DX Built-In Air Cooled A/C Systems ❖ INSTALLATION • OPERATION 2

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Cruisair®

DIRECT EXPANSION SYSTEMS

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For LP-10A

WARNING

This manual contains essential safety information concerning the safe and proper installation of Cruisair direct expansion air conditioning systems. It is very important that you read and understand the contents of this manual thoroughly before attempting to install any Cruisair equipment. If there are any statements in this manual that you do not understand, contact Taylor Made Environmental Applications Department for assistance. Phone (804) 746-1313, Fax (804) 746-7248 (8:00am - 5:00pm United States EST).

NOTICE

As of July 1, 1992, United States federal law prohibits the intentional release of refrigerant gases into the environment, including the R-22 refrigerant used in Cruisair air conditioning systems. Special care must be taken when installing, charging and servicing Cruisair equipment to prevent any loss of refrigerant.

Cruisair does not recommend the practice of using refrigerant to purge air and moisture from the system at installation. This formerly used practice of purging is in violation of United States federal law.

INTRODUCTION

This manual covers installation procedures for Cruisair direct-expansion air conditioning systems.

In addition, there are specific installation sheets for some models which may be shipped with Cruisair air conditioning equipment, providing additional details for specific components.

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CHAPTER 1: Description of Basic Components

Basic Principles

The Cruisair air conditioning system consists of three basic components and, in some cases, several accessory parts. They are: (1) cooling unit; (2) control 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.

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. 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 by absorbing the heat in the air. This air is forced through the coil by the fan or blower.

Controls/Switches

There are two basic types of controls and switches used with Cruisair systems: the SMX series of microprocessor controls and the SA family of rotary knob switch assemblies. The SA type switch assembly has rotary knobs for controlling the system. Figure 1 shows a typical SA switch assembly.

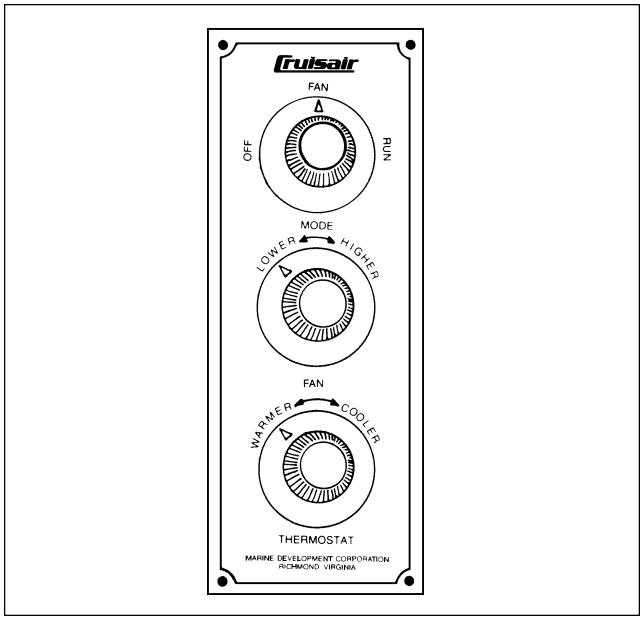


Figure 1. SA 3 Series Control

The SMX series controls are advanced microprocessor based systems, with more than 20 user programmable functions. These functions are described in the SMX series owner's manuals. Figure 2 shows an SMXII control panel.

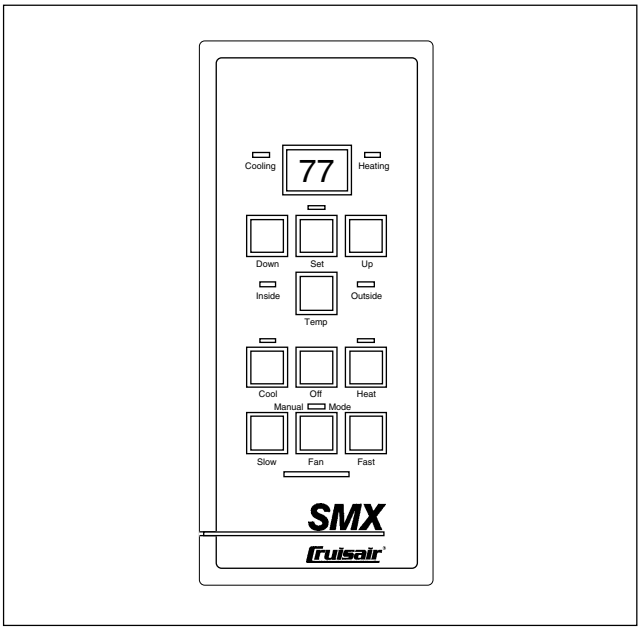


Figure 2. SMX Series Keypad

Condensing Unit

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

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.

