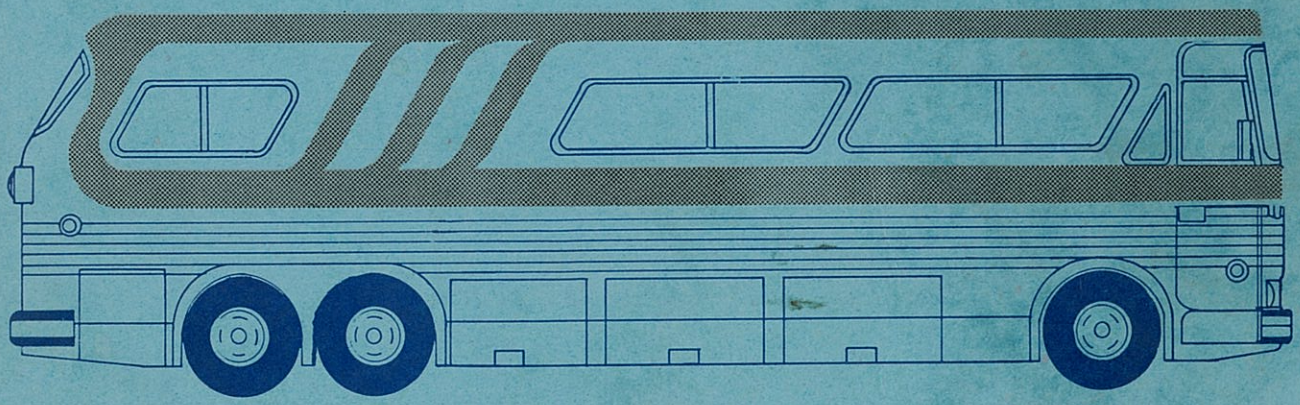
Cruisair®

MOTOR COACH BUILT - IN AIR CONDITIONING



INSTALLATION OPERATION & MAINTENANCE

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I

INTRODUCTION

The CRUISAIR® mobile air conditioning system consists of three basic elements and in some cases several accessory parts. They are: (1) Cooling unit; (2) controls or switch assembly; and (3) condensing unit. This instruction manual will describe and explain the function of the basic parts of a CRUISAIR® system and will outline the installation, interconnection and startup of a complete system. It also includes maintenance and operation of CRUISAIR® equipment in general.

II

GENERAL DESCRIPTION OF BASIC COMPONENTS

A. COOLING UNIT:

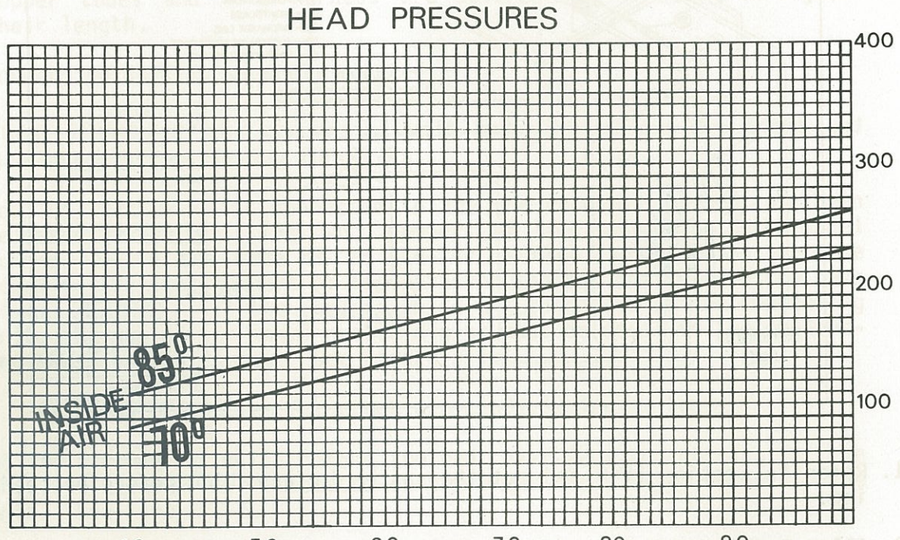
The cooling unit is a refrigerant-to-air heat exchanger coupled to a fan or blower which is located in the space to be cooled (such as a bedroom or living area). A cooling unit is sometimes referred to as an "evaporator" or a "cooling coil," but in this manual, we will use the term "cooling unit." The cooling unit is constructed of a series of copper tubes held in place by vertical aluminum fins. Inside these tubes, the refrigerant expands to produce a chilling effect. This chilled fin-tube assembly cools the air forced through it by the fan or blower.

