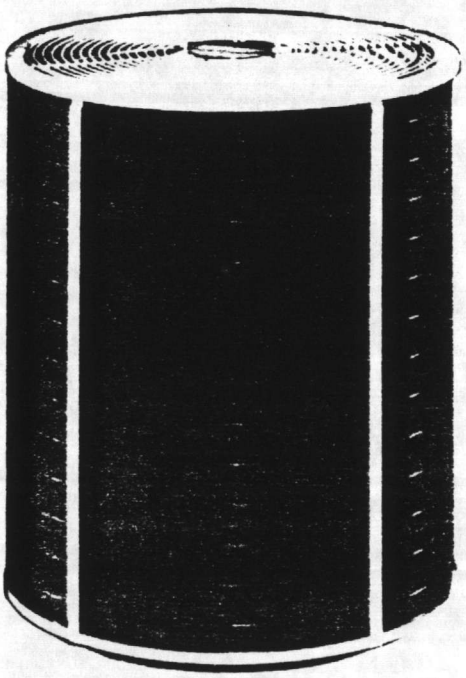
INSTALLATION INSTRUCTIONS AND OPERATING PROCEDURE



HIGH EFFICIENCY CONDENSING UNITS

SERIES AD

Bulletin No. 7211-050

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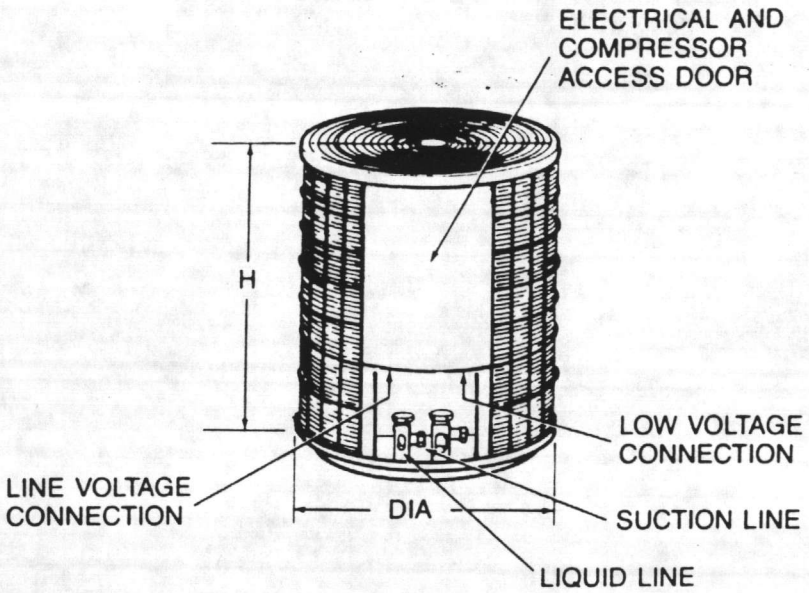
DIMENSIONAL DATA



UNIT DIMENSION AND VALVE SIZE				
COOLING TONS	CABINET SIZE		CONNECTION SIZE	
	H	DIAM	LIQUID VALVE	SUCTION VALVE
1½	25½	24	¼	⅝
2	29½	24	¼	⅝
2½	37½	24	⅜	¾
3	37½	24	⅜	¾
3½	35¾	30	⅜	¾
4	39¾	30	⅜	¾*
5	43⅞	30	⅜	¾*

*⅞" CONNECTION PROVIDED ON UNITS WITH SWEAT ONLY VALVES

GENERAL INFORMATION

These units have been designed and tested at the manufacturer's laboratories. They are rated in accordance with A.R.I. Standards.

These units, with a wide variety of Furnace/Air Handlers and Evaporator Coil combinations, are designed for use in residential and commercial type buildings.

They can be used in combinations with conventional forced warm air heating systems and also may be used as a straight cooling system independent of the heating.

COMPRESSOR CONDENSER SECTION

Each condensing unit is shipped containing an operating charge adequate to handle 25 feet of refrigeration lines.

NOTE: DO NOT USE ANY PORTION OF THE CHARGE FOR PURGING OR LEAK TESTING.

All condensing units are shipped less drier. If a drier is not already built-into the evaporator coil, it is recommended a drier be installed.

All evaporator coils are shipped with a holding charge in them to keep out contaminants. To release the charge, read the coil installation section carefully.

NOTE TO INSTALLING DEALER: THE OWNER'S MANUAL AND WARRANTY ARE SHIPPED WITH THE CONDENSING UNIT. It is important that the owner receives this or that it is prominently displayed near the indoor Furnace/Air Handler Unit.

LIQUID & SUCTION LINES

Fully Annealed refrigeration lines should be used when installing the system. The suction line is fully insulated and needs no additional insulation.

Standard liquid and suction line lengths are 15, 20, 25, 30, 35 and 50 feet. Like evaporator coils these have a holding charge. DO NOT ATTEMPT TO SAVE ANY OF THIS CHARGE. For installation instructions on the liquid and suction lines, see Part #4.

READ THE FOLLOWING INSTRUCTIONS COMPLETELY BEFORE ATTEMPTING THE INSTALLATION PROCEDURE.

DATA SUBJECT TO CHANGE WITHOUT NOTICE.
CODE: AD-72110500887

PART #1
INSTALLATION INSTRUCTIONS

FOUNDATION CONSTRUCTION

ZONING ORDINANCES MAY GOVERN THE MINIMUM DISTANCE THE CONDENSING UNIT CAN BE INSTALLED FROM THE PROPERTY LINE. CHECK THESE ORDINANCES BEFORE PROCEEDING.

The remote condensing unit is to be installed on a solid foundation. This foundation should extend a minimum of 2" beyond the sides of the Condensing Unit and must be level. SEE FIGURE 1 and TABLE 1.

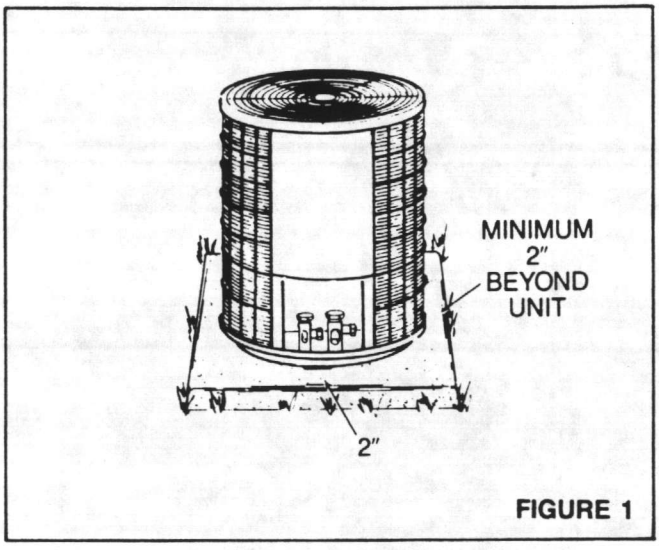
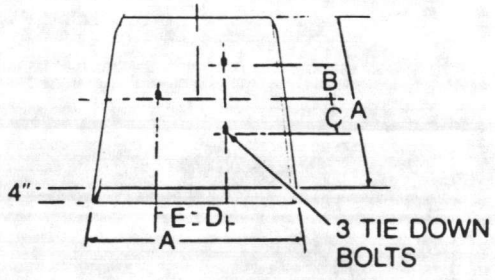


FIGURE 1

TABLE 1

BASE DIA.	DIMENSION (INCHES)				
	A	B	C	D	E
24"	28	6 3/16	8 1/2	6 3/16	8 1/2
30"	34	9 3/8	9 3/8	5 3/8	10 13/16



CONCRETE PAD
SQUARE OR CIRCULAR

This foundation can be a precast slab. It can also be a monolithic poured slab. It is recommended that the foundation slab NOT be in contact with or be an integral part of the building foundation. This will eliminate the possibility of noise transmission, between the equipment slab and the house foundation. SEE FIGURE 2.