CHAPTER 2: Installation Of Basic Components

The following instructions should be followed, in their proper sequence, when installing Cruisair equipment. Read and understand the instructions in this manual before proceeding.

Cooling Unit

In all installations, the cooling unit must be installed so the air discharge grill is installed as high as possible, (minimum three feet above the floor level). 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 it before discharging to a suitable drain outside. The cooling unit drain must be installed so the drain tube makes an immediate 1" drop after leaving the drain fitting.

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.

Cooling units with model number prefixes EFB, EBH, or EFL should be mounted as high as possible, directly behind the discharge grills.

Centrifugal or blower type cooling units, model number prefixes EBS, EBO, EHBO, EBL or EHBL, should be mounted low, near the return air grill, and the discharge air ducted to the discharge grill 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 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.

The cross sectional area refers to the 'free air' 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

Minimum Grill And Free Air Area

EVAPORATOR		DUCT	GRILL AREA		FREE AIR AREA	
Type	BTU's	Size In.	Return (Sq. In.)	Supply	Return (70%) (Sq. In.)	Supply (60%)
EBL	16,000	2 @ 5	144	2 @ 49	101	2 @30
EBO	4,000	4	64	32	45	19
	7,000	5	72	49	51	30
	10,000	6	100	60	70	36
	14,000	7	144	80	101	48
	16,000	7	144	80	101	48
EBS	14,000	7	144	80	101	48
	16,000	7	144	80	101	48
EFB	10,000	NA	100	100	70	60
	14,000	NA	144	144	101	87
	16,000	NA	144	144	101	87
EBH	14,000	NA	144	144	101	87
	16,000	NA	144	144	101	87
EFL	1,000	NA	40	40	28	24
	14,000	NA	128	128	90	77
	16,000	NA	128	128	90	77

Figure 3. Minimum Grill and Free Air

removed and cleaned easily. The filter material 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.

See Figure 3 to determine the minimum grill and free air areas for each model cooling unit.

Control or Switch Assembly

The control or switch assembly is supplied as a separate item. The rotary switch assembly has three knobs and the plate is printed either for horizontal or vertical installation. It is designed to be mounted in an opening cut on the job and is fastened from the front with four screws. The wiring from the switch assembly terminates in a color coded terminal strip that should be securely mounted in a suitable place. Electrical connections for all systems are typically the same.

Operation of the SA type controls is covered in Chapter 6.

The thermostat in the switch assembly has a 10 foot capillary tube leading from it to the 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.

The SMX control system uses a Temperature Sensing Element (TSE) to control the operation of the system. Like the thermostat bulb on the SA type control, this TSE must be installed in the return air path of the conditioned air. These sensors are available in various lengths from 10 to 80 feet.

Operation of the SMX type controls is covered in the SMX Series Control Systems User's Guide, L-634.

Condensing Unit

Cruisair condensing units are designed to be installed in a compartment ventilated to the outside. Air entry and exit openings to the exterior should be protected by rain proof louvers or grills. Space should be provided on all sides of the unit to allow air to enter it for cooling the condenser. 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 and in such a way that the unit can be removed for service if necessary.

ACA Series Condensing Units

Return Air

Minimum Grill Area	Free Air (70%)
240 sq. in.	168 sq. in.

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.) Both the suction and discharge lines should be insulated individually to prevent moisture from forming on the tube and for vibration protection. Also insulate the connecting flare nut joints carefully to prevent dripping of moisture from these joints.

Caution •••••••••••••

Always use refrigeration grade, seamless, soft copper tubing. Never use neoprene, Teflon, rubber or any other type hose not designed specifically for use with R-22 and approved by Cruisair. The refrigerant used in Cruisair systems is monochlorodifluoromethane or R-22. This gas is compatible with very few tube compositions with copper being the most frequently used. (Engine driven systems use a different type refrigerant so therefore can use a neoprene refrigerant lines.) 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 4.

