provide a steady stream of cool air into the aisles, on the other side, cooking equipment rejects heat that must be exhausted from the store. The exhaust volume alone can dictate a large outdoor air intake to keep a positive pressure in the space. In addition, people and cooling loads fluctuate continuously during store operating hours.

Reduce latent loads to save energy

Since refrigerated cases provide the majority of the store's sensible cooling, the latent load becomes the focus for HVAC designers. Conventional DX systems must overcool the air to manage the latent load and then reheat to maintain store comfort. Overcooling and then reheating air to maintain the stores humidity level can substantially increase energy and operating costs. Desiccant dehumidification is the most cost effective and energy efficient method to reduce a supermarkets moisture load.

Supermarket Moisture Loads

Loads	lb./hr.
People	23.2
Ventilation	424
Infiltration	31.1
Doors	37.7
Vegetable Spray	10.5
Display Cases	-65.6

Moisture Removal Cost Comparison

Typical Energy Cost to Remove 120 Pounds of Water Per Hour

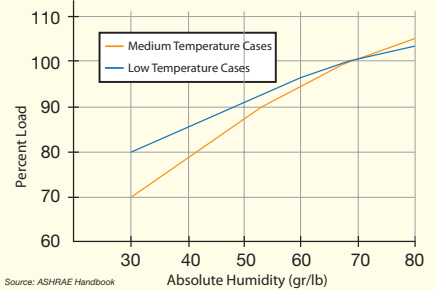
Dehumidifier	\$1.00
Air Conditioner	\$7.86
Produce/Dairy Cases	\$9.13
Meat/Deli Cases	\$10.62
Frozen Food Cases	\$14.83
Ice Cream Cases	\$16.72

Source: Tyler Refrigeration Advance Development

Refrigerated Cases

Display cases are designed to operate in a wet bulb condition of 64°F or less. Humidity resulting from ventilation air and internal loads will increase the refrigeration load on the display cases and cause frost formation on the evaporator coils.

Refrigeration Case Loads



Source: ASHRAE Handbook

Defrost of the coils is necessary to continue providing refrigeration, but will increase energy consumption and compressor run time. The anti-sweat heaters that help prevent fogging on case doors can also consume between 25-40 kW per hour. The amount of "on" time needed by these heaters is directly related to the store humidity level.

The mechanical designer should reduce the latent load on the refrigerated display cases, which in return will reduce the amount of defrost cycles and anti-sweat heater run times. In addition, product display, product shelf life, and energy costs will benefit from having reduced humidity within the supermarket.

Design practices to observe



After reviewing the design ambient conditions for the supermarket's location, you must calculate the sensible load and latent load independently to properly select and size the HVAC system.

1. Separate sensible and latent loads

Sensible and latent loads for a supermarket are different from most commercial applications. The effect of the refrigerated display cases impacts both sensible and latent loads. The designer should account for these Case Credits to avoid oversizing the HVAC system.

2. Treat the outdoor air before it comes into the store

Ventilation air in most cases will be the major source of moisture. (Refer to ASHRAE Standard 62 guidelines) The designer needs to account for exhaust hood activity and introduce the proper amount of outdoor air to offset exhaust. Vestibules and door openings can be another source of moisture so a positive air pressure is recommended. In terms of energy, it is less costly to treat outdoor air with the HVAC system than the refrigerated cases.

3. Take advantage of a lower humidity to raise temperature for occupant comfort

Without humidity control, maintaining the store at 75° F for customer comfort means employees are too hot, which has a negative effect on productivity. At 40% RH, employees feel comfortable even at 75°F because at low humidity, natural perspiration is a highly effective cooling mechanism.

4. Maintain 40% RH, reduce defrost cycles

Most major case manufacturers recommend that the indoor humidity level be held at 55% RH or less. As the RH level is reduced, case operation is improved.

Basic approaches to applying dehumidification systems

The following approaches have their advantages and disadvantages and must be evaluated to meet the needs of the client.

Central System

A single unit can meet all the temperature and humidity control needs of a typical supermarket. Dry air is distributed throughout the store, improving the comfort conditions for both customers and employees. Central systems do the work of multiple conventional units in larger stores, so you save on wiring, duct work, rigging and roof work, in addition to reducing your operational costs.

Target Air Approach

Some stores have a high concentration of refrigerated cases and benefit from the dry air directed in that zone. The majority of the stores' ventilation air would be processed through this unit, with multiple rooftop packages serving the general merchandise area.

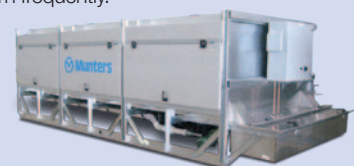
Treat Outdoor Air Separately

The third method would be a dedicated outdoor air unit ducted either directly into the space or into a return air duct of either a central system or multiple roof top packages.

