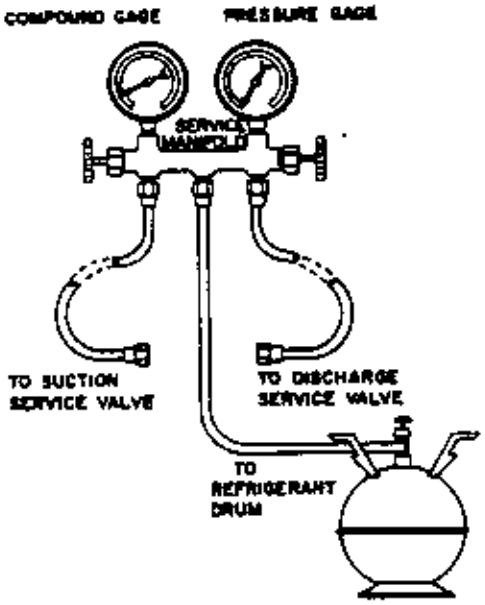
PROCEDURE FOR
LEAK TEST-EVACUATION-CHARGING

GAUGE MANIFOLD

A necessary instrument in checking and servicing air conditioning and heat pump equipment is the gauge manifold. Its purpose is to determine the operating refrigerant pressures in order for the serviceman to analyze the condition of the system.

The valving on the manifold is so arranged that when the valves are closed (front-seated) the center port on the manifold is closed to the gauges and gauge ports. With the valves in the closed position, the gauge ports are still open to the gauges, permitting the gauges to register system pressures. Opening either valve opens the center port to that side of the manifold and system.



ATTACHING GAUGE MANIFOLD

For leak testing, purging, checking charge, charging liquid or evacuating, connect high pressure side of gauge manifold to Schrader valve on liquid or discharge line. Connect suction side of gauge manifold to Schrader valve on suction line. On heat pumps the suction line is between compressor and reversing valve.

ATTACHING MANIFOLD HOSE TO SCHRADER VALVE

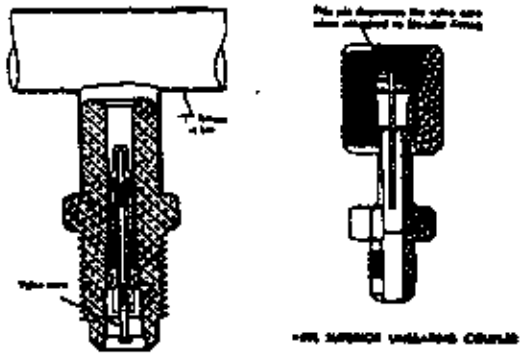
WARNING

As a safety measure, it is wise to attach refrigerant hoses at the lowest pressure readings on the system. To do this:

(a) Put high pressure hose (B) on first. (Unit should not be running).

(b) Put low pressure hose (A) on second. (Unit should be running).

1. Remove cap from valve.
2. Make sure gauge manifold valves are closed.
3. If hose does not have an unseating pin, a number 395 Superior or equivalent unseating coupler must be used.



4. Make sure coupler is lined up straight with Schrader valve. Screw coupler on to valve.
5. Open gauge manifold valve slightly and purge air from hose with refrigerant.
6. Read the suction pressure on compound gauge and heat pressure on pressure gauge.
7. To remove, push end of hose tight against end of Schrader valve and hold in place while quickly unscrewing coupler nut from Schrader valve.
8. Remove coupler from Schrader valve. Replace caps on valve.

WARNING

As a safety measure, it is wise to detach refrigerant hoses at the lowest pressure readings on the system. To do this:

(a) Remove the suction pressure hose (A) first. (Unit is running).

(b) Remove the high pressure hose (B) next. (Unit is not running).

LEAK TEST

1. Remove gauge port cap from suction and liquid service valve ports and attach manifold gauge hoses. Connect an upright R12 drum to center port of gauge manifold. Open refrigerant drum valve and manifold high pressure gauge valve to pressurize system. Pressurize the complete system with R22 until the pressure reaches 100 psig. DO NOT exceed 150 psig.
2. Close manifold high pressure gauge valve. Check all soldered joints, including those on the evaporator coil with an Electronic Leak Detector. If a leak is found which requires soldering, pressure in the system must be bled off since it is impossible to solder with unit pressurized. Be sure all leaks are located and marked before bleeding pressure from system.
3. Close drum valve and disconnect from center port. Release refrigerant into the atmosphere through suction line of gauge manifold.
4. Correct any leaks and recheck. When leaks, if any have been repaired, system is ready to be evacuated and charged. Relieve all pressure from the system down to 0 psig.

EVACUATION

1. Evacuate the system to less than 1000 microns, using a good vacuum pump and an accurate high vacuum gauge. Operate the pump below 1000 microns for 60 minutes and then close valve to the vacuum pump. Allow the system to stand for 30 additional minutes to be sure a 1000 micron vacuum or less is maintained.