AT NO TIME SHOULD THE CONDENSING UNIT BE SET ON BRICKS OR CONCRETE BLOCKS.

CONDENSING UNIT LOCATION

After having made allowances for the zoning ordinances, care should be exercised not to locate the condensing unit immediately adjacent to sleeping areas or in corners where operating noise levels can be amplified. See FIGURE 2. Select a location as reasonably close to the indoor unit as possible, thus avoiding any long refrigeration line runs. Position the unit in such a way that the hot condenser air will be directed away from roof over-hang. SEE FIGURE 2.

Place the unit so there is a minimum distance of 24" between the building wall and the air inlet or service panel side of the unit. This allows room for servicing.

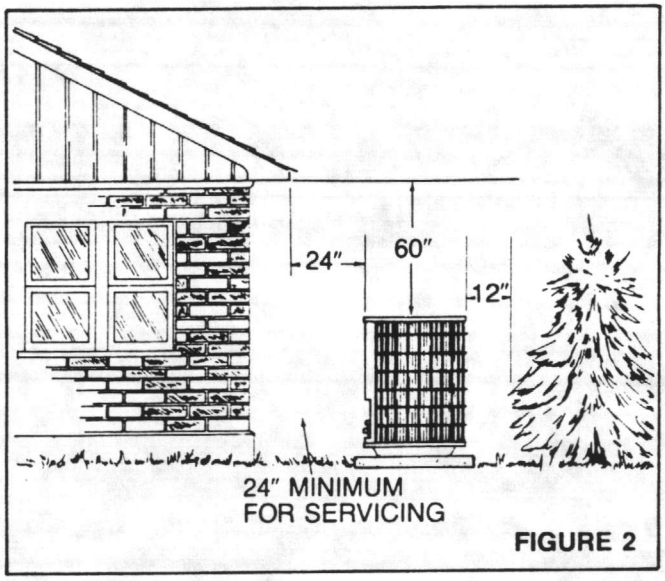


FIGURE 2

ROOF TOP INSTALLATIONS

Quite frequently it becomes necessary to install multiple or single units on a roof structure. If this is done, be sure to elevate the units. Set the equipment on 4 × 6 stringers perpendicular to the roof joists. Again, be sure to level these stringers. SEE FIGURE 3. For anchoring units on roof SEE FIGURE 4 and 5.

These units are designed with "top discharge" condenser air movement. That is, the condenser air is taken in through the curved condenser coil and is discharged out the top.

To insure quiet operation and maximum efficiency of the unit, eliminate any obstructions which might interfere with the air discharge of the unit.

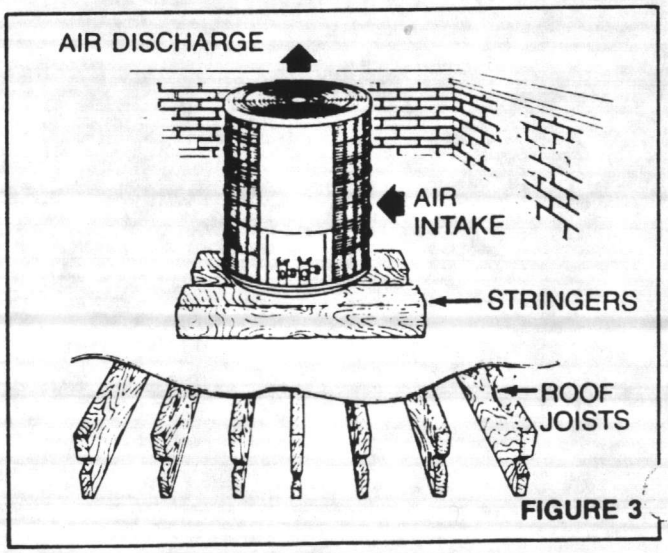
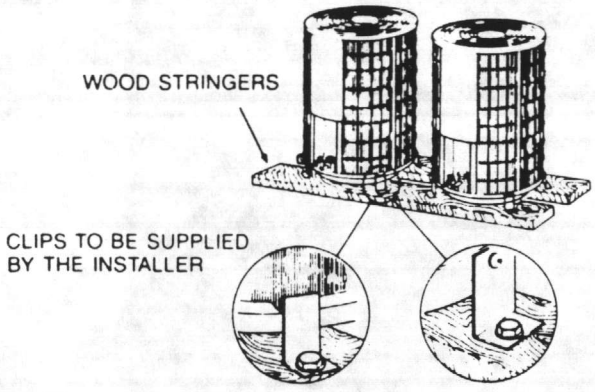


FIGURE 3

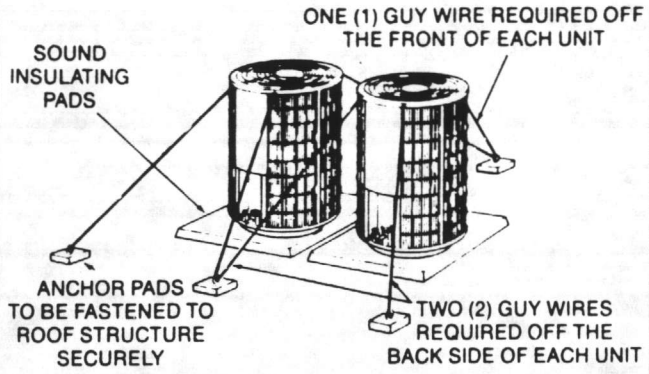
METHOD OF ANCHORING CONDENSING UNITS TO ROOF TOP WHEN THE UNITS SET ON WOOD STRINGERS



TWO (2) CLIPS REQUIRED ON THE FRONT AND ON THE BACK OF THE UNIT.

FIGURE 4

METHOD OF ANCHORING CONDENSING UNITS TO ROOF TOP WHEN THE UNITS ARE SET ON SOUND INSULATING MATERIAL



ANCHOR PADS, "1" BOLTS AND GUY WIRES TO BE SUPPLIED BY INSTALLER

FIGURE 5

NOTE: WHEN CONDENSING UNIT IS TO BE INSTALLED ON A "BONDED GUARANTEED ROOF", A RELEASE MUST BE OBTAINED FROM THE BUILDING OWNER TO FREE THE INSTALLER FROM ALL LIABILITIES.

