

Application Engineering Bulletin

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DESIGN CONSIDERATIONS FOR HEAT RECLAIM SYSTEMS

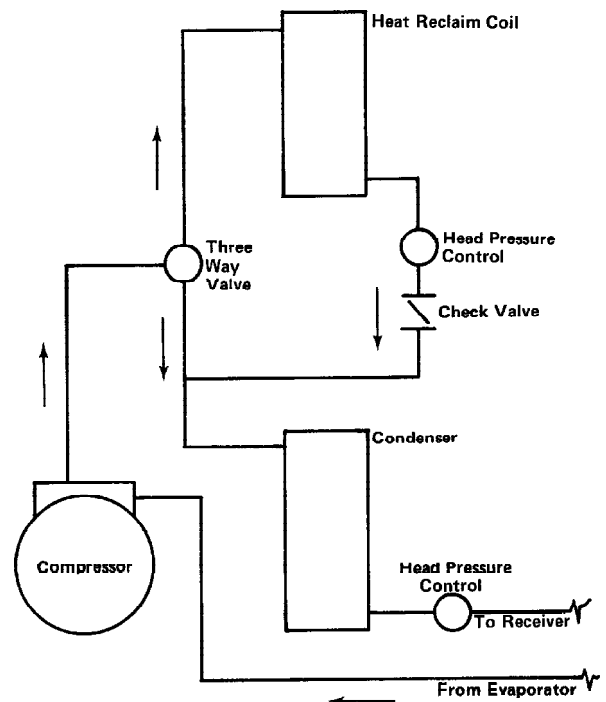
Heat reclaim systems have proven to be a major source of energy savings, particularly in connection with supermarket refrigeration. During periods when store areas require heating, heat normally discharged outdoors through the condenser can be diverted to a heat transfer coil in the heating duct, providing heat to the store with substantial savings in both cost and energy. Throughout the year, hot water requirements may be satisfied with discharge line heat exchangers.

With proper design, large savings can be obtained with no threat to the compressor. However system designers must remain alert to the fact that compressors in low temperature systems must operate very close to dangerous temperature levels, and the operating safety of the compressor cannot be ignored when considering system modifications for heat reclaim.

Condenser Heat Reclaim

Various system designs have been utilized, and both parallel and series connections have been used for the heat reclaim coil and the condenser. Due to system balancing problems, the series connection has proven to be more satisfactory, and a schematic diagram of a typical heat reclaim system is shown in Figure 1.

Since the heat reclaim coil and the condenser are both in effect serving as condensers in the circuit, some means of condensing pressure control must be provided to prevent the condensing temperature from falling to a level which could not efficiently be used for store heating. With return air temperature typically



Schematic Diagram of Typical Heat Reclaim System

FIGURE 1

in the 70°F to 75°F range, condensing temperatures of 100°F or higher are usually required to provide a reasonable temperature difference for effective heat transfer. In the system as shown, this is accomplished by means of the head pressure control valves and some additional refrigerant charge.

A number of compressor failures have been reported on heat reclaim systems over the years and field investigation reveals that these failures have been on low evaporating temperature condensing units where the condensing pressure was maintained by cycling the condenser fan. Any single stage Copeland compressor operating at evaporating temperatures below 0°F must have adequate air over the compressor for proper cooling. It appears the source of the compressor failures has been operation during the heat reclaim cycle of compressors on condensing units where compressor cooling is provided by the condenser fan or fans resulting in inadequate air over the compressor. It is conceivable that the heat reclaim coil could perform all or most of the condensing function, and the condenser fan could be cycled off for hours at a time.

The requirement for adequate air over any Copeland compressor operating at 0°F and below is a standard Copeland specification. Operation of compressors at low evaporating temperatures without air over the compressor is considered misuse, and compressors failing due to such abuse are not subject to warranty replacement.

Fan cycling for condensing pressure control where a single condenser fan is used is not recommended on any air-cooled compressor or low temperature compressor unless an auxiliary compressor cooling fan is used.

On condensing units with multiple condenser fans applied to heat reclaim systems, an auxiliary compressor cooling fan must be used unless specifically approved otherwise by the Copeland Application Engineering Department.

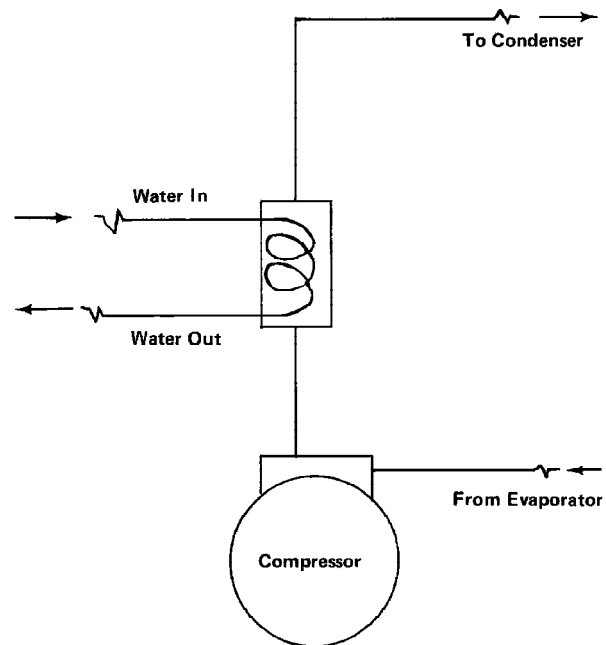
Discharge Line Hot Water Heaters

Discharge line heat exchangers such as shown in **Figure 2** can provide an economical source of hot water. The heat transfer takes place with the superheated discharge gas, so water temperatures much higher than condensing temperatures can be obtained.

Instances have been reported of field personnel intentionally setting head pressure controls at a higher

than normal level in order to get hotter water from a heat reclaim water heater. This not only endangers compressor life, it increases the overall energy consumption of the compressor, and may be counterproductive from both a cost and energy saving standpoint. Obviously the available heat is limited since removing the superheat from discharge gas is only a fraction of the heat given off during the condensing process.

One other potential danger with this type of heat exchanger is excessive pressure drop. Any pressure drop introduced into the discharge line increases the discharge pressure at which the compressor must operate. 3 to 4 psi pressure drop will not introduce a major penalty, but on commercial applications, greater pressure drop may lead to compressor overheating and early failure. Pressure drops on this type of device in excess of 5 psi should not be considered acceptable, particularly on medium and low temperature systems.



Schematic Diagram Of Discharge Line Water Heater

FIGURE 2