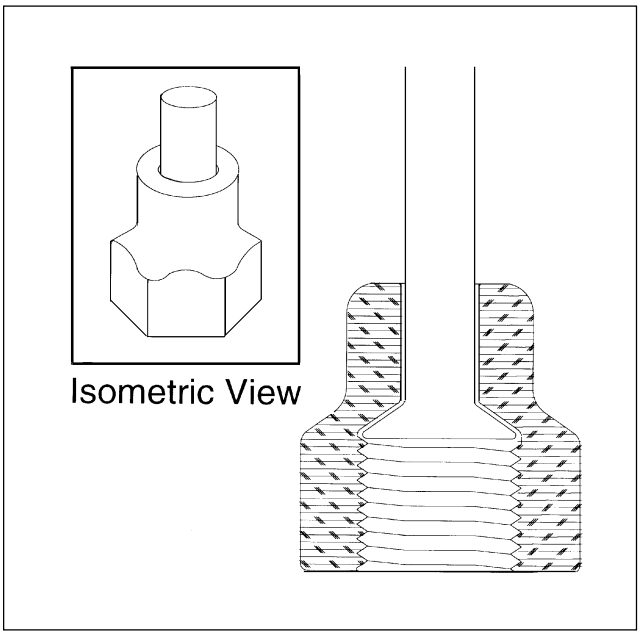


Figure 4. Diagram of Flared Joint

Only the long stem forged flare nuts, such as those that 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. After the tubing is insulated and in place, secure it with clamps. For proper line sizes, see Figure 5.

2. Wire Harness

SA Series Controls

The wire harness connects the condensing unit to the main switch assembly terminal strip. The harness or cable should include six conductors. Normally the wire harness is run along with the connecting copper tubing but this is not necessary.

SMX Series Controls

An interconnect cable (CX) is available in various lengths from 10 to 80 feet. The cable includes a plug on each end for ease of installation. The SMX series also uses an electronic temperature sensor which comes in various lengths and it too plugs in.

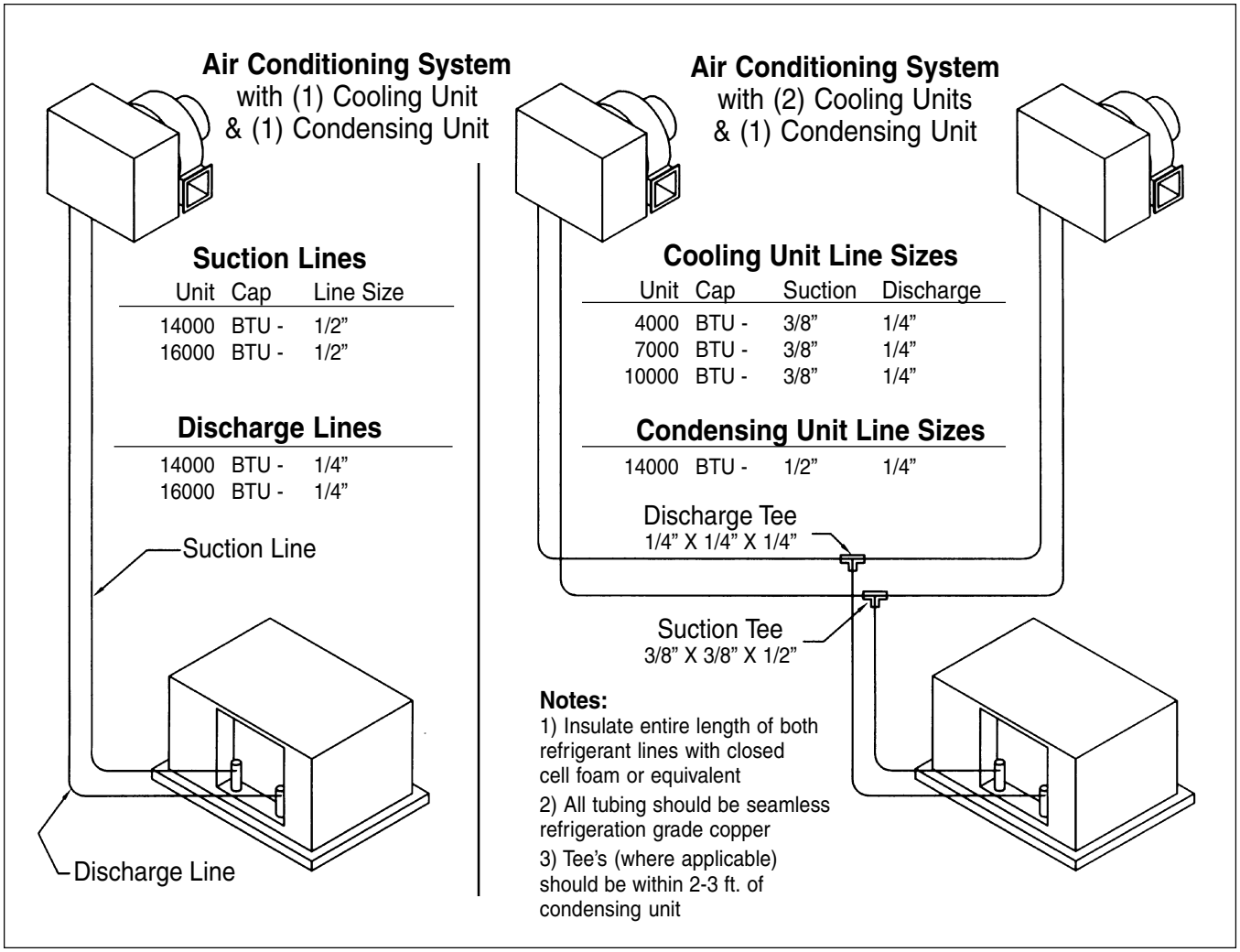


Figure 5. Refrigerant Line Sizes.

