



energy miser environment systems water source heat pump installation, start-up and maintenance manual

SUPPLEMENT FOR SPLIT SYSTEMS — CONDENSING SECTION WITH MATCHING AIR HANDLER

The information contained in this supplement deals specifically with FHP split system heat pumps models SE, HE, LT, and SL. It is to be used together with information contained in our standard start-up and maintenance manuals.

The **condensing section** should be mounted on a cement slab or similar support to provide a good base and some degree of levelness. It is designed for outdoor installation, however, where ambient temperatures can fall below freezing, we recommend the unit be installed in a heated area to prevent possible condenser freeze-up and to optimize the overall system performance.

The **air handler** should be mounted on isolating pads, and air supply and return ducts should be attached thru canvas connectors to isolate vibration and noise from the building structure. Flexible wiring and conduit should be used for the same reasons.

CAUTION: Holding charge of refrigerant:

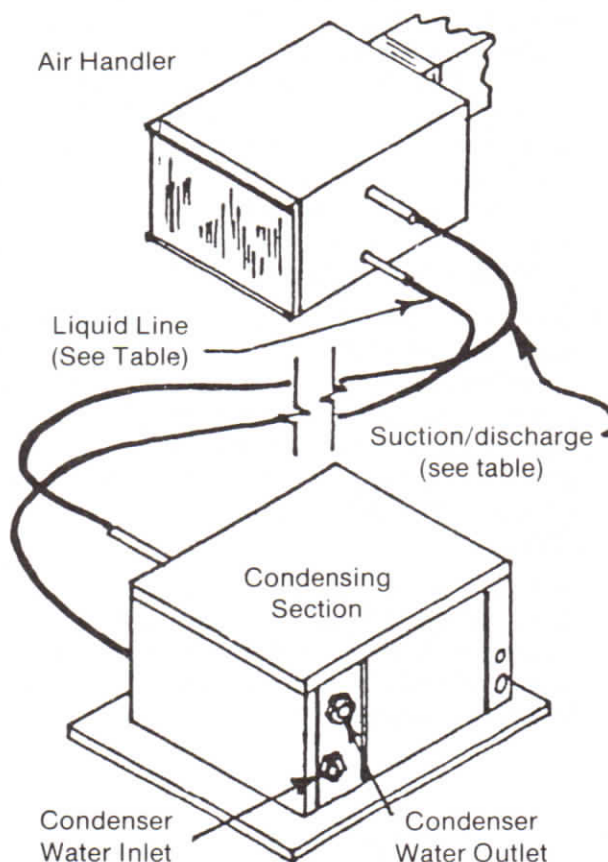
Both the condensing section and the air handler section are **factory supplied with a holding charge of refrigerant only**. Using the gauge ports provided, evacuate this holding charge before attempting to cut the sealed refrigerant lines or otherwise open the system.

Interconnecting refrigerant line sizes should be in accordance with table 1 in the following instructions. Copper tubing should be clean and free of moisture and dirt or trash. Suction/discharge line **MUST** be insulated with at least 3/8" wall, closed cell, foam rubber insulation or the equivalent. It is not generally necessary to insulate the liquid line of models SE or HE systems, except where routed in walls or thru attic space where they could be surrounded by hot, humid air, and condensation on the lines could result. The **liquid line of all model LT and HLT systems should be insulated**, due to the relatively low liquid line temperatures normal to these ground water units.

Refrigerant lines generally can and should be routed and supported so as to prevent the transmission of vibrations into the building structure.

Experience and good design practice dictate 75 feet as the maximum practical length for interconnecting refrigerant lines in split system heat pumps, without special considerations. Beyond 75 feet system losses become considerable, and the total refrigerant charge required can compromise the reliability and design life of the equipment.

Pump-down must never be used with heat pumps.



After the interconnecting refrigerant lines have been installed, the entire system should be pressurized with R22 and leak checked. Then, using a good vacuum pump, evacuate the system for a minimum of six (6) hours, then charge in accordance with Tables 1 and 2 in the following instructions.