PART #2
INSTALLING THE EVAPORATOR COIL

The Evaporator Coil must be installed before proceeding with the refrigeration piping. Consult the installation instructions of the indoor unit (i.e. Air Handler; Fan Coil Unit; etc.) for details regarding installation.

EVAPORATOR ORIFICE SELECTION

Some evaporator coils require an orifice (piston or restrictor) in order to operate properly with the appropriate outdoor condensing unit.

Refer to the Variator/Restrictor Chart in the appendix of these instructions. If the coil does not have a restrictor already installed or if the restrictor/piston installed is not the one indicated on the Chart, a replacement piston is required. The correct number piston is either included with the evaporator coil or may be purchased from the Parts Department. See the evaporator coil (indoor unit) instructions for details of changing the piston.

NOTE: The proper piston or restrictor must be installed in the evaporator coil liquid connection prior to the installation of the refrigerant lines.

PART #3
INSTALLATION OF REFRIGERATION TUBING

REFRIGERATION LINE SETS:

NOTE: It is permissible to add to the line length up to a maximum of 100 feet. If it is necessary to add tubing in the field, use dehydrated or dry sealed deoxidized copper refrigeration tube. DO NOT use copper water pipe.

IT IS IMPORTANT THAT NO TUBING IS CUT OR SEALS BROKEN UNTIL YOU ARE READY TO ACTUALLY MAKE CONNECTIONS TO THE EVAPORATOR AND TO THE CONDENSER SECTION.

Flare nuts are provided on the flared ends of the suction and liquid lines. Lines are charged with R22 to keep them dry. Rubber plugs in the tube ends will hold the charge until the final connections are made.

DO NOT REMOVE RUBBER PLUGS FROM THE TUBE ENDS UNTIL READY TO MAKE CONNECTIONS AT EVAPORATOR AND CONDENSER.

PLEASE! Under no circumstances leave the lines open to the atmosphere for any period of time.

BE EXTRA CAREFUL WITH SHARP BENDS, THIS TUBING CAN "KINK" VERY EASILY, AND IF THIS OCCURS, THE ENTIRE TUBE LENGTH WILL HAVE TO BE REPLACED.

EXTRA CARE AT THIS TIME WILL ELIMINATE FUTURE SERVICE PROBLEMS.

SUSPENSION AND INSTALLATION OF REFRIGERATION LINES

DO NOT fasten liquid or suction lines in direct contact with the floor or ceiling joist. Use an insulated or suspension type of hanger. A good hanger can be made by using a conduit clamp similar to those used by an electrician for suspending conduit or as illustrated in FIGURE 10.

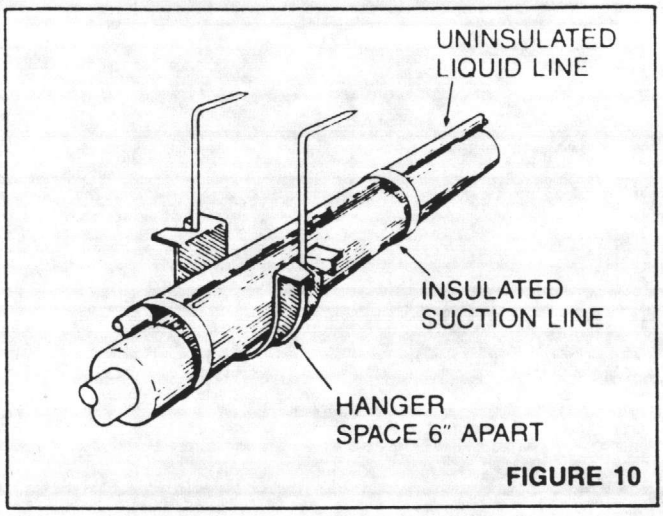


FIGURE 10

Keep both lines separate, and insulate only the suction line.

Do not let refrigerant lines come in direct contact with foundation. When running refrigerant lines through the foundation or wall, the openings should be made large enough to allow for a sound absorbing material to be placed or installed between the tubing and the foundation. This will prevent noise transmission between the tubing and the wall section of the building.

INSTALLATION INSTRUCTIONS FOR CONDENSING UNITS THAT ARE HIGHER THAN EVAPORATOR.

NOTE: When the condensing unit is installed above the evaporator coil, it should be installed with trap at evaporator coil and inverted "P" trap at top of riser. SEE FIGURE 11.

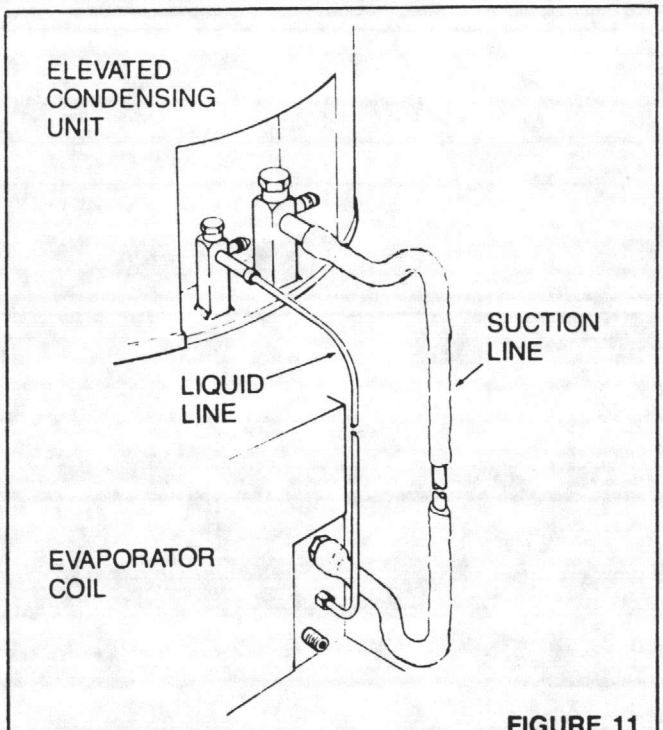


FIGURE 11

PART #4
CONNECTING THE SUCTION AND LIQUID LINES

CONNECTING REFRIGERATION LINES TO OUTDOOR CONDENSING UNIT

The outdoor condensing unit comes with either combination Flare/Sweat Brass service valves or straight Sweat brass service valves.

TUBING CONNECTIONS FOR UNITS EQUIPPED WITH COMBINATION FLARE/SWEAT CONNECTION

DO NOT REMOVE PLUGS FROM TUBE ENDS UNTIL READY TO MAKE CONNECTIONS AT CONDENSER.

IN ORDER TO MINIMIZE THE POSSIBILITY OF A REFRIGERANT LEAK, WE STRONGLY SUGGEST THAT BRAZED CONNECTIONS BE MADE.

BRAZE CONNECTIONS:

Before making brazed connections, be sure all joints are clean. Before heat is applied for brazing, nitrogen should be flowing through the tubing to prevent oxidation and scale formation on inside tubing.