B. CONTROLS OR SWITCH ASSEMBLY:

The switch assembly consists of a main switch, a fan speed control, and a thermostat. All switch assembly wiring terminates at a color-coded terminal strip which is the electrical center of the CRUISAIR® system. From this terminal strip, the 115 volt power is distributed in the proper sequence to operate the cooling unit fan or blower as well as the power to operate the condensing unit.

C. CONDENSING UNIT:

The condensing unit consists of the refrigerant compressor, the refrigerant receiver, refrigerant-to-air heat exchanger or condenser, condenser fan or blower, the associated electrical components, and the system service valves.



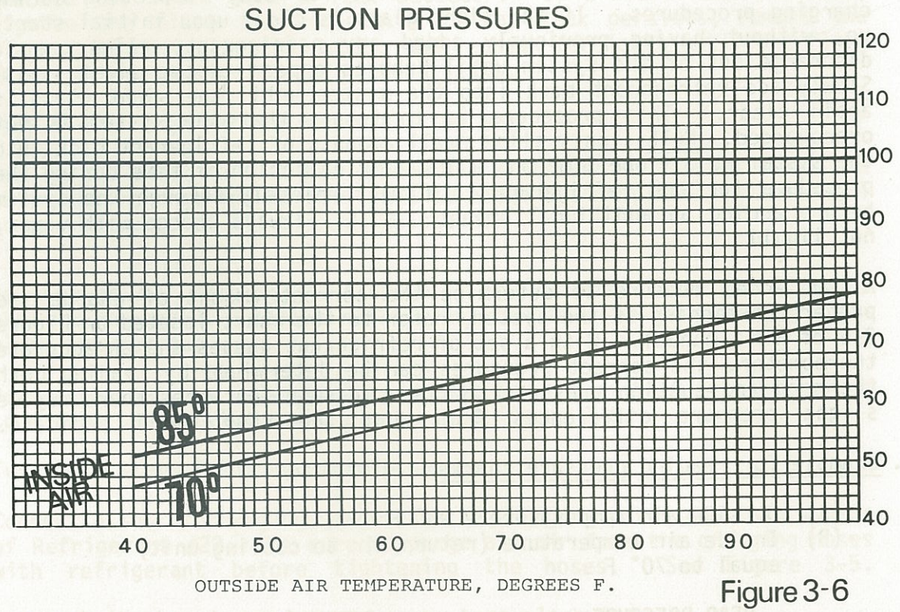


Figure 3-6

When the system is operating properly in warm weather, with the fan on high, the compressor should run warm to hot. The 3/8" or 1/2" suction copper tube and service valve should be cold and sweating. A warm suction service valve indicates too little gas. A cold compressor indicates too much gas.

14. After the charging procedure is completed, remove the charging hoses from the condensing unit as follows:

    A) Close the valve on the source of refrigerant #22.
    B) Rotate both service valve stems fully counterclockwise.
    C) Remove the charging hoses from the gauge ports.
    D) Replace gauge port caps and stem covers on both service valves.

C. Charging procedures in the event there is a complete loss of refrigerant from the system:

1. Secure a refrigeration-type vacuum pump and a set of refrigerant charging gauges and hoses suitable for use with high temperature refrigeration systems using Refrigerant #22.

2. Pressurize the connecting copper tubing and check for leaks as outlined in Section IV-B, paragraphs 1-3.

3. Remove the refrigerant can from the purging port and replace the red cap.

4. Remove the stem covers from both service valves.

5. Rotate the stems on both service valves all the way counterclockwise.

6. Rotate the stem of the 1/4" service valve one turn clockwise.

7. Remove the top cap from the 1/4" service valve gauge port (Figure 3-5). Connect a vacuum pump and allow it to operate 30 minutes on a new system or longer if substantial moisture is suspected to be in the system. This is a good refrigeration service practice.