2. An alternate method of removing moisture and noncondensables from the system is:

   a) Evacuate system to 29 inches vacuum for ten minutes per ton of system. Break vacuum with refrigerant to be used for final charging of system and vapor charge to 35-50 lbs. gauge pressure. Leave vapor charge in system for a minimum of five minutes. Reduce pressure to five to zero gauge pressure.

   b) Repeat step (a) two more times.

   c) Evacuate system to 30 inches vacuum for twenty minutes per ton. Charge system with the specified kind and quantity of refrigerant (charge into vacuum).

> **WARNING**
>
> At no time use the compressor to evacuate the system or any part of it.

3. Disconnect charging line at vacuum pump and connect to refrigerant supply. (Dial-A-Charge Cylinder) crack valve and purge charging line at center on manifold. Then close valve.

4. The system is now ready for the correct operating charge of Refrigerant 22.

CHARGING

1. SINGLE PACKAGE UNITS - Refer to the unit serial plate for the full operating charge.

2. SPLIT SYSTEMS - The outdoor unit factory charge is shown on the unit serial plate. The total system charge required to recharge the system after service repairs should be marked on the serial plate under TOTAL R22 CHARGE. This is normally marked by the installer and is determined from the R22 System Charge Table located on the inside of the outdoor unit access panel.

3. CTO ADAPTER KITS - When using CTO adapters and field tubing, use the procedure outlined on the bottom of page 3, Manual 2100-002. This determines the correct ounces of R22 for the tubing only.

4. FILTER-DRIER CHARGES - If a liquid line filter-drier is used, either in conjunction with field tubing and a CTO adapter kit, or as part of procedure for system clean-up after a compressor burn-out, additional R22 must be added to the system when recharging. This is in addition to the amount determined from the R22 System Charge Table.

PART NO.	MODEL NO.	OZ. of R22
5202-001	C-0835	4
5202-002	C-1635	10
5201-009	BFK-0835	7
5201-010	BFK-1635	13

PRELIMINARY CHARGING STEPS

If the system has been open to the atmosphere, it should be first evacuated. Then proceed as follows:

1. Attach a drum of proper, clean refrigerant to the center port of the charging manifold with one of the charging hoses.

2. Attach a second charging hose to the suction gauge (low pressure) side of the gauge manifold.

3. Remove the cap from the suction line valve.

4. Loosely attach the suction gauge hose to the line valve. Open the valve on the refrigerant drum and the suction valve on the charging manifold slightly to purge the air from the manifold and hoses before tightening the fitting.

5. Attach the third hose to the high pressure side of the manifold and the liquid line valve. Repeat steps 3 and 4 above.

CHARGING THE SYSTEM BY WEIGHT*

1. Connect manifold as instructed.

2. Place refrigerant drum upright on scale and determine exact weight of the refrigerant and cylinder or use a Dial-A-Charge cylinder.

3. With manifold suction valve closed and manifold discharge valve open, open refrigerant cylinder valve and allow pressure in system to balance with pressure of cylinder. For charging in the liquid phase, drum is placed upside down (valve down).

4. When there is approximately a full charge, front seat (close) the discharge manifold valve and let the system stabilize for about five minutes.