The following is the recommended field processing for the Modified 45° Flare/Braze field port connections:

1. Remove flare insert. SEE FIGURE 12

BRAZE CONNECTION AT SERVICE VALVE

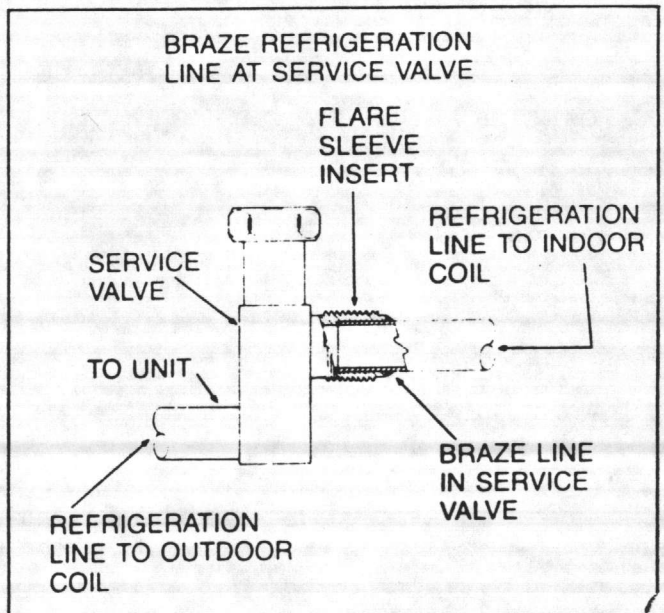


FIGURE 12

2. Clean tube end with emery cloth or steel brush.
3. Use Stay Bright 8, or a low temperature silver solder when brazing. It will flow at about 450° keeping the valve cooler.
4. Use Stay-Clean Flux or Silver solder flux paste not liquid.
5. Use Calgon Thermo-Trap heat absorbing paste or an equivalent heat sink product, to keep the valve body from heating up. This will protect the O-ring inside the valve body. Quench the area and use wet rags if nothing else is available.
6. Make the braze joint as quickly as possible to prevent damage to the O-ring on the valve stem.
7. After the joint has cooled for about 1 minute—quench the joint and tubing with water using wet rags. Leave rags on valve body and rewet with water to help cool area.

FLARE CONNECTION:

Before making connections be sure all joints are clean and that flare and flare seat are free of burrs and flaws.

When flare connections are used, make sure that the flare on the tubing is a good, clean flare.

1. Place flare insert into braze counterbore on the field port. SEE FIGURE 13.
2. Place two drops of refrigeration oil on the male threads of the port.
3. Connect up standard 45° flare nut and tubing by hand until tubing flare "bottoms" against the flare insert or a definite resistance is felt.
4. Make a positioning mark lengthwise from the flare nut to the valve port and, using the line as a guide, tighten the flare nut an additional ⅓ turn (2 hex flats) to secure assembly.
5. In order to prevent loosening of flare nut, apply soft solder as shown in FIGURE 13.

TUBING CONNECTIONS FOR UNITS EQUIPPED WITH STRAIGHT SWEAT SERVICE VALVES.

The brass service valves are equipped with a copper stub connection already swaged to accommodate the suction and liquid lines. Hard solder with 5% silver ("Sil-flos" for example) is recommended for brazing copper to copper.

1. Clean the tube ends to be brazed and DO NOT flux.
2. Cut and fit straight lengths of tubing and elbows (if used).
3. After cleaning, braze all joints in the lines.
4. Use a heat sink compound to cool the service valve while brazing.
5. The valve service ports must be front seated (i.e. shipping position) before the lines are brazed to the valves. (See Purging and Evacuating Instructions).
6. It is recommended that dry nitrogen flow through the lines while brazing.

FLARE NUT CONNECTION AT SERVICE VALVE

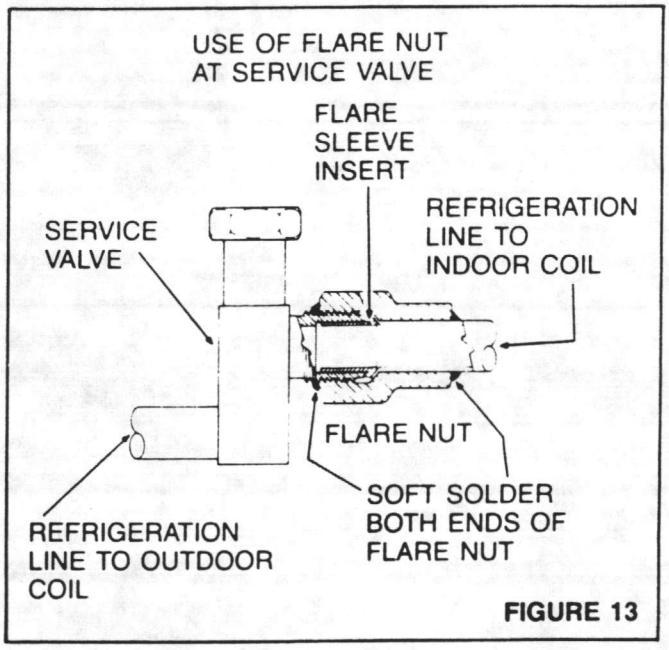


FIGURE 13

PART #5
PURGING, EVACUATING, AND CHARGING INSTRUCTIONS

THESE INSTRUCTIONS ARE INTENDED FOR USE WITH CONDENSING UNITS THAT ARE PRECHARGED AT THE FACTORY WITH ADEQUATE REFRIGERANT TO HANDLE UP TO 25 FEET OF REFRIGERATION TUBING.

PURGING PROCEDURE:

The liquid line and suction line service valves have been closed after final testing at the factory. DO NOT DISTURB THESE VALVES AT THE PRESENT TIME. IT WILL BE NECESSARY TO MAINTAIN THE CLOSED POSITION OF THESE VALVES UNTIL THE LINES HAVE BEEN LEAK CHECKED AND PURGED OR THE CHARGE IN THE UNIT MAY BE LOST.

1. Remove the gauge port cap on the gauge port of the liquid service valve.
2. Purge gauge bar and hose with refrigerant before connecting the charge hose to this liquid line gauge port.
3. Open the hand valve on the liquid connection of the gauge bar, and briefly purge (about 5 seconds) the liquid line to the indoor coil. SEE FIGURE 14.
4. Pressurize the liquid line, the indoor coil and the suction line with refrigerant. Remove gauge port cap, allow lines and coil to purge until refrigerant is discharged from lines, and suction service valve. Replace suction line gauge port cap, pressurize the lines and indoor coil, until the pressure in the lines and system is equal to that in the refrigerant drum. The greater the pressure in the system, the less the chances of passing over a leak.
5. There should now be sufficient refrigerant in the system to make the first check for leaks. Check the entire system for possible leaks. This can be done with a Halide torch or an Electronic Leak Detector.

After any leaks have been repaired, follow the previous procedure, and again check for leaks. Once the system is leak tight, release the pressure on the tested lines by depressing the Schraeder valve on the suction line service valve.

EVACUATION

PROCEDURE FOR EVACUATING A REFRIGERATION SYSTEM

It is mandatory that a thorough evacuation of the refrigeration system be performed. Various models of vacuum pumps are available through supply houses to handle this task. To effectively evacuate the system, there are several guidelines which should be considered in selecting a pump.

First, a two stage vacuum pump with a capacity of 2.5 CFM to 5.0 CFM has been found to be of adequate size, without being excessive.