SPLIT SYSTEM REFRIGERANT LINE SIZING & CHARGING

PREFACE:

To maximize system performance, efficiency, and reliability, and to minimize installation costs, it is always in the best interest of the customer to keep refrigerant lines as short as possible. Every effort should be made to locate the condensing (outdoor) section and the air handler (indoor) section of the system as close as possible to each other.

GENERAL INFORMATION:

1. Pressure drop (friction losses) in refrigerant suction and hot gas lines reduces system capacity and increases power consumption as much as 10 percent or more, depending on length of lines, number of bends, etc. Pressure drop in liquid lines affects performance to a lesser degree, provided that a solid column of liquid (no flash gas) is being delivered to the expansion device, and that the liquid pressure at the expansion device is sufficient to produce the required refrigerant flow.
2. Oil is continually being circulated with the refrigerant and, so, oil return to the compressor is always a consideration in line sizing. Suction lines on split system heat pumps are also hot gas lines in the heating mode, but are treated as suction lines for sizing purposes. If the recommended suction line sizes are used, there should be no problem with oil return.
3. Vertical lines should be kept to a minimum. Vertical liquid lines will have a vertical liquid lift in either cooling or heating, and the weight of the liquid head is added to the friction loss to arrive at the total liquid line pressure drop.

LINEAR VS. EQUIVALENT LINE LENGTH:

1. **Linear length** of a line is the actual measured length, including bends. The **linear length of the liquid line is used to compute the additional refrigerant charge** that must be added to the basic charge

to determine the total charge for a given system (refer to table 2).

2. **Equivalent length** is the combined total of (1), the actual lengths of all straight runs and (2), the equivalent lengths of all elbows, valves, and fittings in a particular line. Equivalent valve or fitting length is equal to the length of a straight pipe or tubing of the same size having the same pressure drop as a particular valve or fitting. The **ASHRAE Fundamentals Handbook**, Chapter 34, provides tables for determining losses in equivalent feet of pipe or tubing for various valves and fittings.

Liquid and suction line sizes are based on equivalent lengths, as given in Table 1.

THINGS TO REMEMBER:

1. **Do not overcharge a system.** Charge all systems by weight as determined from the total of the BASIC CHARGE (table 1) and the LIQUID LINE CHARGE (table 2).
2. **Do not oversize liquid lines** unless absolutely unavoidable. If oversized lines must be used, a suction line accumulator may be required, and the addition of a crankcase heater may be necessary on some models, depending upon the total system charge. **Consult factory for recommendation.**
3. **Suction line size** must be one of those given in Table 1. Horizontal suction runs should be pitched slightly toward the compressor to provide free drainage and aid oil return.
4. If a liquid line drier-filler is required, it must be of the **bi-directional type only.**
5. **Linear line lengths** in excess of 100 feet are not recommended, either with or without a suction line accumulator.