5. Start compressor by setting thermostat.

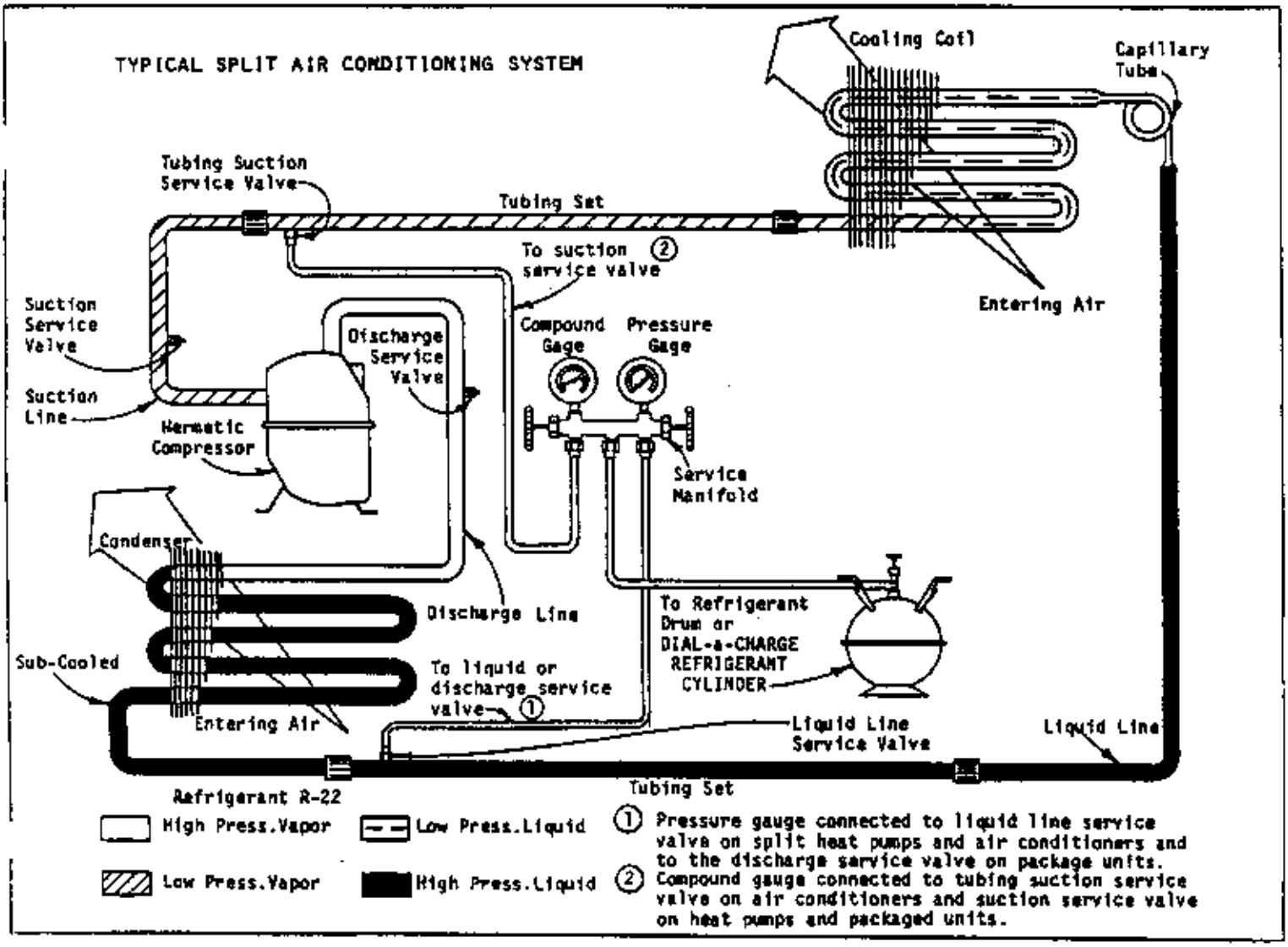
6. Finish charging with vapor by placing drum upright (valve up). Open drum valve and manifold low pressure valve to allow refrigerant to flow into the system. Throttle refrigerant drum valve to keep pressure about 100 psig for R22.

7. When the correct weight of refrigerant has been added to the unit, close refrigerant cylinder valve and allow unit to run for 30 minutes. Refer to Start-Up Procedure and Check List for further start-up details. Check the charge against the allowable head pressure as shown in the Head Pressure Chart and correct if needed.

8. Front seat gauge manifold valves, disconnect charging and gauge hoses and replace all valve caps.

> **WARNING**
>
> To speed refrigerant flow, it may be necessary to place refrigerant drum in a pan of warm water (not greater than 130°F). Remember to either consider the total weight of the pan of water or remove the drum for weighing frequently to keep track of the charging process.

*This charging method requires the scales or Dial-A-Charge cylinder to be extremely accurate since the charge in this type of system is quite critical.



AIR CONDITIONING AND HEAT PUMP ON COOLING CYCLE

TROUBLESHOOTING — SYSTEM PRESSURE CHECK

Low Suction — Low Head Pressure

1. Restricted air flow over indoor coil.
2. Defective indoor fan motor.
3. Low indoor and outdoor temperature.
4. Iced indoor coil.
5. Restricted liquid line, drier, or capillary tube.
6. Low charge.