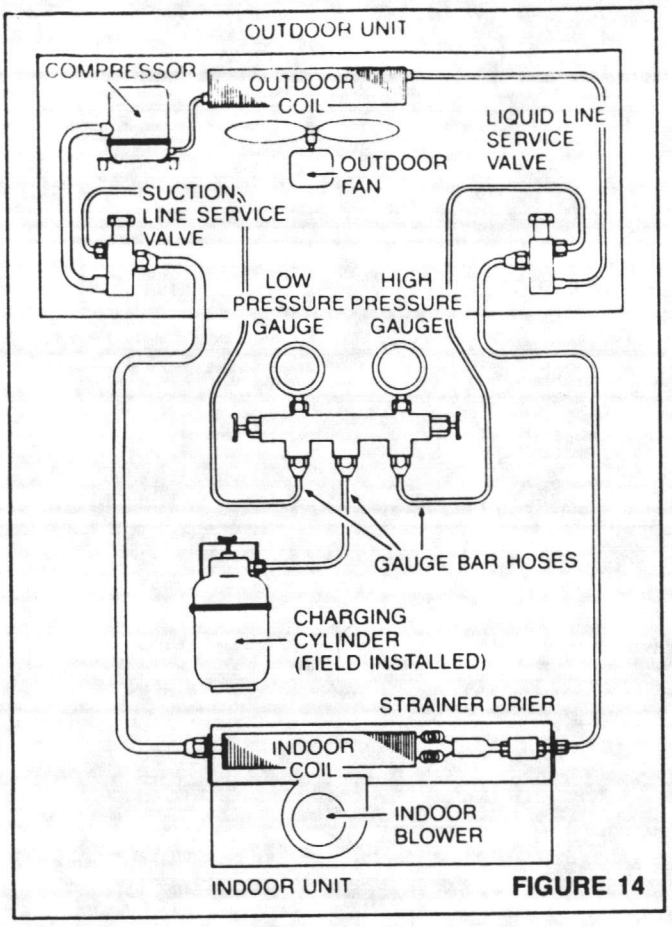


FIGURE 14

Second, vacuum pump to equipment service valve connection should be made with no smaller internal diameter than ⅜". Likewise, length of connections should also be kept as short as possible to minimize the vacuum restriction.

Third, a micron gauge capable of indicating 50 microns or lower is recommended.

RECOMMENDED METHOD OF EVACUATING A SYSTEM

1. Connect the vacuum pump to the suction and liquid line gauge port. SEE FIGURE 15.

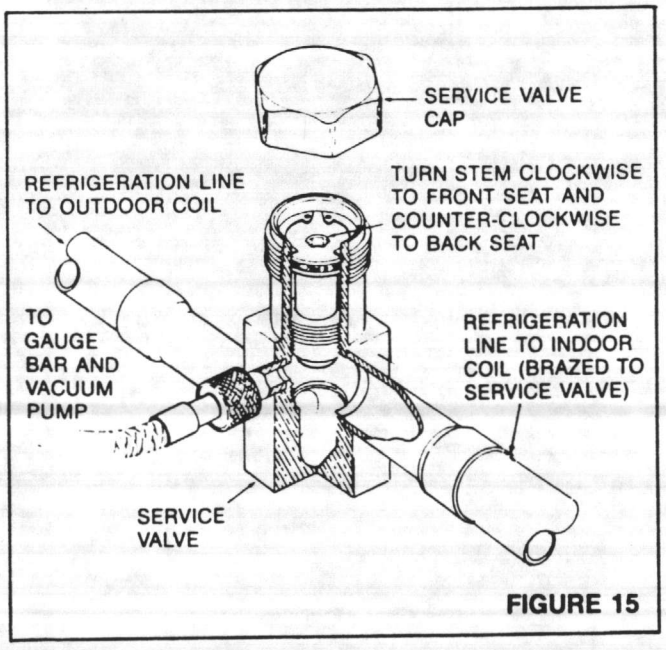


FIGURE 15

2. If the evacuation is being performed on a new system installation, the service valves should be kept in the "front seated" (closed) position. This will allow the mechanic to evacuate the refrigeration lines and the indoor coil, without disturbing the factory charge in the outdoor unit.

   If the evacuation is being performed on an installation where the factory charge has already been released, the service valve seat should be positioned full open. The vacuum pump will then be able to evacuate the outdoor unit, the line set, and the indoor coil.
3. Follow the vacuum pump manufacturer's instructions. Allow the pump to operate until the system has been evacuated down to 300 microns. Allow the pump to continue running for an additional 15 minutes. Turn off the pump and leave the connections secured to the two service valves. After 5 minutes, if the system fails to hold 500 microns or less, check all connections for tight fit and repeat the evacuation procedure.
4. Isolate the vacuum pump from the system by closing the shutoff valves on the gauge bar. Disconnect the vacuum pump.

TYPICAL SPLIT SYSTEM REFRIGERATION CIRCUIT

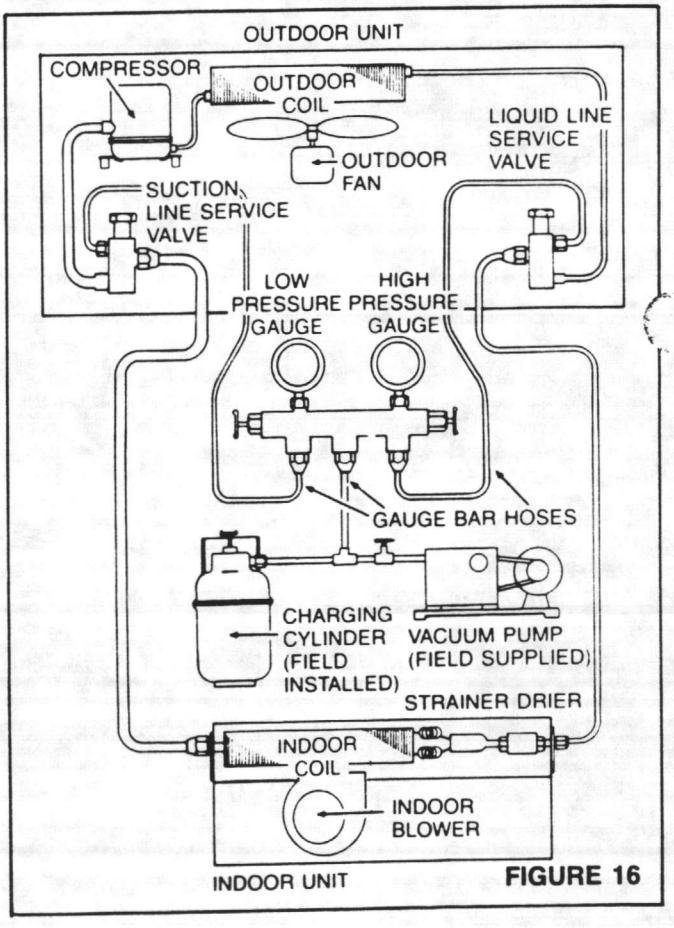


FIGURE 16

VALVE ACTUATION: (FACTORY CHARGED UNITS)

NOTE: The operation of the brass service valves is the same no matter if they come equipped with Flare/Sweat connections or straight Sweat Connections.

