TECH TIP # 3

HARDI
HEATING, AIRCONDITIONING & REFRIGERATION DISTRIBUTORS INTERNATIONAL

One of a series of dealer contractor technical advisories prepared by HARDI wholesalers as a customer service.

Some Good Rules To Follow When Installing Field Charged Cooling Units

As with any refrigeration system, whether residential air conditioning or commercial refrigeration systems, the longevity of the system is predicated on sound refrigeration practices. Listed here are some excellent common tips, refrigerant and condensate piping guidelines to follow to assure the best installation possible.

1. Always use refrigerant line sizes specified by the equipment manufacturer. See Table 1 for frequently recommended sizes.

2. Use the very best Air Conditioning & Refrigeration (ACR) copper tubing and fittings available. Do not use water tubing or cast fittings.

3. When cutting refrigerant tubing, use a tubing cutter. Do not use a hack saw. A hacksaw causes copper particles to enter the refrigerant system.

4. In completing flare fittings, use a quality flaring tool.

5. Run refrigerant piping as direct as possible with as few turns and fittings in the line as practical. See Table 2 for support spacing.

6. Seal ends of tubing after cutting to prevent dirt and moisture from entering the refrigerant system.

7. Install a filter-drier in the liquid line near the evaporator. It is also suggested that a moisture indicator be installed in the liquid line between the filter drier and the evaporator.

8. When brazing refrigerant lines, follow these instructions:

   a) Purge nitrogen through the refrigerant lines to minimize copper oxidation from entering the refrigeration system. Also, avoid **overheating** fittings when repairing leaks or brazing joints.

(continued)

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b) **Never apply heat** to a joint or line in a refrigerant system that is under refrigerant pressure. There is a danger of the line rupturing and/or molten metal blowing out.

c) Avoid **unbrazing** a joint in a line that is under vacuum to prevent air and moisture from entering and contaminating the system.

d) Where possible, **pressurize** the system slightly before disconnecting the lines. This will keep the air and moisture from entering the system.

e) Always **cap** all openings immediately.

9. Exercise care in the use of soft copper tubing so as not to kink or puncture it. Use a mechanical tube bender when forming small radius bends.

10. Avoid unnecessary bends and traps which may collect refrigerant oil and deprive the compressor of proper lubrication.

11. Insulate both liquid and suction line piping from external sources of heat.

12. Design refrigerant piping systems in accordance with local codes and regulations.

13. Design of the **suction line** is more critical than the liquid line because pressure losses of even a very low magnitude have a significant effect upon system capacity. The transfer of refrigerant oil through the suction line is also more difficult than through the liquid line. Refrigerant oil mixes easily with liquid refrigerant and is easily carried to the evaporator. Return of the refrigerant oil through the suction line is much more difficult and requires that the line be sized and installed properly. To insure proper oil return to the compressor, the following design considerations should be kept in mind.

a) Pitch all horizontal lines toward the compressor at a rate of one inch for each ten feet of line. This will permit gravity drain of the oil toward the compressor.

b) When the evaporator is more than 20 feet **below** the condensing unit, most designers install a trap at the mid-point of the line to assist return of the oil to the compressor.

c) When the evaporator is below the condensing unit and the suction line rises after it leaves the evaporator and when the evaporator is equipped with a thermostatic expansion valve, use a trap. The trap will enable the oil to drain away from the expansion valve sensing bulb during shutdown and permit proper valve operation when the unit is restarted. The trap is not required on capillary tube type evaporators or when the suction line drops to a condensing unit below the evaporator.

14. Evaporators are generally equipped with a ¾" female pipe thread fitting for the **condensate drain**. The installer may attach a hose fitting, pipe fitting or sweat fitting adapter to this fitting and pipe the condensate to a drain in accordance with local codes. In general, the pipe should be full size to the drain.

A **trap** must be formed in the condensate line. If the evaporator is on the discharge side (upstream) of the blower, the trap will prevent loss of air through the condensate line. If the evaporator is on the return side (downstream) of the blower, the trap will permit the condensate to drain properly. Without a trap, air will flow up the condensate drain line, prevent proper drainage and may cause the drain pan to overflow into the furnace or into the conditioned area. **Do not operate unit without a condensate trap.**

Table 1 -- Recommended Refrigerant Pipe Sizes

This table eliminates the use of complicated calculations concerning the equivalent length of all fittings in the piping system. The table, however, is based upon certain maximum pressure losses in the piping systems which are equivalent to eight elbows in each line. If an unusually large number of elbows or fittings are required for a given application, increase piping one size.

Suction Line	**Length in Feet**				
Condensing Unit Size (Tons)	Up to 40’	Up to 50’	41-75	51-75	76-100
1 ½	5/8	-	¾	-	¾
2	5/8	-	¾	-	7/8
2 ½	¾	-	7/8	-	7/8
3	-	¾	-	7/8	7/8
3 ½	-	7/8	-	1 1/8	1 1/8
4	-	7/8	-	1 1/8	1 1/8
5	-	7/8	-	1 1/8	1 1/8
7 ½	-	1 1/8	-	1 3/8	1 3/8
10	-	1 3/8	-	1 3/8	1 5/8
Liquid Line					
1 ½	¼	-	3/8	-	3/8
2	¼	-	3/8	-	½
2 ½	3/8	-	1/2	-	½
3	-	3/8	-	½	½
3 ½	-	½	-	½	½
4	-	½	-	½	5/8
7 ½	-	5/8	-	5/8	5/8
10	-	5/8		5/8	3/4

Table 2 -- Recommended Support Spacing for Copper Tubing

Tube OD (inch)	Distance Between Supports (Feet)
¼	4
3/8	5
½	6
5/8	6
¾	6
7/8-1 1/8	8
1 3/8	10
1 5/8	10