SWEP piping recommendations for the installation of an evaporator

Summary:

- For dual evaporators, makes sure the piping arrangement is as symmetric as possible
- The expansion valve should be mounted in horizontal position relative the inlet connection with a straight pipe in between
- The pipe between the expansion valve and the evaporator inlet should be between 150-300mm or with a ratio of pipe length to pipe inner diameter of 10-30.
- The inlet pipe diameter should be chosen so that velocity in pipe is 10-25m/s, preferable in the upper range.
- If reduction of the inlet pipe diameter is needed this should be done directly after the expansion valve
- Outlet connections should be selected to avoid bad oil return and too high performance loss.

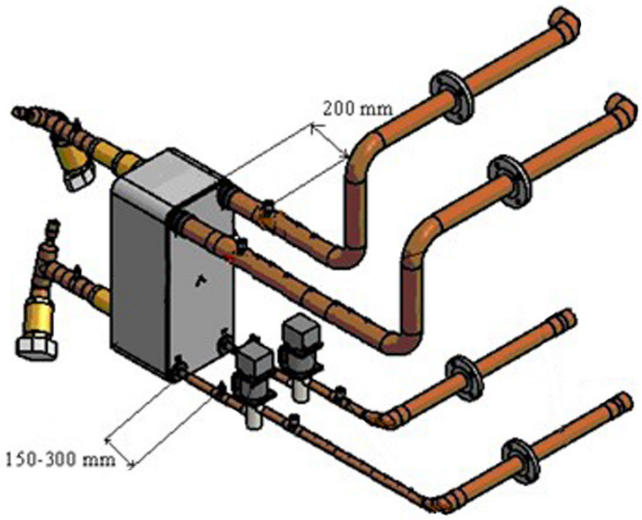

Figure 1. Recommended installation of an evaporator.

Influence of the Inlet Connection

The SWEP distribution device is most effective when the mixture of liquid and vapor entering the BPHE is homogeneous. After the expansion valve, vapor and liquid are completely mixed. Provided the flow velocity is high enough to create the necessary turbulence, this homogeneous state is kept intact. If the velocity is low, i.e. the pipe dimension is too large, phase separation will occur. Then the refrigerant flow into the

evaporator separates into a fast vapor stream and a slow liquid stream, giving less predictable performance. Instead, if the pipe diameter is very small, the high velocity will induce a high pressure-drop resulting in energy losses and a reduced COP.

In order to maintain a homogeneous mixture, the recommended refrigerant velocity inside the expansion pipe (F3) is 10-25 m/s, preferable in the upper range. The inlet connection should never be larger than the inlet port diameter of the F3 port (see Figure 2), because this increases the risk of phase separation. Due to the distribution device, the inlet port size (F3) is smaller in a V-type evaporator then in a B-model.

A pipe reduction is recommended after the expansion valve rather than just before the connection.

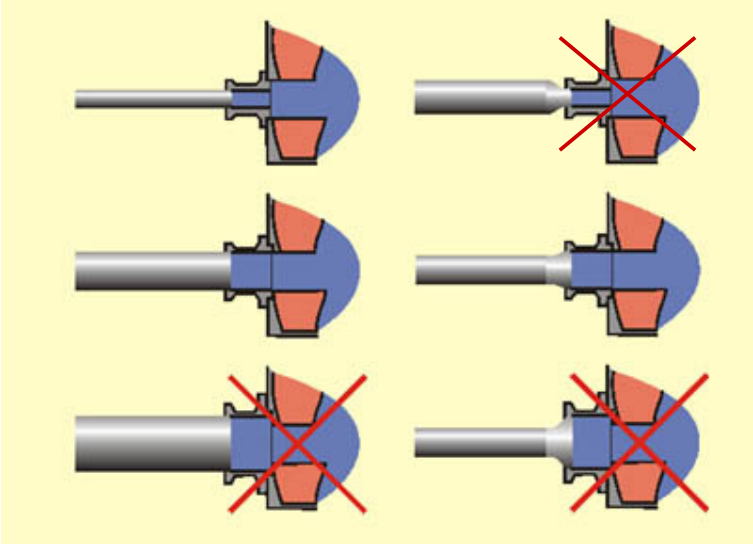

Figure 2. Suggestions for different inlet (F3) connections. The inlet connection can be smaller than the inlet port (top) or the same size (middle), but never larger (bottom).