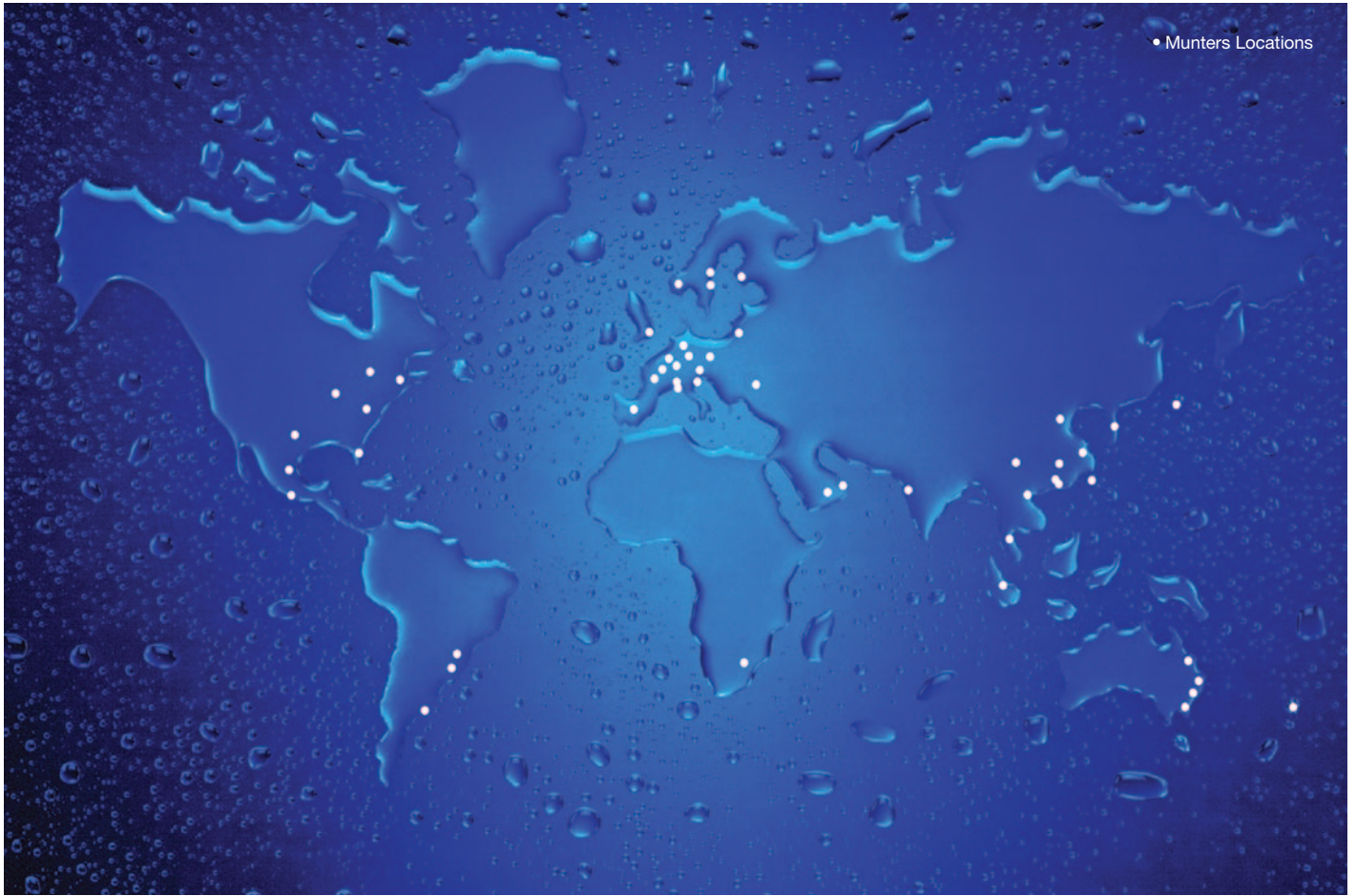
Products offered to service the unique supermarket environment

Munters systems cool and dehumidify 100% outdoor air using one-third the energy of conventional DX systems. With Munters, supermarket operators hold their store at 40- 45% RH which results in 10-15 % savings in the refrigerated cases operation while maintaining superior product display. Conventional DX systems would struggle to meet this condition while desiccant systems can cost effectively maintain these conditions and reduce the total store energy cost. Munters offers a variety of cooling, dehumidification, and energy recovery systems in various sizes and configurations to meet the building needs. Your customers will appreciate a fresh, well ventilated store, and comfortable customers will return frequently.

- ❑ DryCool™ HCU dehumidification utilizing waste heat recovery
- ❑ IceDry™ frozen food box storage dehumidification
- ❑ FreezeAire™ Loading dock freezer dehumidification
- ❑ Oasis™ EPX Indirect evaporative cooling for drier climates
- ❑ Oasis™ PFC Fluid Coolers for secondary closed loop systems, replacing cooling towers



Oasis™ PFC Fluid Cooler System



Munters is a global leader in energy efficient air treatment solutions.

Munters manufactures engineered products that can economically control humidity and temperature, provide energy recovery, and/or utilize direct or indirect evaporative cooling for comfort, process and environmental protection.

With permanent or temporary solutions, Munters offers a wide variety of options to meet specific climate, application and budget requirements.

Munters has net sales approaching \$1 billion USD with more than 20 manufacturing facilities across the globe and sales offices in over 30 countries.

Munters employs approximately 4,300 people worldwide.

For more information see www.munters.us



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