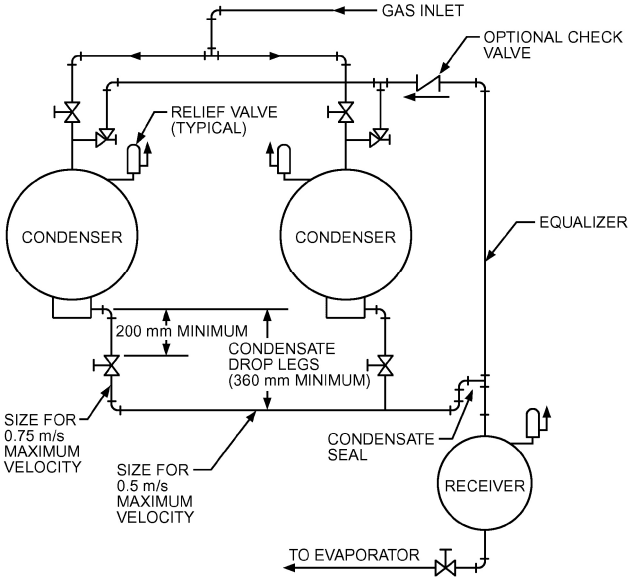

Fig. 10 Parallel Condensers with Through-Type Receiver

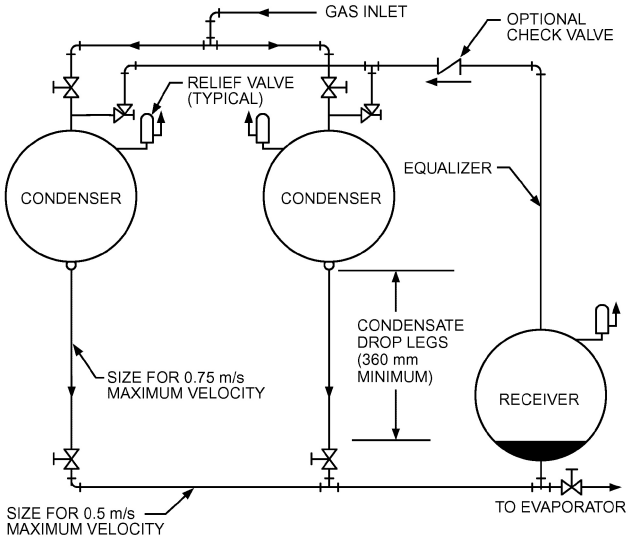

Fig. 11 Parallel Condensers with Surge-Type Receiver

Multiple Condensers. Two or more condensers connected in series or in parallel can be used in a single refrigeration system. If connected in series, the pressure losses through each condenser must be added. Condensers are more often arranged in parallel. Pressure loss through any one of the parallel circuits is always equal to that through any of the others, even if it results in filling much of one circuit with liquid while gas passes through another.

Figure 10 shows a basic arrangement for parallel condensers with a through-type receiver. Condensate drop legs must be long enough to allow liquid levels in them to adjust to equalize pressure losses between condensers at all operating conditions. Drop legs should be 150 to 300 mm higher than calculated to ensure that liquid outlets remain free-draining. This height provides a liquid pressure to offset the largest condenser pressure loss. The liquid seal prevents gas blow-by between condensers.

Large single condensers with multiple coil circuits should be piped as though the independent circuits were parallel condensers. For example, if the left condenser in Figure 10 has 14 kPa more pressure drop than the right condenser, the liquid level on the left is about 1.2 m higher than that on the right. If the condensate lines do not have enough vertical height for this level difference, liquid will back up into the condenser until pressure drop is the same through both circuits. Enough surface may be covered to reduce condenser capacity significantly.

Condensate drop legs should be sized based on 0.75 m/s velocity. The main condensate lines should be based on 0.5 m/s. Depending on prevailing local and/or national safety codes, a relief device may have to be installed in the discharge piping.

Figure 11 shows a piping arrangement for parallel condensers with a surge-type receiver. When the system is operating at reduced load, flow paths through the circuits may not be symmetrical. Small pressure differences are not unusual; therefore, the liquid line junction should be about 600 to 900 mm below the bottom of the condensers. The exact amount can be calculated from pressure loss through each path at all possible operating conditions.

When condensers are water-cooled, a single automatic water valve for the condensers in one refrigeration system should be used. Individual valves for each condenser in a single system cannot maintain the same pressure and corresponding pressure drops.

With evaporative condensers (Figure 12), pressure loss may be high. If parallel condensers are alike and all are operated, the differences may be small, and condenser outlets need not be more

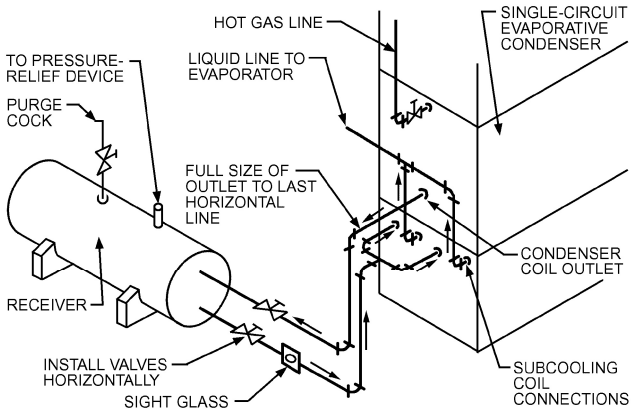

Fig. 12 Single-Circuit Evaporative Condenser with Receiver and Liquid Subcooling Coil

than 600 to 900 mm above the liquid line junction. If fans on one condenser are not operated while the fans on another condenser are, then the liquid level in the one condenser must be high enough to compensate for the pressure drop through the operating condenser.

When the available level difference between condenser outlets and the liquid-line junction is sufficient, the receiver may be vented to the condenser inlets (Figure 13). In this case, the surge-type receiver can be used. The level difference must then be at least equal to the greatest loss through any condenser circuit plus the greatest vent line loss when the receiver ambient is greater than the condensing temperature.

AIR-COOLED CONDENSERS

Refrigerant pressure drop through air-cooled condensers must be obtained from the supplier for the particular unit at the specified load. If refrigerant pressure drop is low enough and the arrangement is practical, parallel condensers can be connected to allow for capacity reduction to zero on one condenser without causing liquid backup in active condensers (Figure 14). Multiple condensers with high pressure drops can be connected as shown in Figure 14, provided that (1) the ambient at the receiver is equal to or lower than the inlet air temperature to the condenser; (2) capacity control affects all units equally; (3) all units operate when one operates,