CHAPTER 3: Start Up Procedures - Final Inspection

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

❒ Cooling unit is bolted securely in place.

❒ Cooling unit return air cross sectional open area is equal to the face area of the unit evaporator coil as a minimum

❒ Return air to the cooling unit should pass through a filter and should come only from the space being cooled.

❒ Switch assembly terminal strips are securely mounted in a dry place, safely out of reach, and covered.

❒ Thermostat temperature sensing bulb or temperature sensing element (TSE) is installed in the cooling unit return air stream. NOTE: These should not be touching metal parts of the cooling unit which may become cold.

❒ Cooling unit condensate drain is in place and working properly. Test by pouring two quarts of water rapidly into the cooling unit drip pan.

❒ Cooling unit wires are connected securely to the condensing unit terminal strip.

❒ Flare nut joints at the cooling unit are tight.

❒ Flare nut joints at the cooling unit are insulated to prevent dripping. Insulate after testing for leaks.

❒ Wire harness to the condensing unit is securely connected to the switch assembly terminal strip.

14,000 BTU/hr Condensing Unit

Voltage	115	230
Wire size	10	12
Breaker size	30	20

Figure 6. Wire and Breaker Size

❒ Power line from the vehicle's panel is connected securely to the condensing unit terminal strip. See wiring diagram. Be sure the proper size circuit breaker of the time delay type is installed. See Figure 6 for proper wire and breaker sizes.

❒ The refrigerant lines between the cooling unit and condensing unit are insulated completely.

❒ Copper tubes and wire harness are secured throughout their length.

❒ Condensing unit is securely mounted.

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

CHAPTER 4: Start Up Procedures - Initial Charging Of A New System

Warning • • • • • • • •

Federal law prohibits the intentional release of refrigerant gas into the environment and requires that you use EPA approved refrigerant handling equipment and procedures to prevent any refrigerant gas from escaping into the air.

The following instructions should be followed in evacuating and charging a Cruisair remote condensing unit system with R-22.

There are three refrigerant circuit components in a Cruisair remote condensing unit system: the condensing unit, the cooling/heating unit and the copper refrigerant lines. The condensing unit is shipped from the factory charged with approximately the amount of refrigerant needed for the whole system. The cooling unit is pressurized with dry nitrogen and the copper tubing contains air.

The procedure will be to evacuate the nitrogen and air from the cooling unit and the copper tubing, then release the refrigerant from the condensing into the entire system. To facilitate this procedure, there is a special port with a red cap located on the right hand base valve of the condensing unit.

Required Tools

- Refrigerant 22 container (typically the disposable type container color coded green for R-22)
- Four valve gauge manifold with self closing fittings on the charging hoses
- Vacuum pump
- Base valve wrench and hand tools
- Accurate thermometer

Proceed as Follows

1. Make sure all flare joints are well made and tight.
2. Do not touch the condensing unit base valve stem covers or service port caps. Remove the red port cap on the right hand base valve.
3. Connect the vacuum pump hose to the vacuum pump. Connect the refrigerant supply line to the refrigerant container (make sure the container valve is OFF). Connect the low pressure gauge hose, equipped with self closing fittings to the red capped port. At this point do not connect the high pressure charging hose to anything.
4. Close all gauge manifold valves.
5. Energize the vacuum pump and open manifold valves for the vacuum pump, the refrigerant container, and the red capped access port (low pressure test gauge).
6. As the pump operates, you will see the low pressure test gauge fall to a vacuum. When the vacuum reaches 28 in. HG, close the vacuum pump valve and turn the vacuum pump off. Leave the system for 15 minutes and then observe the gauge. If any vacuum is lost, a leak is indicated. Find the source of the leak and correct. Return to step #3 above and re-evacuate the system. Continue until the system will hold the vacuum.
7. Open the vacuum pump valve and leave the vacuum pump operating for at least 6 hours or until a vacuum of at least 29 in. HG is achieved. Close the vacuum pump valve and turn the vacuum pump off. Wait one hour. If no vacuum is lost, proceed with charging. If any vacuum is lost, a leak is indicated. Find the source of the leak and correct. Return to step #3 above and re-evacuate the system. Continue until the system will hold the vacuum.
8. Open the refrigerant container valve slowly and allow gas to enter the system until the gauge rises to zero. You have now filled the evacuated lines and cooling/heating unit with refrigerant to a gauge pressure of zero. Close therefrigerant container valve.
9. Remove the low pressure gauge hose from the red capped port. Replace and tighten the red cap.
10. Remove both condensing unit base valve stem caps. Open both base valves fully by turning the valve seems fully counterclock wise. This will allow the refrigerant in the condensing unit to enter the system. Replace and tighten the valve stem caps.