8. Rotate the 1/4" service valve stem fully counterclockwise.

9. Remove the vacuum pump.

10. Remove the gauge port cap from the other service valve.

11. Connect a set of charging gauges to the gauge ports and to a source of Refrigerant #22 (Figure 3-5). Be sure to purge all air from the charging hoses with refrigerant before tightening the hoses.

12. Rotate both charging valve stems one turn clockwise.

13. Refer to Section IV-D and put the system in operation before proceeding.

14. Allow Refrigerant #22 to enter the system through the left hand service valve (suction side) until the sight glass becomes clear or free of gas bubbles.

    NOTE: Sight glass must be installed in the discharge side (1/4" copper line) of the system.

    NOTE: Always charge with vapor, not liquid.

15. To remove charging hoses from the condensing unit, close the valve on the source of Refrigerant #22. Next, rotate both service valve stems fully counterclockwise. Remove charging hoses from the gauge ports. Replace the gauge port caps and the stem covers on both service valves.

    As an added measure to determine the correct amount of charge and proper functioning of the system, refer to Fig. 3-6 of this manual. With a set of refrigerant gauges and an accurate thermometer, the correct pressures can be determined by reading both the head and suction pressure charts. In some instances, there may be slight pressure differences from what the chart will indicate.

D. General Operation:

All CRUISAIR® systems have basically three controls:
(1) off-start-run switch;
(2) fan speed control switch;
(3) thermostat.

To put the system in operation, proceed as follows:

1. Set the main control switch to the OFF position.

2. Turn on main circuit breaker at coach's panel.

3. Turn the thermostat control fully clockwise for maximum cooling.

4. Set the fan speed control to HIGH (center knob).

5. Turn the main control knob to START. This will energize the cooling unit fan.

6. Next turn the main control knob to RUN. This will energize the compressor.

7. To set the thermostat, allow the unit to operate until the area is cooled to the desired temperature. At this point, turn the thermostat knob slowly toward its center position until it "clicks" once. The thermostat is now set to maintain a constant temperature.

8. When operating the system, use any fan speed desired, bearing in mind that the lower the fan speed, the less capacity the system has.

9. To turn the system off, return the main control switch to the OFF position.

    NOTE: Before returning the main control switch to the RUN position, you must allow a minimum of three (3) minutes to elapse.

    FAN SPEED: Fan motors available for use in small air conditioning units are of the shaded pole type and are voltage sensitive. Our design uses 112 volts. At this voltage, fan speeds will be normal in low, medium, and high. If the voltage on which you are operating is lower than 112 volts, fan speeds will be generally lower and system capacity will be slightly reduced. Under such circumstances, the use of LOW FAN is not recommended.

    If the operating voltage is high, fan speeds will be generally higher and there will be less difference between each speed. If you operate at predominately high voltage conditions and the high fan speeds are undesirable, a simple electrical modification to the fan speed control can be made by your dealer to slow the fan speed down overall.

    THERMOSTAT: The thermostat serves to turn the compressor on and off. It has no control over the cooling unit fan which runs continuously.

V

MAINTENANCE

A. Cooling Unit & Switch Assembly:

Switch contacts are of the self-cleaning type and require no maintenance. At the beginning of each trip, check the cooling unit condensate drains for total or partial obstruction by pouring two quarts of water rapidly into the condensate drip tray. It should drain completely within 30 seconds. When the cooling unit was installed initially, a filter should have been installed in the return air to the cooling unit. Locate this filter and clean it if a visible build-up of lint has collected. If filters were installed, they are usually located behind the return air grills.

B. Condensing Unit:

The condensing unit requires minimal maintenance. The refrigeration circuit is hermetically sealed and is charged with oil at the factory. No oil should be added. The Refrigerant #22 gas in the system is adequate for the life of the unit. The gas charge should not be changed or altered except in the event the unit was charged improperly in the original installation or unless a leak occurs which allows gas to escape from the system.

The condensing unit coil should be inspected periodically for possible buildup of dirt and/or obstructions.

Fan motors on the condensing unit should be oiled periodically.

⇨ WARNING ⇦

In conjunction with the operation of air conditioning equipment, there are oversights which can lead to HAZARDOUS conditions which could result in FATAL accidents.