High Suction — Low Head Pressure

1. Defective or broken valves.
2. IPRV valve open.

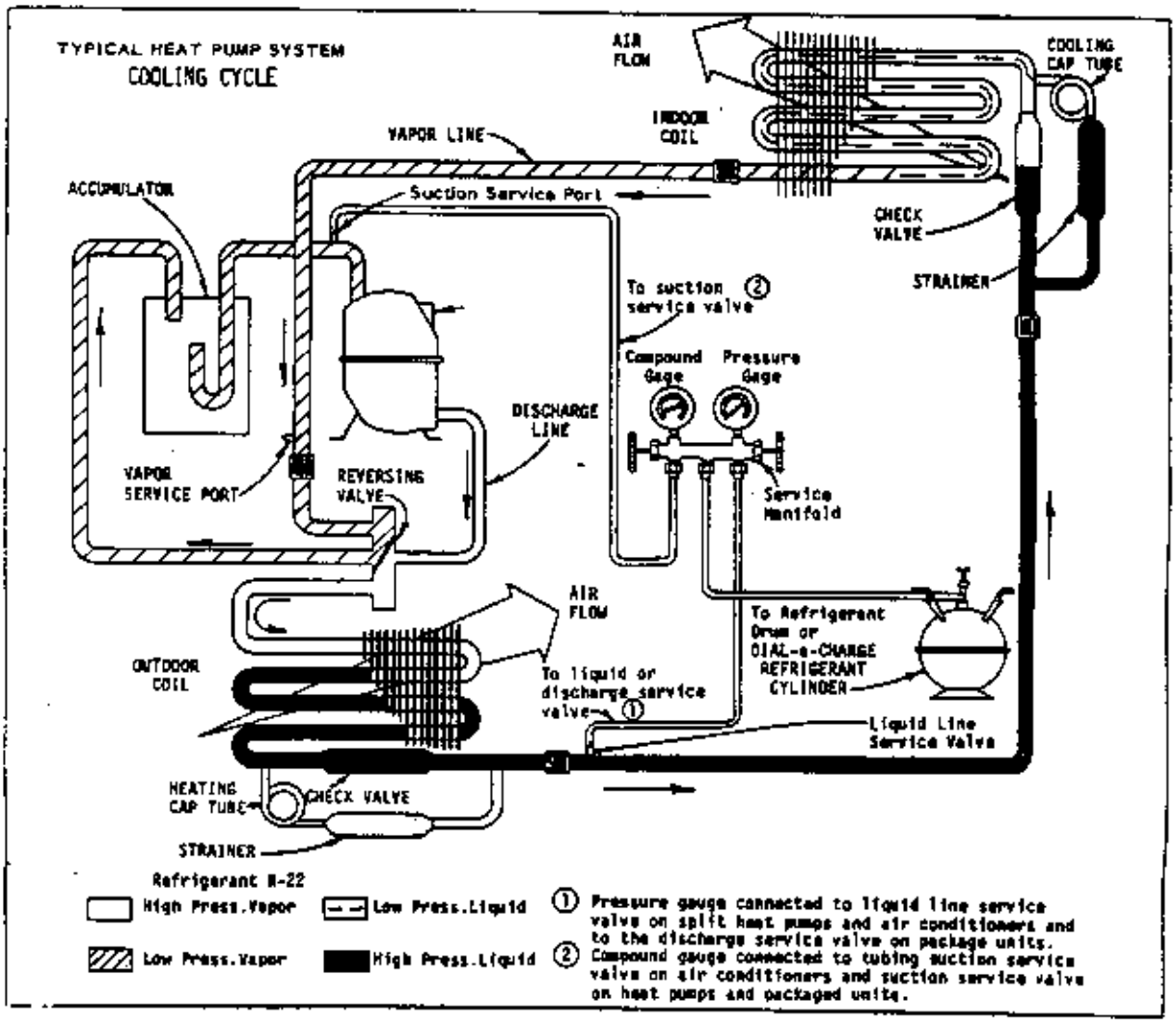