At this point, the system is basically charged and ready for final gas charge adjustment.

Field Charging A System*

To field charge a new system which has been evacuated and initially charged or an older system which shows signs of needing a gas charge, proceed as follows:

Required Tools

- Same as initial charge

Proceed As Follows:

1. Remove both base valve stem caps and confirm valve stems are in the back seated or counterclockwise position.
2. Remove the service port caps from both base valves. No gas should escape. If it does, retighten the cap and call Marine Development Corp. for assistance.
3. Close all gauge manifold valves.
4. Attach the gauge manifold hoses to the gauge ports (high pressure on the right and low pressure on the left). Connect the refrigerant hose to the refrigerant container.
5. Open both base valves to the test position by rotating the stems one turn clockwise.
6. Start the unit and observe the system pressures. Use the Cruisair charging pressure charts, Figure 7a or 7b to determine the proper pressures. These charts are to be used as a guide to setting pressures. **They are not designed to give exact pressure settings.** There are conditions that may cause pressures to vary. Head pressures may vary ± 10%. Suction Pressure settings are more critical (± 5%) for functioning of the system. Through the gauge manifold, adjust the gas charge to obtain the proper system pressures.

Example for reading pressure charts:

Outside air temperature = 95° F.
Inside air (return air) = 70° F.

Head Pressure	Suction Pressure
230 psig	70 psig

7. To remove the gauge manifold, back-seat the base valves by turning the stems counterclockwise. Tighten the stem packing gland nuts. Replace and tighten the stem caps. Remove the gauge hoses. Replace and tighten the port caps.

Removing Refrigerant From A System

When adjusting the charge in the refrigerant system, you may have to remove refrigerant. It is a violation of Federal law to vent refrigerant to the atmosphere and it is necessary that you capture any refrigerant that is removed from the system. There are two methods of doing this.

Use an approved recovery unit and refillable refrigerant container.

Allow refrigerant to escape from the high pressure side into a refillable refrigerant container.

Once the system is properly charged, you are ready for final inspection and check-out.

* It is recommended that the charging be done in the cooling cycle for two reasons:

1. Following instructions, standard refrigeration gauges are connected for the cooling cycle.

2. In the heating cycle, the same pressure may be observed at two different charge levels, and an overcharge may result.

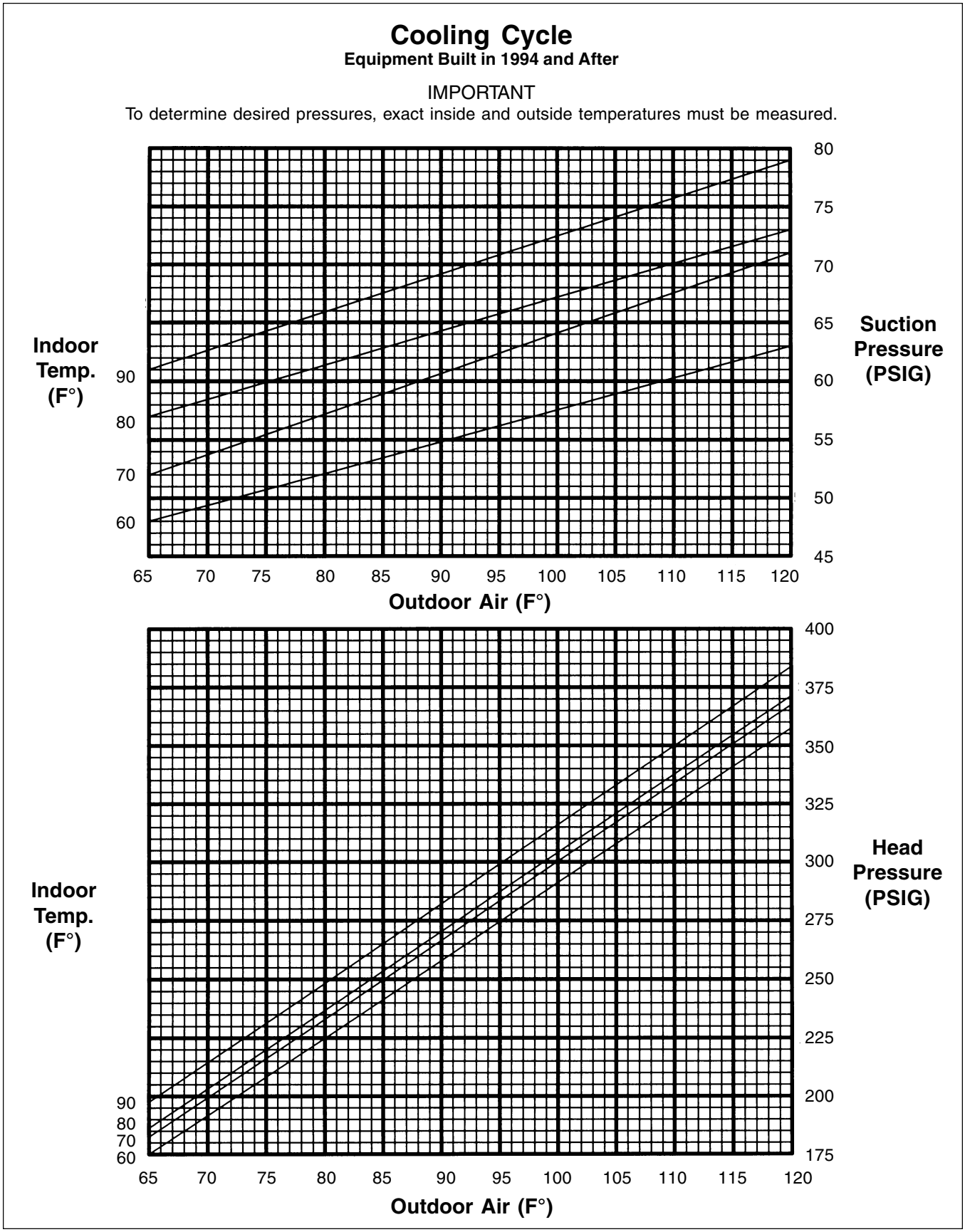


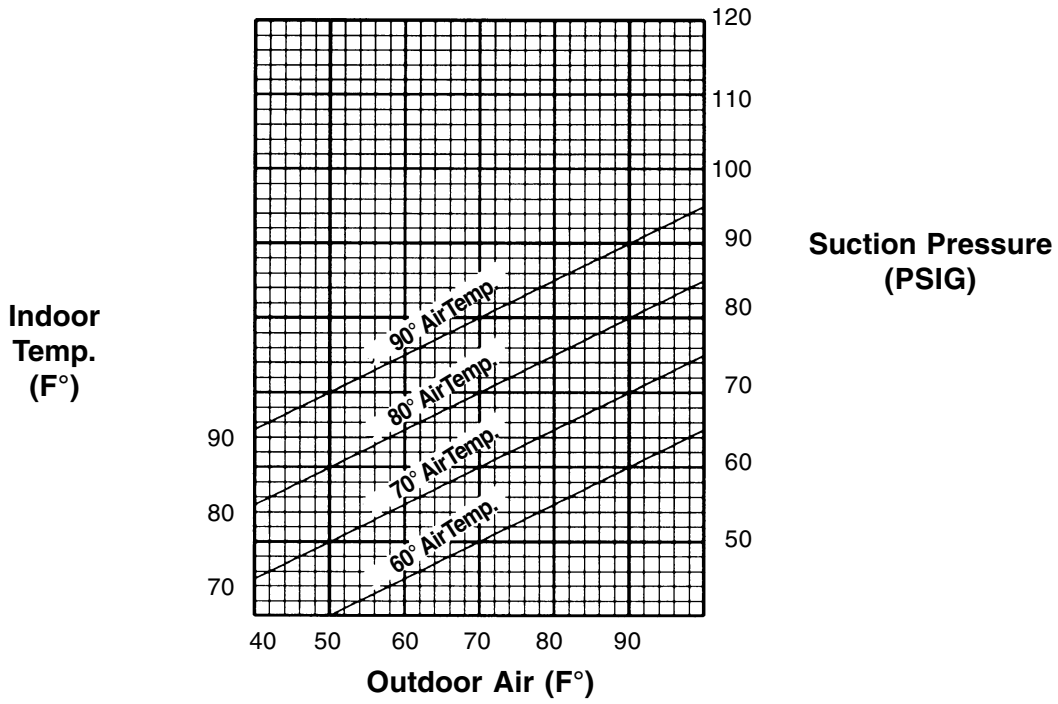
Figure 7a. Charging Pressure Charts

Cooling Cycle

Equipment Built Prior To 1994

IMPORTANT

To determine desired pressures, exact inside and outside temperatures must be measured.