OBSERVE THE FOLLOWING

1. Every CRUISAIR® component must be electrically grounded using the grounding points provided. Failure to complete electrical grounding could result in severe electrical shock and DEATH.

2. Carbon monoxide poisoning is a possibility which should be carefully considered. NEVER close a vehicle and operate an air conditioning system while any engine - generator or propulsion - is operating ON or NEAR the vehicle. Carbon monoxide is an odorless and deadly poisonous gas contained in the exhaust of any engine. When in hearing distance of any operating engine, NEVER CLOSE A VEHICLE AND REMAIN INSIDE.

TROUBLE	PROBABLE CAUSE	SYMPTOMS	REMEDY
Compressor fails to start	Power source failure	No current at power source	Check for tripped circuit breaker
	Faulty switch assembly	No current at condensing unit terminal strip	Check for faulty switch
	Low voltage	Compressor tries to start then cuts off	Correct power source
	Faulty high pressure switch	Voltage to switch but no voltage between the switch and the compressor	Replace high pressure switch
	Faulty running or starting components	Unit draws locked rotor amp. (Locked rotor amp. found on data plate)	Check each component for failure. Replace if defective.
	Faulty compressor	Unit drawing locked rotor amp. (Locked rotor amp. found on data plate)	Replace compressor
Compressor cycles every 15 to 30 seconds	Low voltage	Compressor's thermal overload opens	Correct power source
	Incorrect refrigerant charge	Excessive head pressure	See refrigerant charge instructions
	Restricted condenser air flow	Excessive head pressure. High pressure switch opens.	Correct condenser air flow
	High pressure switch incorrectly set	Switch opens before 425 psi head pressure	Replace high pressure switch
System not cooling	Switch assembly not set properly or thermostat satisfied	Ventilation operation only	Set switch assembly at correct selection
	No or restricted air flow	Compressor cycles quickly	Check for restricted condenser air flow
	System low on refrigerant	Compressor suction line warm	Check refrigerant charge
	Defective TX valve on cooling unit	Sight glass full, not cooling air at cooling unit. Low suction pressure.	Check for defective TX valve
	Thermostat setting satisfied	Compressor runs for short time, then cycles off	Reset thermostat to desired level. Calibrate if necessary.
Iced cooling unit	Low refrigerant charge or restricted air flow	Restricted discharge air flow	Adjust refrigerant charge, clean return air filters, check for air restrictions.
Blower or fan motor inoperative	Power source failure	No current at power system	Check for tripped circuit breaker
	Low voltage	Hot motor. Motor protector cuts motor off.	Check power source
	Faulty switch assembly components	No current to motor	Replace faulty switch
Cooling unit throwing water out of discharge grill	Blocked or restricted condensate drain	Excessive water out of discharge grill	Check for condensate drain restrictions

The basic function of the condensing unit is to compress the expanded refrigerant, flowing back from the cooling unit to the compressor, to a high pressure state. The compressed refrigerant then passes through the heat exchanger (condenser coil) where it gives up the heat which was absorbed in the cooling coil. It is then condensed to a liquid state as it flows to the liquid receiver and the process of flow back to the cooling unit is repeated.

III

INSTALLATION OF BASIC COMPONENTS

A. Cooling Unit:

In all installations, the cooling unit must be installed so the air discharge grill is at least three feet above the floor level. Ideally, the cooling unit discharge grill should be installed as high as possible. The cooling unit must be installed with the condensate drip pan positioned at the bottom of the unit so the water dripping from the evaporator coil collects in the drip pan. The cooling unit drain must be installed so the drain tube makes an immediate 1" drop after leaving the drain fitting and must be routed from that point to continue in a downhill direction to a suitable drain discharge outside the vehicle.

With discharge air grills located high, return air grills should be located as close to the floor as possible to provide the best pattern of air flow. Avoid locating the return air grill in close proximity to the discharge grill since the resulting short circuiting effect of the air flow will impair the effectiveness of the system.

Propeller fan-type cooling units (model number prefix EFB or EBH) should be mounted as high as possible, directly behind the discharge grills.

Centrifugal or blower-type cooling units (model number prefix EBS or EBO) should be mounted low, near the return air grills, and the discharge air ducted to the discharge grills mounted at a high level.