A) After evacuation and/or purging of the connecting lines, remove the service valve cap and fully insert the hex wrench into the stem. Backout counterclockwise until the valve stem just touches the retaining ring. SEE FIGURE 15.

B) Replace service valve cap and torque to 8 - 11 ft. lbs. on 1/4" and 3/8" valves. 12 - 16 ft. lbs. on 5/8" and 3/4" valves.

C) **NOTE: THIS IS NOT A BACKSEATING VALVE.**
Care must be taken to prevent dislodging retainer ring when opening valve.

Torque gauge port cap 4 - 6 lbs.

CAREFUL ADHERENCE TO THE ABOVE INSTRUCTIONS WILL HELP ELIMINATE FUTURE SERVICE PROBLEMS.

CHARGING PROCEDURE:

NOTE: Each compressor-condenser section is shipped containing an operating charge adequate to handle 25 ft. of refrigerant line when matched with an approved evaporator coil.

For line lengths greater than 25 feet, add refrigerant charge as follows:

.20 oz. per additional foot of 1/4" dia. liquid refrigerant line.

.28 oz. per additional foot of 5/16" dia. liquid refrigerant line.

.60 oz. per additional foot of 3/8" dia. liquid refrigerant line.

The recommended method of addition or removal of refrigerant is by weight. This may be accomplished by using the following equipment:

1. An accurate refrigeration scale, or/
2. A charging cylinder - (i.e. Dial-A-Charge, by Robinaire Mfg.)

This equipment may be obtained from most refrigeration supply houses.

NOTE: The transfer of refrigerant becomes more difficult as the ambient temperature drops below 60° F. Attempting to charge with a scale in low temperatures may be impossible. Therefore, investment in a charging cylinder with an internal heat is highly recommended.

REFRIGERATION OIL:

Refrigerant oil to be added for extended line lengths must be one of these types: Sunico 3G; Sunico 3S; Texas Capella B; Texas Capella B Inhibited.

For line lengths greater than 30 foot, add refrigerant oil as follows:

3 oz. per additional 10 foot over 30 feet for all refrigeration line sizes.

PART #6
FINAL REFRIGERATION CHARGE ADJUSTMENT

PROCEDURE FOR DETERMINING INDOOR FAN AIR FLOW.

INDOOR FAN PERFORMANCE. Before any adjustment is made to the refrigerant charge, it is imperative that the air flow characteristics of the indoor fan be established. Recommended air flow for installations is shown on the following chart.

COOLING TONS	CFM WITH DRY COIL	CFM WITH WET COIL*
1½ TON	737	670
2 TON	880	800
2½ TON	1100	1000
3 TON	1375	1250
3½ TON	1430	1300
4 TON	1760	1600
5 TON	2200	2000

*As indicated on the unit correlation tables.

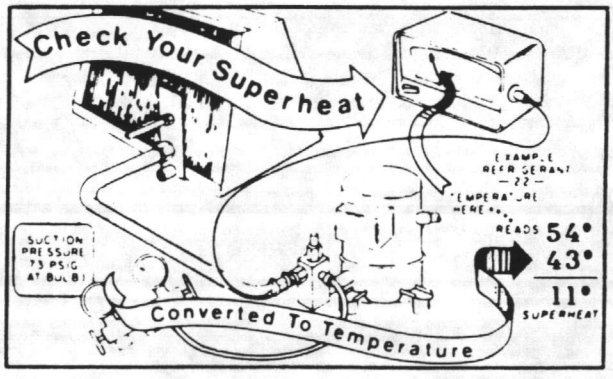
When checking indoor air flow, it is important to remember that the fan will deliver a higher quality of air across a dry coil versus a wet coil. The reason being that the wet coil has additional resistance to air flow due to the water droplets. When checking systems or charts it is vital that reference is made to the corresponding requirement. Correlation tables are figured with a wet coil. Blower charts are calculated with a dry coil.

For on-the-job conversion of air flow figures, the rule of thumb is that there is a 10% difference between the wet coil and dry coil air flow. For example: an air handler with a wet coil, operating with an air flow of 1000 CFM, will yield about 1100 CFM when the coil is dry.

Refer to indoor Unit Installation Instructions for proper method of determining air flow.

TO CHECK SYSTEM REFRIGERANT CHARGE:
(SUPERHEAT METHOD)

1. Attach an accurate temperature sensing device to the suction line approximately 4 - 6" away from the suction line service valve. The temperature sensing device should be clamped securely to the suction line, on a horizontal plane (3 or 9 O'clock) and insulated. Record the suction line temperature.



2. Measure and record the suction line refrigeration pressure. (Measure at the suction line service valve gauge port). Using Chart 1 convert this pressure to the saturation refrigerant temperature. The difference between these two temperatures is the amount of superheat.

CHART 1

TEMPERATURE/PRESSURE CHART
Pressure = p.s.i.g.

TEMPERATURE °F.	R-22	TEMPERATURE °F.	R-22	TEMPERATURE °F.	R-22
- 6	19.3	19	41.9	41	70.0
- 4	20.8	20	43.0	42	71.4
- 2	22.4	21	44.1	43	73.0
0	24.0	22	45.3	44	74.5
1	24.8	23	46.4	45	76.0
2	25.6	24	47.6	46	77.6
3	26.4	25	48.8	47	79.2
4	27.3	26	49.9	48	80.8
5	28.2	27	51.2	49	82.4
6	29.1	28	52.4	50	84.0
7	30.0	29	53.6	55	92.6
8	30.9	30	54.9	60	101.6
9	31.8	31	56.2	65	111.2
10	32.8	32	57.5	70	121.4
11	33.7	33	58.8	75	132.2
12	34.7	34	60.1	80	143.6
13	35.7	35	61.5	85	155.7
14	36.7	36	62.8	90	168.4
15	37.7	37	64.2	95	181.8
16	38.7	38	65.6	100	195.9
17	39.8	39	67.1	105	210.8
18	40.8	40	68.5	110	226.4
				115	242.7

3. Measure and record the outside ambient air temperature.
4. Compare the calculated superheat value with the recommended values given in Chart 2.

CHART 2

OUTSIDE AIR TEMP %F	SUPERHEAT %F CAPILLARY TUBE	TXV
95	5	5-7
90	10	5-7
85	15	5-7
80	20	5-7
75	25	5-7

If the actual superheat readings are higher than shown, the system is most likely under-charged, and charge should be added. Add charge in 4 ounce increments, and recalculate superheat values. Continue adjusting charge until the actual superheat approximately matches the recommended values.

If the actual superheat readings are lower than shown, the system is most likely over-charged and charge should be removed. Remove charge in 4 to 6 ounce increments and recalculate superheat values. Continue adjusting charge until the actual superheat approximately matches the recommended values.

NOTE: Each time that charge is added or removed from the system, allow the system to run approximately 15 minutes before pressure and temperature readings are taken and superheat calculations made.