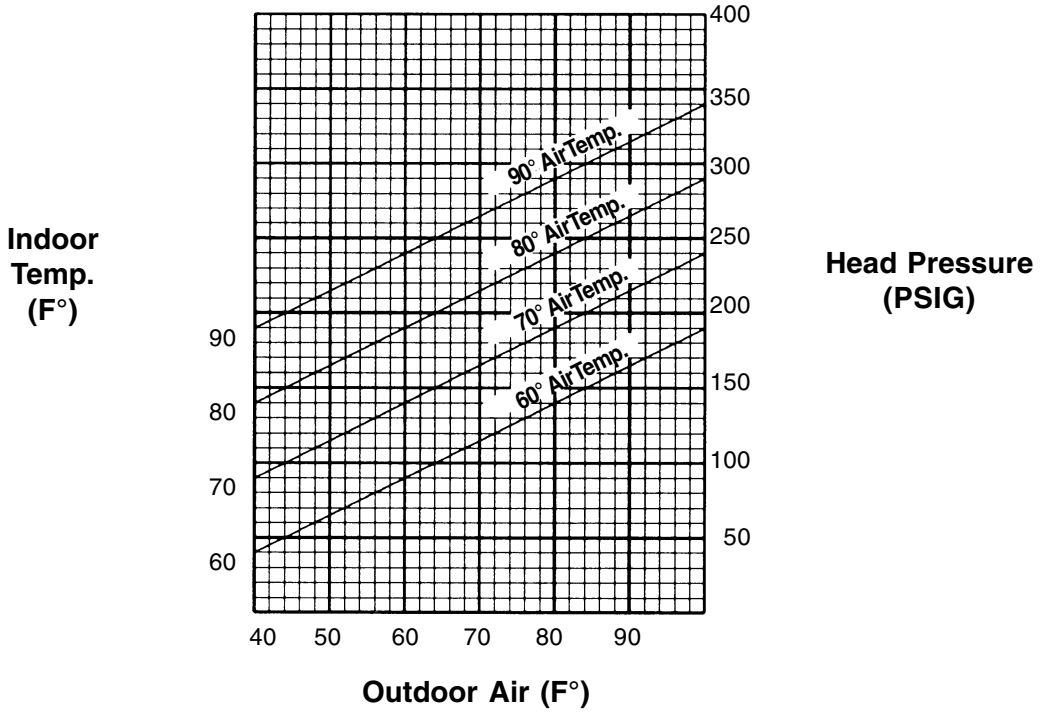


Figure 7b. Charging Pressure Charts

CHAPTER 5: Start Up Procedures - Final Check-Out and Start-Up

❒ Actuate the circuit breaker for the air conditioning.

❒ Actuate the air conditioning system at the control panel/switch assembly, following the directions in the Cruisair owner's manual.

❒ Allow unit to run for 15 minutes, then check the temperature differential by placing an accurate thermometer in front of the discharge grill. After recording the temperature, place the same thermometer in front of the return air grill. The difference the two readings should be 15 to 20 degrees Fahrenheit. Note that humidity will diminish the temperature differential and cooling capacity. Cooling capacity diminishes in very warm outside, air (above 95° F / 35° C), and heating capacity decreases when outside air temperature drops below 40° F / 4° C.

If everything checks okay, the system is ready to go.

CHAPTER 6: General Operation

Operating Instructions: Rotary Knobs

Before attempting to start the Cruisair system equipped with the rotary knob control, verify the OFF/FAN/RUN control is in the off position and proceed as noted below:

Power On
Turn on the circuit breaker on your vehicle's electrical panel designated for the air conditioner.

Set the Thermostat
Turn the WARMER/COOLER knob to the desired mode of operating. (cooling or heating)

Set the Fan Speed
Rotate the fan speed knob to the full clockwise or the High speed position.

Starting the Fan
Move the top control knob to the FAN position to energize the blower. Verify that the fan did start moving air.

Starting the Compressor
Move the top control knob to the RUN position. The compressor will start and the unit will begin to cool or heat, depending on which mode of operation you have selected and what the current inside temperature is.

Setting Desired Temperature
To set the thermostat, allow the unit to operate until the living area is cooled or heated to the desired temperature. At this point, turn the thermostat (WARMER/COOLER) knob slowly toward the center position until you hear it "click" once. The thermostat is now set to maintain the desired temperature.