The cooling unit must be installed so there is an adequate path for the air to re-circulate freely into the unit from the space being cooled. It is important that the cross-sectional area of all discharge air ducts and grills be at least equal to the coil face area of the discharge of the cooling unit involved. An exception is the centrifugal blower-type cooling unit. In these units, the cross-sectional area of the discharge air ducts and grills must be at least twice the area of the discharge air outlet of the cooling units.

NOTE: The "cross-sectional" area refers to the "open" area of a discharge air grill rather than the total area as determined by the overall measurement of the grill itself. For instance, if a grill is made of expanded metal, perhaps only 50% of the area is open for the passage of air. The metal web itself will block air from passing through the other 50%. In such cases, the total area of the grill must be doubled to achieve the required "open" area. Observe this carefully when selecting a grill.

The return air grills used should be the type which have removable filters so they can be removed and cleaned easily. The filter material itself should be a type which will not cause a significant inlet air flow pressure drop. For all discharge air applications, wood or plastic frames are recommended. Aluminum frame grills will become cold and may produce secondary condensation that will drip from the grill frame. If, however, aluminum frame grills must be used, a heater strip can be installed behind the lower edge of the frame to prevent condensation.

B. Controls or Switch Assembly:

The switch assembly is supplied as a separate item. The main switch assembly has three knobs and the plate is printed either for horizontal or vertical installation. The switch assembly is designed to be mounted in an opening cut on the job and is fastened from the front with four screws. Since the switch assemblies for all types of cooling units have infinitely variable type fan speed controls which produce some heat, the switch assembly mounting area should be ventilated. The wiring from the switch assembly controls terminates in a color-coded terminal strip that should be securely mounted in a suitable place. This terminal strip is the center of the system's electrical connections. Electrical connections for all CRUISAIR® systems are typically the same.

Operation of the controls is covered in Section IV-D.

The thermostat in the switch assembly has a 10' capillary tube leading from it to a temperature sensing bulb. This bulb must be located in the system's return air stream so that the bulb is exposed only to the air returning from the space being cooled. If the bulb is mounted directly to the cooling unit, it should be done so that the bulb does not come into direct contact with the cold metal surface of the cooling unit. If this detail is not considered, the thermostat may overcontrol the system causing it to turn off prematurely.

C. Condensing Unit:

CRUISAIR® condensing units are designed to be installed in the coach's lower luggage compartment with ventilation to the outside. Air entry and exit openings to the exterior sidewalls of the coach should be protected by rain-proof louvers or grills. All refrigeration components are hermetically sealed and all electrical components are spark-proof for maximum safety. Make sure the wood base is positioned at the bottom of the unit in a horizontal plane. Fasten the condensing unit wood base securely.

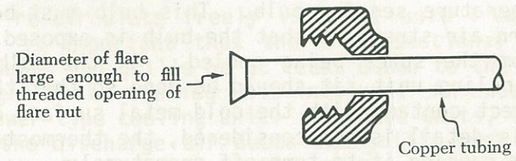
D. Installation Kit:

1. Copper Tubing:

When installing the two connecting copper tubes between the cooling unit and the condensing unit, there are several important factors to consider. First, the tubing can be run in lengths up to 50 feet. It can run uphill, downhill, or sloping, as required, and can have as many bends as necessary. (Avoid sharp bends and do not use soldered elbows.) The suction line should be insulated to prevent moisture from forming on the tube and dripping off. Be sure to insulate the connecting flare nut joints carefully to prevent dripping of condensed moisture from these joints.

CAUTION

Always use refrigeration grade, seamless, soft copper tubing. Never use neoprene, teflon, rubber or any other type hose or tube. The refrigerant used in the CRUISAIR® system is monochlorodifluoromethane, or refrigerant #22. This gas is not compatible with any tubing except copper. (Engine-driven systems use neoprene refrigerant lines because a different type of refrigerant is used.) The copper tubing is connected to the cooling unit and condensing unit with flare joints. Flares of exceptional quality are essential to prevent refrigerant leaks. Flares must be of the 45°, single flare type. Do not use a double flare. The flare should be large enough in diameter to fill the flare nut completely (See Figure 3-1).