PART #7
START-UP PROCEDURE

1. Set Thermostat selector switch to OFF.
2. Set room thermostat at desired temperature. Be sure set-point is below indoor ambient temperature.
3. Set the system switch of the thermostat on COOL and fan switch for continuous operation or AUTO, as desired. Operate unit for 15 - 20 minutes, then check the system refrigerant charge.
4. After the refrigerant charge has been adjusted, the system is now ready for continuous operation.

PART #8
WIRING

NOTE: ALL WIRING MUST BE DONE IN ACCORDANCE WITH NATIONAL AND LOCAL ELECTRIC CODES.

Wire units according to the SINGLE PHASE OR THREE PHASE Diagram. This Diagram can also be found in the electrical box cover of the remote unit.

ELECTRIC SERVICE REQUIREMENTS AND FUSING:

Be sure to check all Local Codes to determine that the unit is installed in accordance with Local requirements. For runs 50% longer, use the next even gauge wire size, than those specified. The minimum wire size shown on rating plate is the National Electric Code requirements.

Normal voltage drop is less than 1% and it can be assumed that inrush voltage drop can be as much as 4% for the maximum length of runs specified in this chart.

Line voltage connections are made at the line side of the contactor in the electrical box of the condensing unit. The unit should be wired through a properly sized fused disconnect switch. Follow the appropriate wiring diagram in this Manual or the wiring diagram attached to the inside of the access door of the condensing unit.

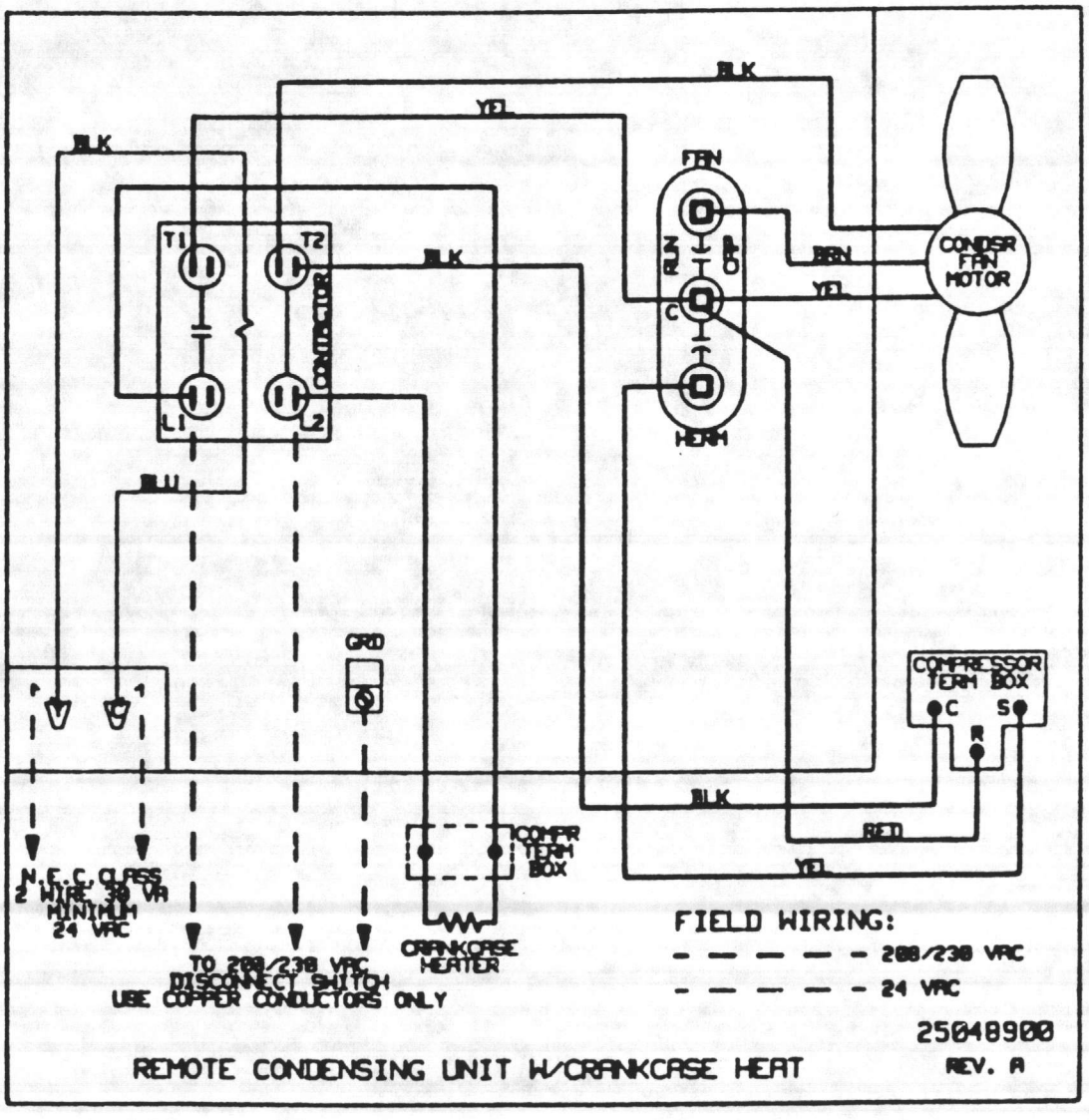
Proper fusing recommendations are also indicated on the Wiring Diagram. However, in general, the best fuse for any unit is the smallest fuse that will hold the equipment on the line under normal use and service without nuisance tripping breakers or blowing of fuses. Time-delay fuses such as fusetron, or fusestat are recommended to prevent blowing due to starting current, (the current in-rush when the equipment starts is often referred to as the Locked Rotor Amps or LRA) A fuse of this kind tied this close, will give maximum equipment protection.

CONTROL WIRING:

The proper or recommended thermostat and subbase for this unit are recommended on the Spec Sheet. This thermostat incorporates the ultimate in flexibility, customer convenience.

REFER TO THE UNIT WIRING DIAGRAM FOR LOW VOLTAGE WIRING DETAILS.

TYPICAL WIRING DIAGRAM



REFRIGERANT PIPING . . .

APPLICATION & INSTALLATION DETAILS:

Proper refrigeration piping design is required to achieve optimum system operation. Piping size, slope, oil traps and other refrigeration components must be designed for each system and carefully assembled to insure correct operation, long equipment life and minimal service. It is recommended that the ASHRAE Handbook of Fundamentals, Chapter 32, be consulted for specific refrigerant piping design information.

Suction line piping design must insure that velocity of refrigerant be maintained at 750 fpm minimum in horizontal lines and at 1500 fpm minimum in vertical risers. Pressure drop in the suction line should be 1-2 psi. Liquid lines must be designed to limit pressure drop to 3 psi maximum. Liquid line risers in excess of 25 ft should be avoided.

HORIZONTAL RUN . . .

THIS CHART RECOMMENDED FOR: HORIZONTAL REFRIGERANT LINES, AND VERTICAL REFRIGERANT LINES WHERE THE COMPRESSOR IS BELOW THE EVAPORATOR COIL, OR WHERE THE VERTICAL LIFT IS LESS THAN 35' TO THE COMPRESSOR.