Low Suction — High Head Pressure

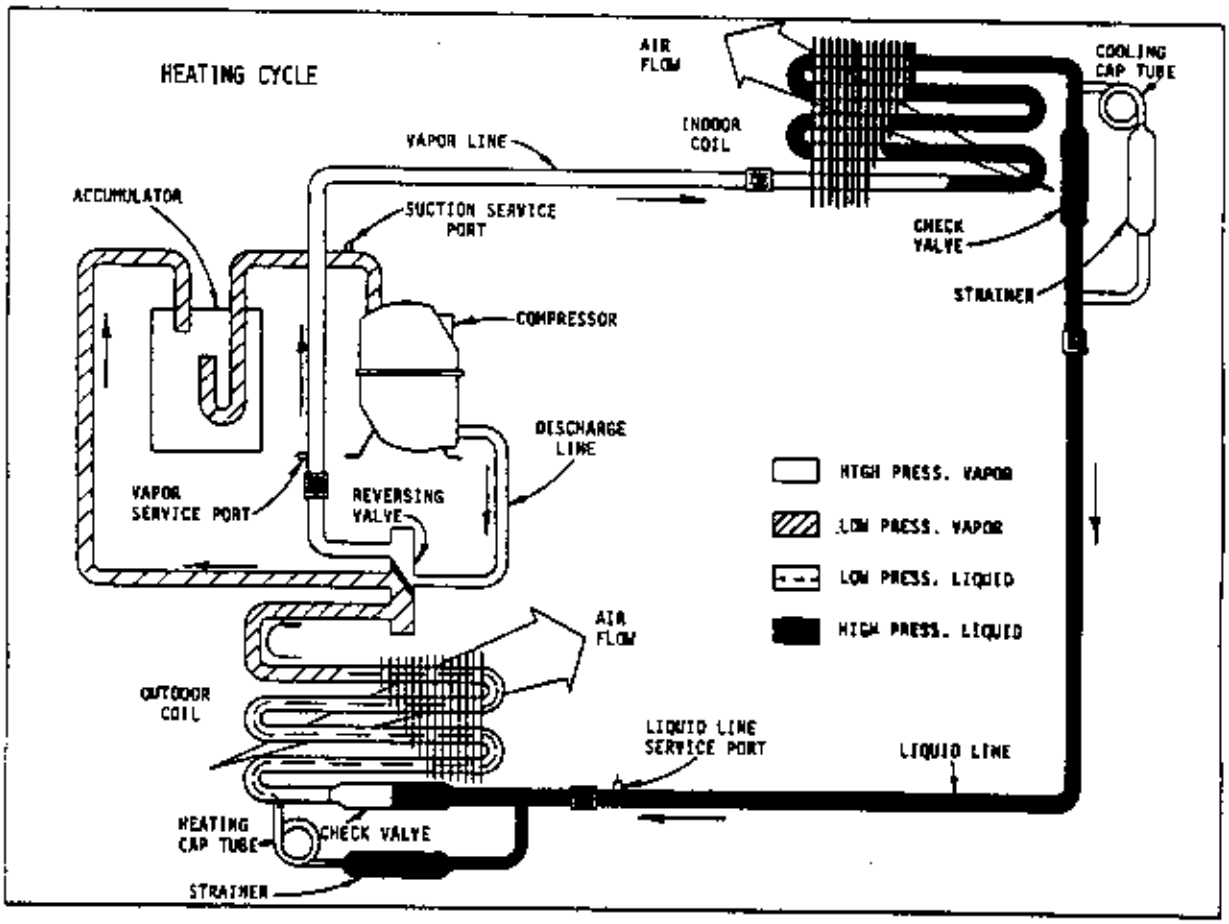
1. Partial restriction and then overcharged.