Only the long stem forged flare nuts, such as are supplied with CRUISAIR® equipment, are strong enough for mobile duty. Do not use long stem machined flare nuts. Flare nuts should be tightened until the nut ceases to offer resistance to tightening. This is the point where the flared portion of the copper tubing is beginning to flow or mash under the force of the nut being tightened. In general terms, tighten 1/4" flare nuts with strength of your forearm, 3/8" flare nuts with the strength of your entire arm, and 1/2" flare nuts with the weight of your body. After the tubing is insulated and in place, secure it with clamps. For proper line sizes, see Figure 3-2.

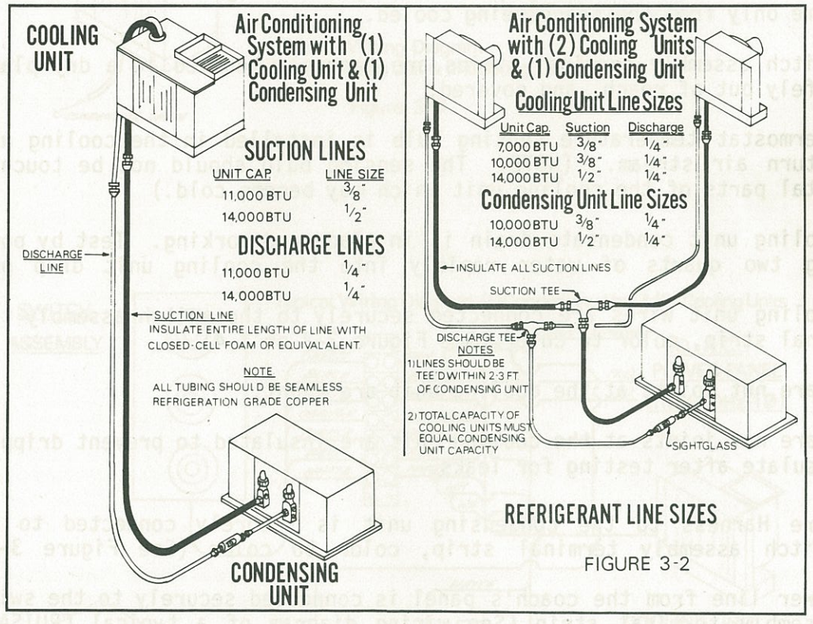


FIGURE 3-2

2. Wire Harness:

The wire harness which connects the condensing unit to the main switch assembly terminal strip is CRUISAIR® part number 31722-16. It is supplied in any length. The harness is always supplied with five (5) wires: one white #12, one purple #12, one green #12, one red #16, and one blue #16. The blue and red wires are not used in most applications and can be trimmed off at the ends of the harness. Normally, the wire harness is run along with the connecting copper tubing, but this is not necessary.

IV

START-UP PROCEDURE

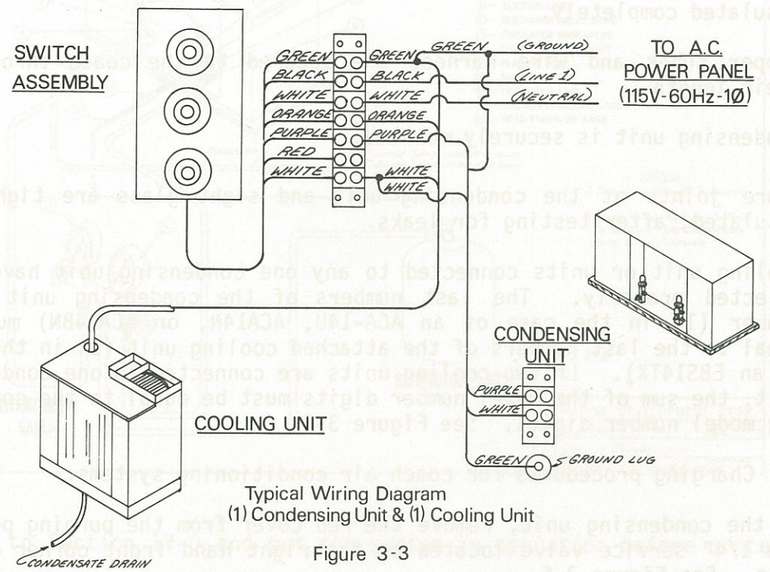
A. Final Inspection:

The following is a list of items to be checked before any CRUISAIR® system is purged or started. Be sure that the:

1. Cooling unit is bolted securely in place.
2. Cooling unit discharge air cross-sectional open area is equal to the face cross-sectional open area of the air outlet portion of the evaporator coil as a minimum. In type C and type O cooling units, this area must be twice that of the unit outlet area.
3. Cooling unit return air cross-sectional open area is equal to the face area of the unit evaporator coil as a minimum.
4. Return air to the cooling unit should pass through a filter and should come only from the space being cooled.
5. Switch assembly terminal strips are securely mounted in a dry place, safely out of reach, and covered.
6. Thermostat temperature sensing bulb is installed in the cooling unit return air stream. (NOTE: The sensing bulb should not be touching metal parts of the cooling unit which may become cold.)
7. Cooling unit condensate drain is in place and working. Test by pouring two quarts of water rapidly into the cooling unit drip pan.
8. Cooling unit wires are connected securely to the switch assembly terminal strip, color to color (See Figure 3-3 or 3-4).
9. Flare nut joints at the cooling unit are tight.
10. Flare nut joints at the cooling unit are insulated to prevent dripping. Insulate after testing for leaks.
11. Wire Harness to the condensing unit is securely connected to the switch assembly terminal strip, color to color (See Figure 3-3).
12. Power line from the coach's panel is connected securely to the switch assembly terminal strip (See wiring diagram of a typical CRUISAIR® system, Figure 3-3 or 3-4). Be sure the proper size circuit breaker of the time delay type is installed (see wire size and breaker chart below).

CONDENSING UNIT CAPACITY

	11,000 B.T.U.	14,000 B.T.U.
WIRE SIZE	#12	#10
BREAKER SIZE	20 AMP	30 AMP



Typical Wiring Diagram
(1) Condensing Unit & (1) Cooling Unit

Figure 3-3

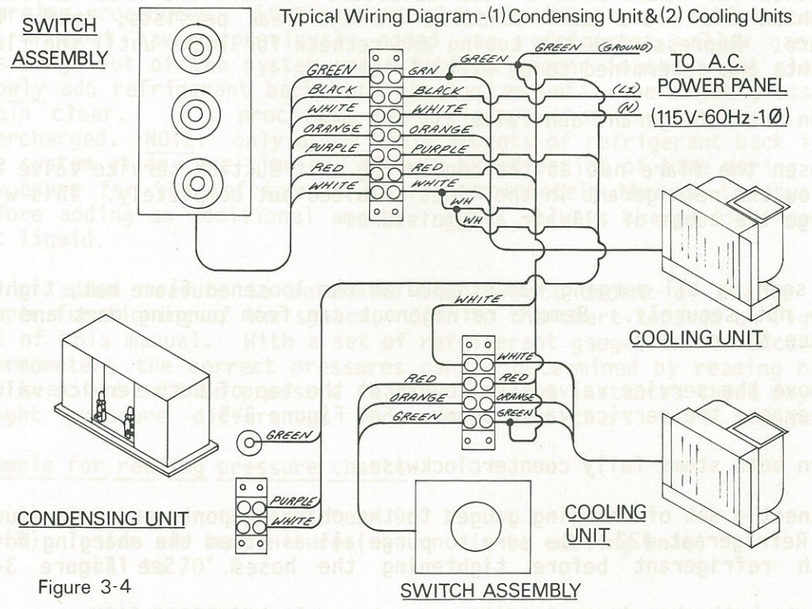


Figure 3-4

13. The suction line between the cooling unit and condensing unit are insulated completely.

14. Copper tubes and wire harness are secured to the coach throughout their length.

15. Condensing unit is securely mounted.

16. Flare joints at the condensing unit and sight glass are tight and insulated, after testing for leaks.

17. Cooling unit or units connected to any one condensing unit have been selected properly. The last numbers of the condensing unit model number (14 in the case of an ACA-14U, ACA14N, or ACA14BN) must be equal to the last numbers of the attached cooling unit (14 in the case of an EBS14TX). If two cooling units are connected to one condensing unit, the sum of the model number digits must be equal to the condensing model number digits. See Figure 3-4.

