

## Prototype Mechanical/Electrical System Recommendations for Grocery Stores

(See Background on Conventional Grocery Store Design and Systems for explanation of refrigeration terms)

### SMALL SIZE STORE IN NEW OR EXISTING BUILDING

**Refrigeration system:** Low charge multiplex or distributed system with ultra high efficiency air-cooled condensers. An alternative could be ultra high efficiency self-contained refrigeration units.

**Space Comfort system:** Small packaged, DX electric cooling with gas or electric heat. These units should be provided with energy recovery wheels. These units should be the premium efficiency selections from whichever manufacturer is selected. These units should be field or factory retrofitted with a capacity control device such as that manufactured by RAWAL. These units should also be provided with hot gas bypass and reheat to control humidity levels. These units could also include demand-based (CO<sub>2</sub>-Controlled) ventilation. For stores that utilize self-contained refrigeration units for their merchandise, an alternative space comfort system could be a variable refrigerant system such as the system manufactured by Daikin. This system is highly energy efficient and utilizes a refrigerant energy recovery system.

**Electrical Appliances:** All electric power using appliances must be Energy Star compliant.

**Artificial Lighting:** All general lighting needs to be high efficiency, color-balanced T8 or T5 fixtures, dimmed in response to available natural light and timer controlled off during unoccupied periods. Lighting for storage spaces, toilet rooms, and similar spaces often unoccupied for large periods during normal operations must have occupancy control sensors for the lighting. Place display lighting close to displayed items.

**Space Temperature Control System:** Stand alone digital, programmable controller provided by the HVAC unit manufacturer.

**Domestic hot water/wash down system:** Domestic water heating system should consist of a solar heating component with an ultra-efficient condensing gas boiler or electric boiler as 2<sup>nd</sup> or backup stage and a storage tank(s).

### MID TO LARGE SIZE STORE IN A NEW OR ADAPTED BUILDING

\* It is strongly recommended for best efficiency that the refrigeration system be integrated with the HVAC systems, particularly in considering use of waste heat. At a minimum the separate trades should be well coordinated and communicating with each other during design and the building should be modeled as a whole.

**Refrigeration System:** Low charge multiplex or distributed system with evaporative condensers and a glycol/water based heat rejection circuit that includes a closed circuit fluid cooler. Alternate would be a decentralized Secondary Loop System with an evaporative condenser and with a heat rejection circuit connected to the HVAC system. While the Secondary Loop System achieves approximately the same energy savings as water cooled distributed systems, it additionally has the potential to reduce the refrigerant recharge by up to 75% to 80% over a conventional multiplex system. In addition to refrigerant liquid and piping savings, this option has the highest capacity to lower total equivalent warming impact (TEWI) on the environment.

**Space Comfort System:** Water-source heat pumps connected to the glycol/water heat rejection circuit. These units would also include a desiccant energy recovery wheel in the outside air and exhaust air to recover energy and temper humidity levels. These units would include demand-based (CO<sub>2</sub>-Controlled) ventilation.

**Electrical Appliances:** Electric appliances should be Energy Star compliant.

**Artificial Lighting:** General lighting should be high efficiency, color-balanced T8 or T5 fixtures, dimmed in response to available natural light and timer controlled off during unoccupied periods. Lighting for storage spaces, toilet rooms, and similar spaces often unoccupied for large periods during normal operations should have occupancy control sensors for the lighting. Place display lighting close to displayed items.

**Environmental Control (building automation) System:** Install separate metering on refrigeration, lighting, and appliance (plug) loads. Control system will monitor and control all energy using systems to maintain consumption and energy use performance at or below as commissioned performance benchmark.

**Domestic Hot Water/Wash Down System:** Provide a heat exchanger in the glycol/water heat rejection circuit to preheat domestic cold water make up to the domestic water heating system. Domestic water heating system should consist of a solar heating component with an ultra-efficient condensing gas boiler or electric boiler as 2<sup>nd</sup> or backup stage and a storage tank(s).

## MID TO LARGE SIZE STORE IN AN EXISTING BUILDING

\* It is strongly recommended for best efficiency that the refrigeration system be integrated with the HVAC systems, particularly in considering use of waste heat. At a minimum the separate trades should be well coordinated and communicating with each other during design and the building should be modeled as a whole.

**Refrigeration System:** Low charge multiplex system with advanced display case sensing and variable speed feedback control for air-cooled condensers. Two (2) refrigerants to water heat exchangers should be installed in the condenser loop to extract condenser loop heat upstream of the air-cooled condensers.

**Space Comfort System:** A packaged rooftop unit system that includes a desiccant energy recovery wheel in the outside air and exhaust air to recover energy and temper humidity levels. These units would include demand-based (CO<sub>2</sub>-Controlled) ventilation. These units should utilize a duct mounted hot water heating coil fed from the one of the heat exchangers in the refrigeration system condenser loop.

**Electrical Appliances:** Electric appliances should be Energy Star compliant.

**Artificial Lighting:** General lighting should be high efficiency, color-balanced T8 or T5 fixtures, dimmed in response to available natural light and timer controlled off during unoccupied periods. Lighting for storage spaces, toilet rooms, and similar spaces often unoccupied for large periods during normal operations should have occupancy control sensors for the lighting. Place display lighting close to displayed items.

**Environmental Control (building automation) System:** Install separate metering on refrigeration system, lighting, and appliance (plug) loads. Control system will monitor and control all energy using systems to maintain consumption and energy use performance at or below as commissioned performance benchmark.

**Domestic Hot Water/Wash Down System:** Preheat domestic cold water make up to the domestic water heating system by passing it through one of the heat exchangers in the refrigeration system condenser loop. Domestic water heating system should consist of a solar heating component with an ultra-efficient condensing gas boiler or electric boiler as 2<sup>nd</sup> or backup stage.