Note: On a split heat pump the vapor line should be within 10 psig of the pressure in liquid line on heating mode and within 10 psig of suction line on cooling mode. If not, check for sticking check valves.

High Suction — High Head Pressure

1. High ambient.
2. Low outdoor air flow
3. Overcharged.
4. Air in system.
5. Restricted condenser.

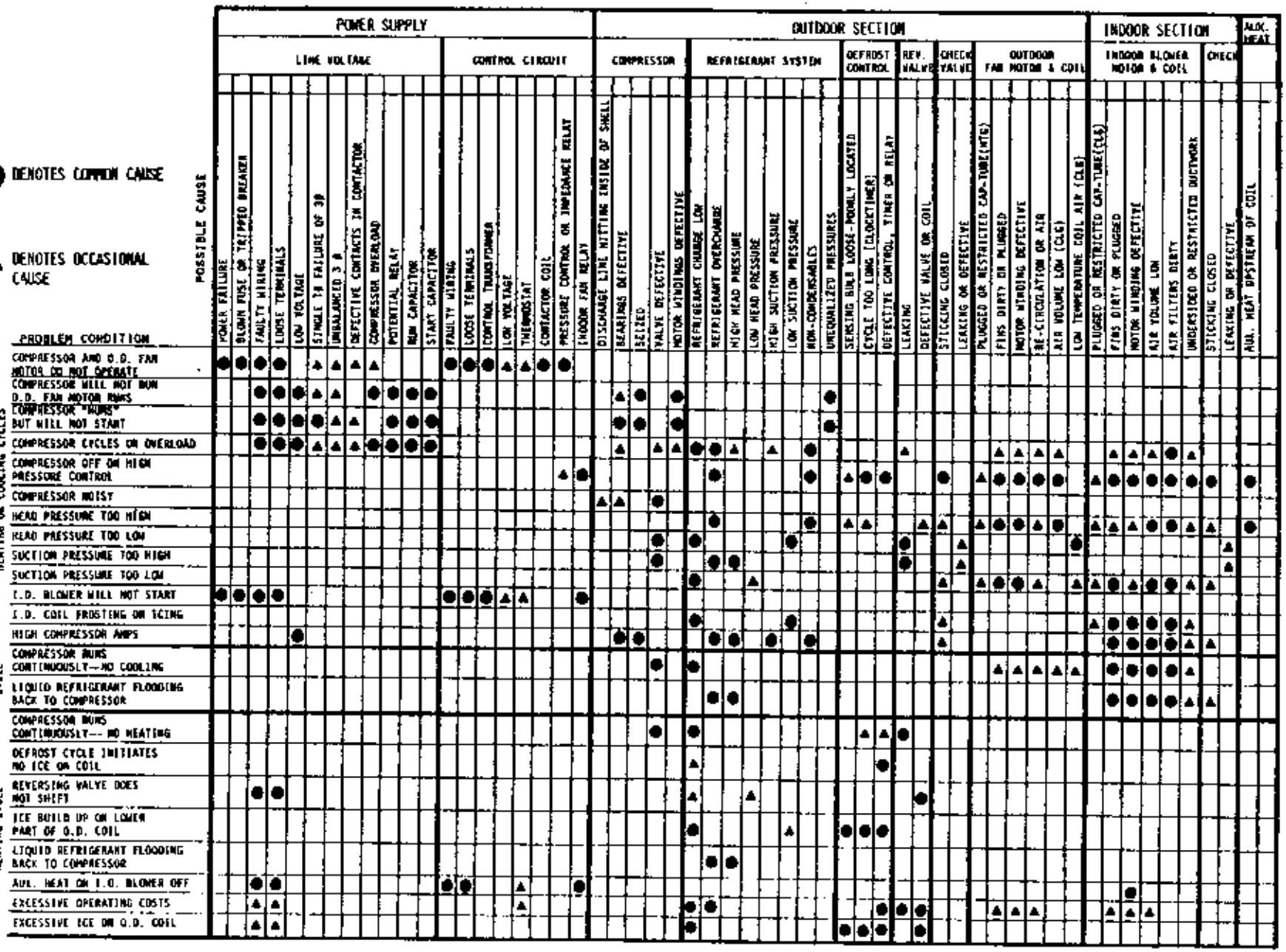

TYPICAL HEAT PUMP SYSTEM
COOLING CYCLE
AIR FLOW
COOLING CAP TUBE
INDOOR COIL
VAPOR LINE
ACCUMULATOR
Suction Service Port
CHECK VALVE
STRAINER
To suction service valve ②
Compound Gage
Pressure Gage
DISCHARGE LINE
VAPOR SERVICE PORT
REVERSING VALVE
Service Manifold
AIR FLOW
To Refrigerant Drum or DIAL-a-CHARGE REFRIGERANT CYLINDER
OUTDOOR COIL
To liquid or discharge service valve ①
Liquid Line Service Valve
HEATING CAP TUBE
CHECK VALVE
STRAINER
Refrigerant R-22
High Press.Vapor
Low Press.Liquid
Low Press.Vapor
High Press.Liquid
① Pressure gauge connected to liquid line service valve on split heat pumps and air conditioners and to the discharge service valve on package units.
② Compound gauge connected to tubing suction service valve on air conditioners and suction service valve on heat pumps and packaged units.


HEATING CYCLE
AIR FLOW
COOLING CAP TUBE
INDOOR COIL
VAPOR LINE
ACCUMULATOR
SUCTION SERVICE PORT
CHECK VALVE
STRAINER
COMPRESSOR
DISCHARGE LINE
VAPOR SERVICE PORT
REVERSING VALVE
HIGH PRESS. VAPOR
LOW PRESS. VAPOR
LOW PRESS. LIQUID
HIGH PRESS. LIQUID
AIR FLOW
OUTDOOR COIL
LIQUID LINE SERVICE PORT
LIQUID LINE
HEATING CAP TUBE
CHECK VALVE
STRAINER