Table 1: Split System Line Sizing and Charging

SYSTEM MODEL	BASIC R22 CHARGE OZ (NOTE 4)	REFRIGERATION LINE O D SIZES FOR EQUIVALENT LENGTHS (NOTE 3)																		SUCTION LINE VERTICAL RISER MAX O D (NOTE 5)
		15 FT		25 FT		35 FT		45 FT		50 FT		60 FT		70 FT		80 FT		120 FT		
		LJO	SUC	LJO	SUC	LJO	SUC	LJO	SUC	LJO	SUC	LJO	SUC	LJO	SUC	LJO	SUC	LJO	SUC	
HECS/HEAH15	31																			5/8
LTCS/LTAH 15	24	1/4	5/8	1/4	5/8	1/4	3/4	5/16	3/4	5/16	3/4	5/16	3/4	5/16	3/4	5/16	3/4	5/16	3/4	
HECS/HEAH 19	38																			5/8
LTCS/LTAH 20	35	1/4	5/8	1/4	3/4	5/16	3/4	5/16	3/4	5/16	3/4	5/16	3/4	5/16	7/8	3/8	7/8	3/8	7/8	
SLCS/SLAH 20	31																			
SECS/SEAH 22	34																			3/4
HECS/HEAH 23	39	1/4	5/8	5/16	3/4	5/16	3/4	5/16	3/4	5/16	3/4	5/16	7/8	3/8	7/8	3/8	7/8	3/8	7/8	
SLCS/SLAH 25	43																			3/4
SECS/SEAH 26	41																			
HECS/HEAH 27	52	5/16	5/8	5/16	3/4	5/16	3/4	5/16	3/4	3/8	3/4	3/8	7/8	3/8	7/8	3/8	7/8	3/8	7/8	
LTCS/LTAH 30	61																			
SLCS/SLAH 30	44																			
HECS/HEAH 31	40																			7/8
SECS/SEAH 32	60																			
HECS/HEAH 34	58	5/16	3/4	3/8	3/4	3/8	3/4	3/8	7/8	3/8	7/8	3/8	7/8	3/8	7/8	1/2	7/8	1/2	7/8	
SECS/SEAH 38	62																			
LTCS/LTAH 40	59																			
SLCS/SLAH 40	57																			
HECS/HEAH 41	50																			7/8
HECS/HEAH 42	69	3/8	3/4	3/8	7/8	3/8	7/8	3/8	7/8	3/8	7/8	3/8	7/8	3/8	7/8	1/2	11/8	1/2	11/8	
SECS/SEAH 46	75																			
LTCS/LTAH 50	82																			
HECS/HEAH 52	84	3/8	7/8	3/8	7/8	3/8	7/8	3/8	11/8	1/2	11/8	1/2	11/8	1/2	11/8	1/2	11/8	1/2	11/8	7/8
LTCS/LTAH 60	84																			
HECS/HEAH 62	87	3/8	7/8	3/8	11/8	1/2	11/8	1/2	11/8	1/2	11/8	1/2	11/8	1/2	11/8	1/2	11/8	1/2	11/8	11/8
LTCS/LTAH 70	93																			
HECS/HEAH 80	134	1/2	11/8	1/2	11/8	1/2	11/8	1/2	11/8	1/2	11/8	1/2	11/8	1/2	13/8	5/8	13/8	5/8	13/8	11/8
LTCS/LTAH 90	134																			
HECS/HEAH 1000	152	1/2	11/8	1/2	11/8	1/2	13/8	1/2	13/8	1/2	13/8	1/2	13/8	1/2	13/8	5/8	15/8	5/8	15/8	13/8
HECS/HEAH 1200	194	1/2	11/8	1/2	13/8	1/2	13/8	1/2	13/8	5/8	15/8	5/8	15/8	5/8	15/8	5/8	15/8	5/8	15/8	

Table 2: Liquid Line Charge per Linear Foot.

	Liquid line size, O.D.				
	1/4	5/16	3/8	1/2	5/8
R22 oz. per foot	.25	.44	.60	1.15	1.95

Example: Model HECS/HEAH 27 with 35 feet of 5/16" o.d. liquid line.
 Total system charge = Basic charge + .44 oz. per foot
 Total system charge = 52 oz. + (.44 x 35 ft.) = **67.4 oz.**

Notes:

- Maximum linear (actual) liquid line lengths **without a suction line accumulator** installed are:

Model sizes 15 thru 60 = **60 feet**
 Model sizes 62 thru 90 = **50 feet**

Maximum linear line lengths **with** suction accumulator installed are **100 feet**, all models.

- Liquid and suction line sizes (diameter) are based on EQUIVALENT LINE LENGTHS. When the computed equivalent length falls between values in table 1, use size given for next longer length.

- Refrigerant line charge is based on LINEAR LINE LENGTH. Total system refrigerant charge is **BASIC CHARGE** plus **LINE CHARGE**. Refer to table 2 for example.
- These line sizes are required for vertical suction/hot gas lines, whether or not the air handler is above or below the compressor, to maintain adequate gas velocity for oil entrainment.
- Horizontal suction/hot gas line sizes must not exceed the largest diameter given in table 1 for a given heat pump.