B. Charging procedures for coach air conditioning systems:

1. At the condensing unit, remove the red cover from the purging port on the 1/4" service valve located on the right hand front corner of the unit. See Figure 3-5.

2. To this port, attach a can of Refrigerant #22 and open the can valve for 15 seconds and then close the can valve.

3. The connecting tubing is now pressurized and the flare joints can be checked for leaks with a leak detector. If a flare leak is found, tighten the flare and recheck. If the leak persists, remake the flare. Repressurize the tubing and recheck for leaks until the flare joints are determined to be without leaks.

4. Open the refirgerant can valve all the way.

5. Loosen the flare nut at the condensing unit suction service valve and allow the refrigerant in the lines to bleed out completely. This will purge the tubes of all air and moisture.

6. As soon as all purging has stopped at the loosened flare nut, tighten the nut securely. Remove refrigerant can from purging port and replace the red cap.

7. Remove the service valve stem covers at the top of both service valves to expose the service valve stems. See Figure 3-5.

8. Turn both stems fully counterclockwise.

9. Connect a set of charging gauges to the charging ports and to a source of Refrigerant #22. Be sure to purge all air from the charging hoses with refrigerant before tightening the hoses. See Figure 3-5.

10. Rotate both charging valve stems one turn clockwise.

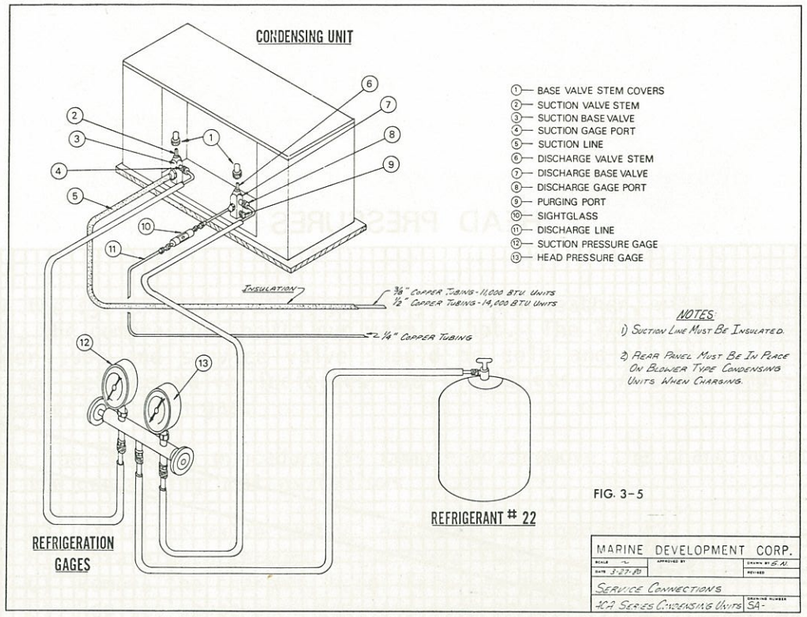


FIG. 3-5

11. Refer to Section IV-D and put the system in operation before proceeding.

12. Allow Refrigerant #22 to enter the system through the left hand service valve (suction side) until the sight glass becomes clear or free of bubbles. Note: sight glass must be installed in the discharge side (1/4" copper line) of the system. As a convenience, mount the sight glass close to the service valves for easy inspection during charging procedures. If the sight glass is clear upon initial start-up, without having previously added any refrigerant, allow gas to discharge out of the system until bubbles appear in the sight glass. Slowly add refrigerant back into the system until the sight glass is again clear. This procedure is to insure that the system is not overcharged. NOTE: only allow small amounts of refrigerant back into the system at any one time and allow a brief period of time during the procedure for the refrigerant to flow completely through the system before adding an additional amount. NOTE: always charge with vapor, not liquid.

As an added measure to determine the correct amount of charge and proper functioning of the system, refer to the chart located on Figure 3-6 of this manual. With a set of refrigerant gauges and an accurate thermometer, the correct pressures can be determined by reading both the head and suction pressure charts. In some instances there may be slight pressure differences from what the chart will indicate.

13. Example for reading pressure charts:

(A) Outside air temperature = 95° F
(B) Inside air temperature (return air to cooling unit) equal to 70° F

HEAD RRESSURE	SUCTION PRESSURE
230 psig	70 psig

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