QUICK REFERENCE TROUBLE-SHOOTING CHART FOR AIR TO AIR HEAT PUMP

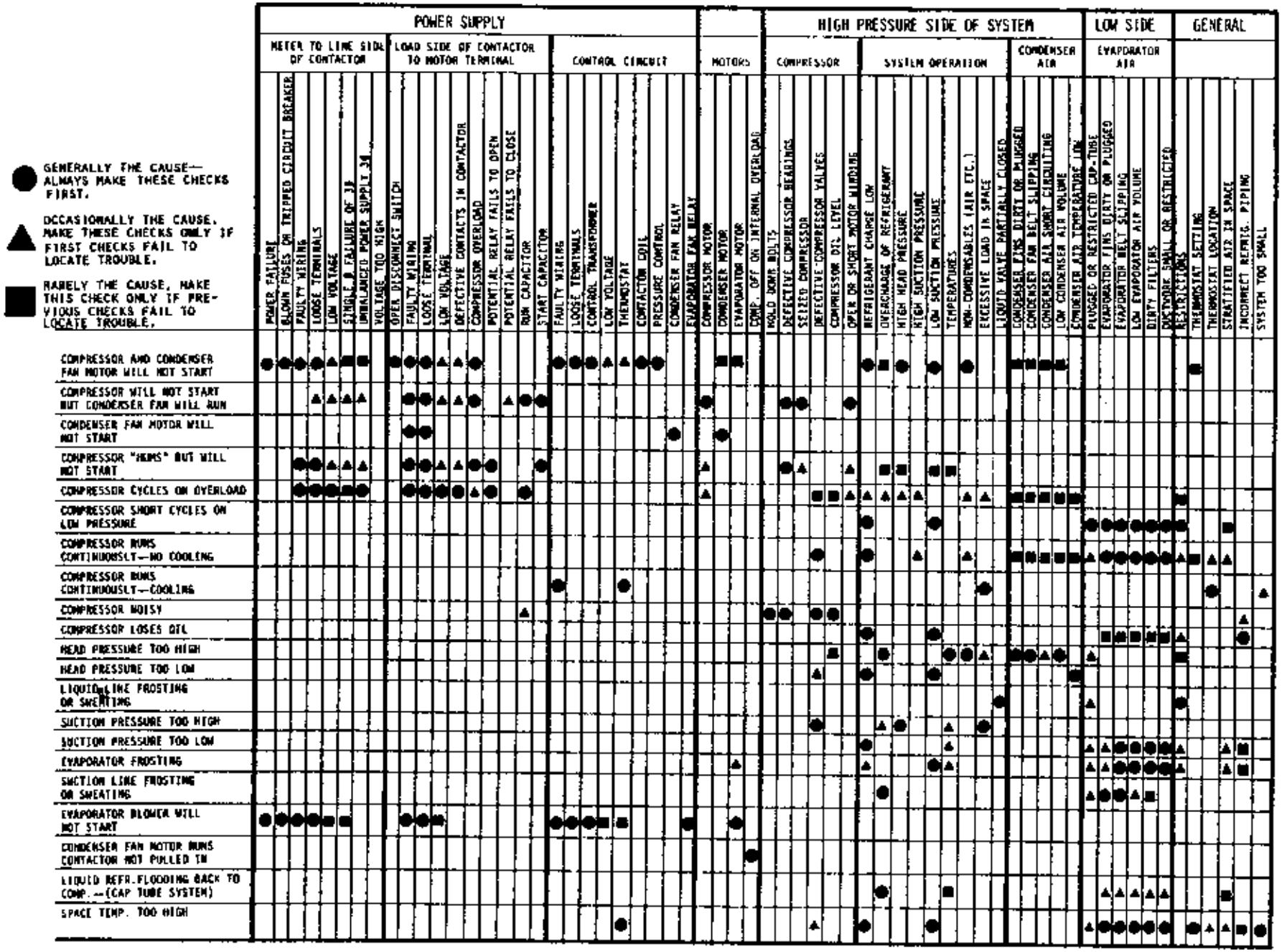
● DENOTES COMMON CAUSE

▲ DENOTES OCCASIONAL CAUSE



F1237-387

TROUBLE-SHOOTING CHART FOR AIR CONDITIONERS



F1238 387

R22 TOTAL SYSTEM CHARGE FOR SPLIT AIR CONDITIONING AND HEAT PUMP SYSTEMS

The following tables are used to determine the operating charge for split air conditioning and heat pump systems. The values shown are the total amount of refrigerant received in the precharged system components, which include the outdoor unit, indoor unit, and inter-connecting tubing. This is also the amount of refrigerant required for a system recharge following any refrigeration system repairs.

Find the outdoor section (Table A matching indoor section (Table B) and connecting tubing set (Table C) for system being used. Add the ounces of charge for each of the system components together. This value is the TOTAL SYSTEM CHARGE.

_____ OZs	+	_____ OZs	+	_____ OZs	+	_____ OZs
OUTDOOR UNIT (Table A)		INDOOR UNIT (Table B)		TUBING SET (Table C)		TOTAL SYSTEM CHARGE

To change total charge to lbs. and Ozs., divide by 16.

EXAMPLE: 2#ECQ1 with 2#Q5 coil and R#35 tubing set.

33 OZs	+	5 OZs	+	7 OZs	+	45 OZs

or $\frac{45 \text{ Ozs.}}{16}$ = 2 lbs. 13 oz.

In the event that the installer is running his own tubing by using a CTO kit or is modifying a precharged tubing set by adding or subtracting a few feet of tubing length, the tubing set should be evacuated and charged before being connected to the outdoor and indoor sections. To determine TUBING SET ONLY charges, use the following table:

TABLE D
(Shows Charge in Ozs.

Tubing Set Length in Ft.	10	15	20	25	30	35	40	45	50	55	60
1/2" O.D. Liquid Line	2	2	3	3	5	7	9	11	—	--	--
3/8" O.D. Liquid Line	2	2	5	8	11	14	17	20	23	26	29

To determine a TOTAL SYSTEM CHARGE for a system that is connected with a non-standard tubing length, the outdoor basic charge (from Table A) plus the indoor unit basic charge (from Table B), is added to the tube set based on liquid line O.D. size (Table D). This value is the TOTAL SYSTEM CHARGE.

NOTE: If your tubing length is between the sizes shown in the table, use a charge value appropriately between the values shown for the tubing length shorter and longer than actual length.

