

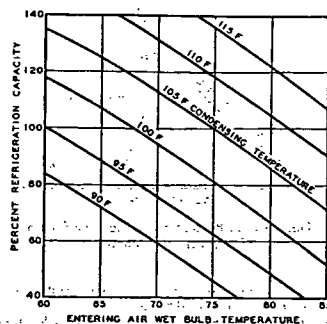


Fig. 29 ... Typical Rating Curves for Evaporative Condensers

increasing the effectiveness of an oil separator which can be located between it and the condensing coil. The design may differ from that of the condenser coil because of the lower transfer heat rate on the refrigerant side.

Water Treatment

In many areas the make-up water is virtually saturated with low solubility salts. To withstand the further concentration which is inevitable in a recirculating system, polyphosphate chemicals are used to enable water to become somewhat supersaturated without precipitation of scale-forming solids. Principles of water treatment are given in Chapter 15.

Condenser Location

Evaporative condensers located indoors can be used to ventilate the machine room or may be connected by ductwork to the outside. In cold climates, it may be desirable to provide suitable dampers to prevent lowering of the temperature of the machine room below a workable condition, or to provide doors to prevent lowering of temperature of adjacent work areas.

Air contaminated with food dusts will often cause excessive slime formation and should be exhausted by duct connections to the outdoors. Condensers located in dirty or dusty areas should be protected by filters in the air intake.

Evaporative condensers located outdoors may be protected from freezing during cold weather by placing the pump and water tank in a heated area below the condensers, as shown in Fig. 30. The piping can be arranged so that each time the pump stops, all the water drains back into the water tank and thus avoids freezing. Electric heaters in the sump pan, controlled by a thermostat, have also been used to prevent freezing. A steam coil immersed in the sump of the evaporative condenser is another effective means for preventing freezing during winter operation. Quite often, steam may be available if the building and therefore economical to use.

If the condenser must operate during cold weather, automatic dampers should be provided to avoid excessively low head pressure and to prevent freezing during extreme conditions.

Long discharge ducts tend to condense moisture from the nearly saturated air leaving an evaporative condenser. This is

especially true if the ducts pass through a cool space such as a basement. This condition should be avoided by keeping the ducts as short as possible. It may be necessary to anticipate some condensation even with insulated ducts and to provide drainage at points where no damage will result. Obviously, the eliminators must be highly effective.

Capacity Modulation

To assure the proper operation of expansion valves or other refrigerant control devices, it is often necessary to avoid extremely low condensing pressures such as might result during winter operation with an evaporative condenser. Capacity reduction, controlled by a pressure switch, can be obtained in several ways: by (1) intermittent operation of the water circulating pump, (2) intermittent operation of the fan, (3) intermittent operation of both the pump and fan, (4) placing a modulating or a two-position damper in the air stream to reduce the air flow. The intermittent operation of the water pump is definitely not recommended, since a thin film of scale is deposited each time the pump is stopped and the water is evaporated from the tube surface. After continued cycling, a thick deposit of scale will result. Of the other three methods, the use of a modulating or a two-position damper is often most desirable since it may be used to prevent freezing in cold weather. For cold weather operations, the pump and a sump tank should be located in a heated area.

PART IV: LIQUID RECEIVERS

In systems using water-cooled condensers, it is common practice to use the condenser as the receiver; but, in many cases, it is advisable and necessary to use a separate receiver. It is desirable to have the receiver, or condenser when one is used as the receiver, of such a size that it can hold the entire refrigerant charge. However, this is not always possible, especially on systems with large flooded evaporators. In all cases: (1) the minimum receiver volume should be such that it can absorb the seasonal fluctuations in liquid refrigerant requirements; (2) the liquid seal in the receiver must never be

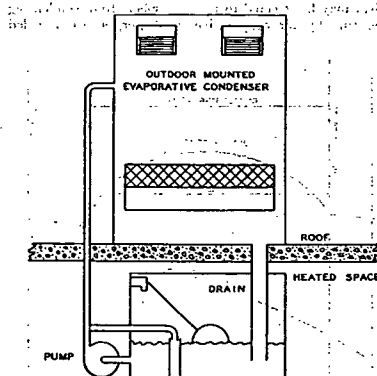


Fig. 30 ... Evaporative Condenser Arranged for Year-Round Operation

broken, and (3) the liquid level should never build up into the condenser while it is in operation. Although the receiver is a part of the high side, its size is determined by the design and operation of the low side.

Air-cooled condensers have a smaller storage volume for refrigerant and, on systems where storage for the entire charge of refrigerant is necessary, they require a separate receiver. Receivers also provide storage for the extra refrigerant charge for systems with head pressure control that requires flooding of the condenser coil to reduce capacity during winter operation. On systems using air-side head pressure control, a receiver is not required for operation of the head pressure control.

On systems in which the air-cooled condenser is designed with an integral subcooling coil, a receiver must not be included between the outlet of the subcooling coil and the expansion valve, unless provision is made to valve off the receiver and bypass the liquid around it during system operation. A receiver will operate with liquid and refrigerant vapor in the vessel, making it impossible to maintain a flooded subcooling coil. Furthermore, subcooled liquid entering the receiver will immediately condense a part of the vapor and revert to the saturated condition. A receiver may be located between the condenser outlet and the inlet to an independent subcooling coil. A liquid seal in the subcooling coil can then be maintained so that no loss of subcooling occurs.

In systems using water-cooled condensers, the receiver is normally located near the condensing unit in the equipment room. In systems using air-cooled condensers, the receiver is preferably located in the equipment room, but may be located outdoors at the air-cooled condenser. In cases where the receiver is located so that the receiver pressure may exceed the condenser pressure, e.g., on roof tops or in attic installations, the receiver should be vented to the condenser. In some instances it may also be necessary to insulate the receiver or to provide a ventilated housing over the receiver.

When a flooding type head pressure control for an air-cooled condenser is used, the receiver is preferably located indoors. This minimizes liquid subcooling and low receiver pressures on shut-down during winter operation, making it easier to get the compressor on the line without cycling on low pressure cut-out. If a vent line is used, it should be valved off during winter operation.

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