REFRIGERANT LINE LENGTH (FEET) HORIZONTAL RUN

		10	20	30	40	50	60	70	80	90	100
AD018	LIQUID LINE	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
	SUCTION LINE	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8
	% CAPACITY REDUCTION	—	—	—	0.5%	0.7%	1.0%	1.4%	1.7%	2.0%	2.2%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD024	LIQUID LINE	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
	SUCTION LINE	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8
	% CAPACITY REDUCTION	—	—	—	0.8%	1.4%	2.0%	2.6%	3.2%	3.8%	4.4%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD030	LIQUID LINE	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	SUCTION LINE	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
	% CAPACITY REDUCTION	—	—	—	0.8%	1.4%	2.0%	2.6%	3.2%	3.8%	4.4%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD036	LIQUID LINE	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	SUCTION LINE	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
	% CAPACITY REDUCTION	—	—	—	1.2%	2.0%	2.8%	3.6%	4.4%	5.2%	6.0%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD042	LIQUID LINE	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	SUCTION LINE	3/4	3/4	3/4	3/4	3/4	7/8	7/8	7/8	7/8	7/8
	% CAPACITY REDUCTION	—	—	—	0.7%	1.1%	1.6%	2.0%	2.5%	2.9%	3.3%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD048	LIQUID LINE	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	SUCTION LINE	3/4	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
	% CAPACITY REDUCTION	—	—	—	0.8%	1.3%	1.9%	2.4%	2.9%	3.4%	4.0%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD060	LIQUID LINE	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	SUCTION LINE	3/4	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8
	% CAPACITY REDUCTION	—	—	—	0.8%	1.3%	1.9%	2.4%	2.9%	3.4%	4.0%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz

NOTE:

1. Shaded area represents factory charged system at 25 feet of refrigerant line.
2. Refrigerant oil to be added for extended line length must be one of these types; Sunico 3G; Sunico 3S; Texas Capella B; Texas Capella B Inhibited.
3. Liquid and Suction line are all O.D. refrigeration grade copper tube or pipes. Diameter shown allows for a normal amount of elbows and bends.
4. Line length over 35 feet require an addition of a 3 minute short cycle timer.

REFRIGERATION PIPING . . . VERTICAL RUN . . .

THIS CHART RECOMMENDED FOR: VERTICAL REFRIGERANT LINES WHERE THE LIFT TO THE COMPRESSOR EXCEEDS 35'.

REFRIGERANT LINE LENGTH (FEET) VERTICAL RUN

		10	20	30	40	50	60	70	80	90	100
AD018	LIQUID LINE	1/4	1/4	1/4	3/16	3/16	3/16	3/16	3/16	3/16	3/16
	SUCTION LINE	5/8	5/8	5/8	1/2	1/2	1/2	1/2	1/2	1/2	1/2
	% CAPACITY REDUCTION	—	—	—	.5%	.7%	1.0%	1.4%	1.7%	2.0%	2.2%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD024	LIQUID LINE	1/4	1/4	1/4	3/16	3/16	3/16	3/16	3/16	3/16	3/16
	SUCTION LINE	5/8	5/8	5/8	1/2	1/2	1/2	1/2	1/2	1/2	1/2
	% CAPACITY REDUCTION	—	—	—	0.8%	1.4%	2.0%	2.6%	3.2%	3.8%	4.4%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD030	LIQUID LINE	5/8	5/8	3/8	5/16	5/16	5/16	5/16	5/16	5/16	5/16
	SUCTION LINE	3/4	3/4	3/4	5/8	5/8	5/8	5/8	5/8	5/8	5/8
	% CAPACITY REDUCTION	—	—	—	0.8%	1.4%	2.0%	2.6%	3.2%	3.8%	4.4%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD036	LIQUID LINE	5/8	5/8	3/8	5/16	5/16	5/16	5/16	5/16	5/16	5/16
	SUCTION LINE	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
	% CAPACITY REDUCTION	—	—	—	1.2%	2.0%	2.8%	3.6%	4.4%	5.2%	6.0%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD042	LIQUID LINE	5/8	5/8	3/8	5/16	5/16	5/16	5/16	5/16	5/16	5/16
	SUCTION LINE	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
	% CAPACITY REDUCTION	—	—	—	0.7%	1.1%	1.6%	2.0%	2.5%	2.9%	3.3%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD048	LIQUID LINE	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	SUCTION LINE	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8
	% CAPACITY REDUCTION	—	—	—	0.8%	1.3%	1.9%	2.4%	2.9%	3.4%	4.0%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz
AD060	LIQUID LINE	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
	SUCTION LINE	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8
	% CAPACITY REDUCTION	—	—	—	1.3%	2.2%	3.2%	4.1%	5.0%	5.9%	6.8%
	REFRIG. OIL ADDED (oz.)	—	—	—	1 oz	2 oz	3 oz	4 oz	5 oz	6 oz	7 oz

NOTE:

1. Shaded area represents factory charged system at 25 feet of refrigerant line.
2. Refrigerant oil to be added for extended line length must be one of these types; Sunico 3G; Sunico 3S; Texas Capella B; Texas Capella B Inhibited.
3. Liquid and Suction line are all O.D. refrigeration grade copper tube or pipes. Diameter shown allows for a normal amount of elbows and bends.
4. Line length over 35 feet require an addition of a 3 minute short cycle timer.

When the total line length exceeds 35 feet, use this chart for sizing the liquid line. For suction line sizing on lift applications, refer to this chart for sizing the lift section (only) of the total line length. Use the larger size tubing, shown on the Horizontal Chart, for the horizontal portion of the application.

START-UP CHECK SHEET

OWNER _____

_____

_____

CONDENSING UNIT MODEL _____

COMPRESSOR MODEL _____

EVAPORATOR MODEL _____

INDOOR UNIT MODEL _____

SUCTION TUBE SIZE _____

DATE OF INSTALLATION _____

INSTALLER _____

_____

_____

SERIAL NUMBER _____

SERIAL NUMBER _____

THERMOSTAT MODEL _____

LINE LENGTH _____

LIQUID TUBE SIZE _____

RECORD AFTER 30 MINUTES CONTINUOUS OPERATION

TIME AND DATE OF SERVICE		
CONDENSER OUTLET AIR TEMPERATURE °F		
CONDENSER INLET AIR TEMPERATURE °F		
HEAD PRESSURE		
SUCTION PRESSURE		
VOLTAGE, CONTROL CIRCUIT		
VOLTAGE, CONTRACTOR LOAD SIZE		
TOTAL CONDENSING UNIT AMPS		
CONDENSER FAN AMPS		
REFRIGERANT CHARGE FACTORY		
REFRIGERANT CHARGE AMOUNT REMOVED		
REFRIGERANT CHARGE AMOUNT ADDED		
SUCTION TUBE TEMPERATURE AT VALVE, °F		
SUCTION TUBE TEMPERATURE AT EVAPORATOR, °F		
EVAPORATOR INLET AIR TEMPERATURE, °F		
EVAPORATOR OUTLET AIR TEMPERATURE, °F		
EVAPORATOR MOTOR VOLTAGE		
EVAPORATOR MOTOR AMPS		
AIR FILTER SIZE		

NOTES: _____