TABLE A SPLIT SYSTEM AIR CONDITIONERS	
MODEL	OUTDOOR UNIT FACTORY CHARGE
18ECQ2 24ECQ4 30ECQ4	26 oz. 39 oz. 52 oz.
31ECQ1 36ECQ5 37ECQ1	54 oz. 58 oz. 63 oz.
42ECQ1 48ECQ2 60ECQ1	84 oz. 86.5 oz. 101 oz.
SPLIT HEAT PUMPS	
18HPQ4	41 oz.
24HPQ4 30HPQ5	47 oz. 73 oz.
36HPQ5 36HPQ6* 42HPQ2	83 oz. 87 oz. 91 oz.
48HPQ5 60HPQ5 WQS30	122 oz. 112 oz. 50 oz.
WQSD30 WQS36 WQSD36	52 oz. 59.5 oz. 61.5 oz.
WQS50 WQSD50	110 oz. 112 oz.

NOTE: If model number is not shown on tables, check unit data plate for correct charge.

TABLE B INDOOR UNITS		
HORIZONTAL "H" EVAPORATOR COILS		
Model	Factory Charge	For Use With
3HCQ1 4HCQ 5HCQ	7 oz. 12 oz. 7 oz.	30ECQ4, 31ECQ1, 36ECQ5, 37ECQ1 42ECQ1, 48ECQ2 60ECQ1
"A" EVAPORATOR COILS		
18QS3 24QS1 2ACQ1	4 oz 3 oz. 2 oz.	18ECQ2 24ECQ4 18ECQ2, 24ECQ4
3ACQ3	5 oz.	30ECQ4, 31ECQ1, 36ECQ5, 37ECQ1
4ACQ2 5ACQ1	2.5 oz. 7 oz.	42ECQ1, 48ECQ2 48ECQ2, 60ECQ1
BLOWER COIL UNITS		
B18EHQ1 B24EHQ1 B30EHQ	7 oz. 7 oz. 2 oz.	18HPQ2, 24HPQ2, 18HPQ4, 24HPQ4 18HPQ2, 24HPQ2, 18HPQ4, 24HPQ4, 18ECQ2, 24ECQ4 31ECQ1, 30ECQ4, 30HPQ4, 30HPQ5
B36EHQ1	8 oz.	30ECQ2, 31ECQ1, 36ECQ5, 37ECQ1, WQS30, WQSD30, WQS36, WQSD36, 30HPQ4, 36HPQ4, 30HPQ5, 36HPQ5, 36HPQ6
BC48A	23 oz.	42ECQ1, 48ECQ2, 60ECQ1, 42HPQ1, 48HPQ4, 42HPQ, 48HPQ2, WQS50, WQSD50, 42HPQ2, 48HPQ5
BC60A	43 oz.	60HPQ4, 60HPQ5, 60ECQ1
HEAT PUMP COIL		
H18QS1 H24QS1	7 oz. 7 oz.	18HPQ2, 24HPQ2, 18HPQ4, 24HPQ4, 18ECQ2, 24ECQ2 18HPQ2, 24HPQ2, 18HPQ4, 24HPQ4
H3AQ1 *	10 oz.	30HPQ4, 36HPQ4, 30HPQ5, 36HPQ5, 36HPQ6 WQS30, WQSD30, WQS36, WQSD36
H4AQ1	23 oz.	42HPQ, 48HPQ2, 42HPQ1, 48HPQ4, 42HPQ2, 48HPQ5 WQS50, WQSD50
H5AQ1	43 oz.	60HPQ4, 60HPQ5

*When using an H1AQ1 with a 36HPQ6 outdoor unit, installer must add 13 oz. to factory charge (total system charge is 113 oz.)

TABLE C CHARGED TUBING SETS FOR USE WITH 18ECQ2, 24ECQ4, 18HPQ2, 24HPQ2, 18HPQ4, 24HPQ4				
Model	Charge	Length in Ft.	Liquid Line	Suction Line
CT15 RW25 RW35 RW45	3 oz. 3 oz. 7 oz. 11 oz.	15 25 35 45	1/4" 1/4" 1/4" 1/4"	5/8" 5/8" 5/8" 5/8"
FOR USE WITH 30ECQ4, 31ECQ1, 36ECQ5, 37ECQ1, 30HPQ4, 36HPQ4, 30HPQ5, 36HPQ5, 36HPQ6, WQS30, WQS36, WQSD30, WQSD36				
CTO CT15 CT25 CT35 CT45	None* 2 oz. 3 oz. 14 oz. 20 oz.	0 15 25 35 45	3/8" 1/4" 1/4" 3/8" 3/8"	3/4" 5/8" 3/4" 3/4" 3/4"
FOR USE WITH 42ECQ1, 48ECQ2, 60ECQ1, 42HPQ, 42HPQ1, 42HPQ2, 48HPQ2, 48HPQ4, 48HPQ5, 60HPQ4, 60HPQ5, WQS50, WQSD50				
CTO-12 CT15-12 CT25-12 CT35-12 CT45-12	None* 2 oz. 8 oz. 14 oz. 20 oz.	0 15 25 35 45	3/8" 3/8" 3/8" 3/8" 3/8"	7/8" 7/8" 7/8" 7/8" 7/8"

*CTO and CTO-12 for field installed tubing. (See Table D for charging).