SUPERMARKET REFRIGERATION SUPERHEAT OPTIMIZER SYSTEM

The superheat optimizer system (superheat sensor system) offers a practical solution to common and often overlooked refrigeration problems and significantly improves the performance and efficiency of supermarket refrigeration systems. The system was developed and patented by Super S.E.E.R. Systems Inc. One of the main causes of inefficiency in supermarket refrigeration systems is the lack of attention paid to superheat control and the resulting negative energy penalties and overall system ramifications. The superheat optimizer system directly addresses these problems and the industry need to focus on operational and cost efficiencies. The system is ideal for low & medium temperature cases and walk-in boxes.

SYSTEM BENEFITS

Superheat optimizer system value added benefits:

- Faster and more accurate valve setup
- Stable system operation at low superheats/reduced TDs/increased suction pressure
- Reduced compressor run times
- Steady TXV control = constant discharge air temperatures
- Faster pull-down
- Fully flooded coils frost evenly resulting in faster defrosts and improved airflow
- Reduced retail product shrinkage and shock
- Improved product integrity, appearance, longer shelf life
- Improved oil management
- Reduced system maintenance costs
- Increased cooling capacity and system efficiency
- Utility savings and improved net bottom line

COMMON PROBLEMS FACING SUPERMARKET REFRIGERATION SYSTEMS

Improper superheat control results in the evaporator not being fully flooded and active at all times, due to the fact that the thermostatic expansion valve (TXV) is hunting and not maintaining steady superheat control. The unnecessarily large area of the coil used for superheat renders this area practically ineffective for heat transfer. As the TXV hunts, the result is a partial emptying and refilling of the evaporator coils with liquid refrigerant, which can lead to a reduction in cooling capacity of up to 35%.

The TXV bulb, sensing the temperature of the suction gas at the evaporator outlet, controls the flow of liquid refrigerant into the evaporator. This closed loop feedback system control is fine in theory; however, it encounters numerous problems in actual operation. One of the main problems arises due to unequal loading of multi-circuit evaporators, with the least loaded circuit dictating the control of the TXV. This results in a greater amount of vapor and less liquid, thereby significantly reducing system capacity and efficiency.

Other common problems in controlling superheat are due to laminar flow in evaporator tubes and minimal surface contact between the sensing bulb and the suction line. These inefficiencies result in a lag in TXV bulbs sensing refrigerant temperature due to oil coating the inside of the suction line and the barrier effect. Valve hunting results in continuously varying discharge air temperatures. Further complications arise when the liquid refrigerant running in the liquid line that feeds the TXV is exposed to this air stream and fluctuates in the same manner. As the liquid temperature changes, so does the mass flow rate through the TXV.

SOLUTION - SUPERHEAT OPTIMIZER SYSTEM

Implementing the patented superheat optimizer system includes:

- installing the superheat sensor at the evaporator outlet
- insulating the liquid line and all components (suction-to-liquid heat exchanger, shut-off valve, dryer, etc.) located in refrigerated areas
- upsizing the TXV, orifice and distributor tubes

SUPERHEAT SENSOR

The superheat sensor consists of two concentric copper tubes. The outer tube is larger and sealed to the inner tube, forming an annular space between the tubes. The inner tube is closed at its mid point and is perforated to allow flow into and out of the annular space. Suction gas flows into the first inner chamber, then out through the perforations, into the annular chamber, then via the perforations, into the outlet chamber of the inner tube, into the suction line and finally the compressor. There are no moving parts and the pressure drop through the superheat sensor is negligible.

The purpose of this contorted flow path is to mix and turbulate the liquid refrigerant component with the superheated vapor portion, causing instant vaporization of any liquid. The turbulence generated in the chamber averages the temperature of the suction gas from multi-circuit coils, resulting in stable and