

## Energy Efficiency - System Design Strategies: Refrigeration Secondary Loop System

**Strategy:** Design for water chilled lines to refrigerator cases with refrigerant contained within the central cooling unit using evaporative condensers.

System involves secondary fluid loops on both condensing and refrigerating sides, with water-to-air heat recovery heat pumps. Low temperature (frozen foods) and a medium temperature (for chilled food) primary loops use noncorrosive and nontoxic brines with high heat capacities and low viscosities at low temperatures. They eliminate the use of refrigerants on both cold and freezing sides of the system and are separately pumped to the display cases and cold storage rooms. The display case heat exchangers are designed to use secondary fluids so the temperature differences between the brines and the air are minimized. Warm secondary loops reject the condensing excess heat to the outdoor air by means of remote air-cooled liquid coolers typically located on the roof. Loops use ethylene glycol as the warm secondary fluid.

**Relevant Store Scale/Type:** M,L/New & Adapted

### Initial Cost:

1. Coolants and high efficiency compressors and evaporative condensers; the rest is similar to multiplex systems.

### Return on Investment:

1. Savings in the 10-11% range annually as compared to multiplex systems.
2. Further operating savings if integrated with HVAC system to use waste heat. See Integrated HVAC with Refrigeration.

### Operator Benefits:

1. The more efficient and shorter defrosting cycles, higher average evaporating temperatures, proper insulation of the secondary fluid piping, and close coupling of the compressor racks to the condensers and fluid chillers (evaporators) contribute towards the energy-use savings.
2. Can reduce refrigerant demand up to 80%.
3. Highest capacity to lower total equivalent warming impact (TEWI) – water cooled units followed by evaporative cooled.

### Technical Considerations:

1. Use a good installer and have a good maintenance contract with them.
2. Requires additional maintenance of glycol and evaporative coolers.
3. The use of evaporative heat rejection for the fluid loop is recommended to reduce energy usage.

### Product/Manufacturer Suggestions, Resources & Examples:

See also section on Integrated HVAC and Refrigeration

Articles on Secondary Loop Refrigeration Systems in Supermarkets:

[http://findarticles.com/p/articles/mi\\_m5PRB/is\\_9\\_49/ai\\_n25012861](http://findarticles.com/p/articles/mi_m5PRB/is_9_49/ai_n25012861)

Investigation of Secondary Loop Supermarket Refrigeration Systems:

[www.energy.ca.gov/pier/final\\_project\\_reports/500-04-013.html](http://www.energy.ca.gov/pier/final_project_reports/500-04-013.html)

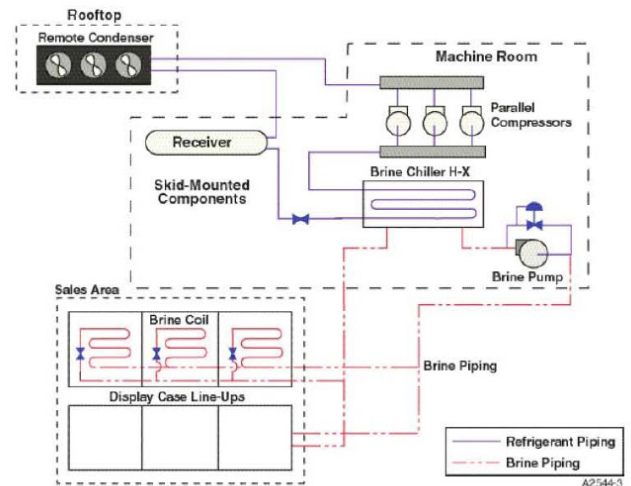


Figure 3. Flow Diagram for a Secondary Loop Refrigeration System

Source: Southern California Edison and Foster-Miller, Inc. 2004. "Investigation of Secondary Loop Supermarket Refrigeration Systems." Report prepared for California Energy Commission, Public Interest Energy Research Program.