Influence of Outlet Connection

The refrigerant vapor leaving the evaporator should have a velocity high enough to eject the small volume of compressor oil that circulates in the system. The oil will otherwise accumulate, adhere to the channel walls and reduce the heat transfer coefficient, which will result in lower evaporation temperature and reduced system capacity. A common recommendation is to design vertical outlet pipes to attain 5-10 m/s and horizontal pipes 2.5-5 m/s to ensure oil return. The higher velocity should be used for evaporation at low temperatures, where the viscosity of the oil is increased.

An undersized connection and suction pipe (see Figure 3) will result in unnecessarily high vapor velocities. In the suction pipe, velocities above 25 m/s lead to considerable energy losses, thus lowering the total COP for the system, especially if the suction pipe is long or with many bends. A larger connection and suction pipe will reduce the velocity and restore the performance. In addition, design combining three different diameters as in case d or f in figure 4 should be avoided. Doing this create unnecessary pressure drop and lower performance.

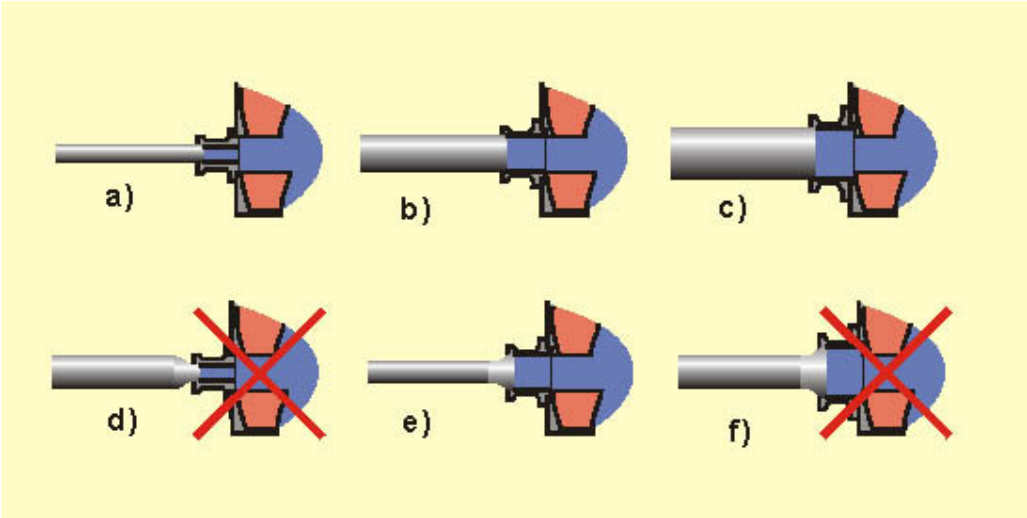

Figure 3. Suggestions for different outlet (F1) connections. Avoid making a design with changing diameters like in case d and f. case d) where port diameter is reduces in the connection and then expanded again to the pipe.

Expansion valve position

Figure 4 shows the recommended position of the expansion valve relative to the inlet port of a SWEP evaporator. The best position is at level with or higher than the evaporator inlet. If this is not possible, the selection of the correct pipe size and the distance from the expansion valve to the inlet port becomes more critical.

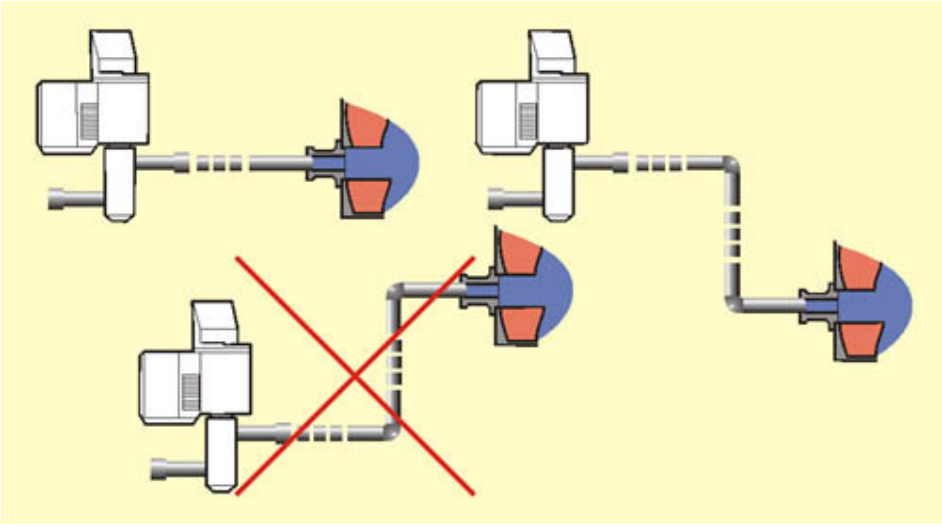

Figure 4. Recommended positions for the expansion valve.