Setting the Fan Speed
Use the center knob to set the fan speed to the desired air flow by rotating it between the LOW and HIGH position.

Turning the System Off
To turn the system off, rotate the top knob to the OFF position. The other knobs can be left where they are set for later operation.

Note
If you turn the system off or if you wish to switch between cooling and heating, wait three minutes to allow the unit's internal pressures to equalize before attempting to restart the compressor.

Operating Instructions: SMX Series Controls

Several different models of SMX Series controls are available. Operation procedures are similar for all of them. Any differences are noted below:

Power On

Turn on the circuit breaker on your vehicle's electrical panel designated for the air conditioner. The system will automatically begin operating with settings that were in effect when the power was interrupted. If the system had been shut down using the OFF key, it will be necessary to select the cooling or heating mode to restart the system.

Selecting the Desired Temperature

Display the current setpoint by pressing the SET key. The LED above the key will light and setpoint will be displayed in degrees Fahrenheit or Celsius. The setpoint is the temperature you wish to maintain. It is adjusted by pressing the UP or DOWN key adjacent to the SET key.

Displaying Interior Temperature

To display the current interior temperature, press the TEMP key once. The display will show the inside temperature.

(SMXII)

For an alternating display of both inside temperature and setpoint, press the TEMP key again. Return to inside temperature display by pressing TEMP again.

(SMX and SMX OnLine)

To display the outside temperature, if your system is equipped with an outside thermistor, press the TEMP key again. The small LED marked "Outside" will light and the display will show outside temperature. Press the TEMP key a third time and you will see an alternating display of setpoint, inside temperature and outside temperature. Return to inside temperature by pressing TEMP again.

Selecting the Cooling or Heating Mode

Select the cooling or heating mode by pressing either the COOL or HEAT key. The small LED above the key will light up to show whether the system is in the cooling or heating mode. For automatic changeover between cooling and heating, press the COOL and HEAT keys simultaneously, and both LED's will light. The "Heating" or "Cooling" LED on either side of the TEMP display will light when the compressor is running to indicate the operating status of the system.

Adjusting Fan Speed

Select manual or automatic fan speed by pressing the FAN key. This switch toggles back and forth between manual and automatic. The line of small LED's below the FAN key will give you a visual indication of the relative fan speed. In the manual mode, you can control fan speed by using the SLOW and FAST keys. When in the automatic mode, fan speed is adjusted by the computer, based on the differential between the setpoint and actual inside temperature.

Adjusting Brightness

The brightness of the display and status LED's can be adjusted on the SMXII from the keyboard by pressing the SET key a second or third time. The SMX Online is automatically adjusted to constantly provide easy reading of the display both during the day and at night.

Turning the System Off

To turn the system off, press the OFF key. Note that the data display remains on until you turn off the circuit breaker on your vehicle's electrical panel.

Advanced Programming

Refer to the SMX series user's guide for additional details on Cruisair's computer-based control systems.

Cooling Unit and Switch Assembly

Switch contacts are self-cleaning 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 path. Locate this filter and clean it if a visible buildup of lint has collected. If filters were installed, they are usually located behind the return air grills.

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 (R-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 condenser coil should be inspected periodically for possible buildup of dirt and/or obstructions. Fan motors on the condensing units 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:

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.

Carbon monoxide poisoning is a possibility which should be carefully considered. NEVER close a vehicle and operate an air conditioning system while any engine or generator 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 audible range of any operating engine, **NEVER CLOSE A VEHICLE AND REMAIN INSIDE.**

CHAPTER 8: System Failure Troubleshooting Guide

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 compressor	Replace high pressure switch
	Faulty compressor	Unit draws 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 psig head pressure	Replace high pressure switch
System not cooling	Switch assembly not set properly or thermostat satisfied	Ventilation operation only	Set switch and thermostat at correct selection
	No or restricted air flow	Compressor cycles quickly condenser air flow	Check for restricted
	System low on refrigerant	Compressor suction line warm	Check refrigerant charge
	Thermostat satisfied	Compressor runs for short time and then cycles off	Reset thermostat to desired level. Calibrate if necessary
Iced cooling unit	Restricted air flow	Restricted discharge air flow	Clean return air filter & check for air flow restrictions
	Low refrigerant charge	Compressor suction line warm	Check refrigerant charge
Blower or fan motor inoperative	Power source failure	No current at power system	Check for tripped circuit breaker
	Low voltage	Hot motor. Motor thermal/electric protector open	Check power source
	Faulty switch assembly	No power 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

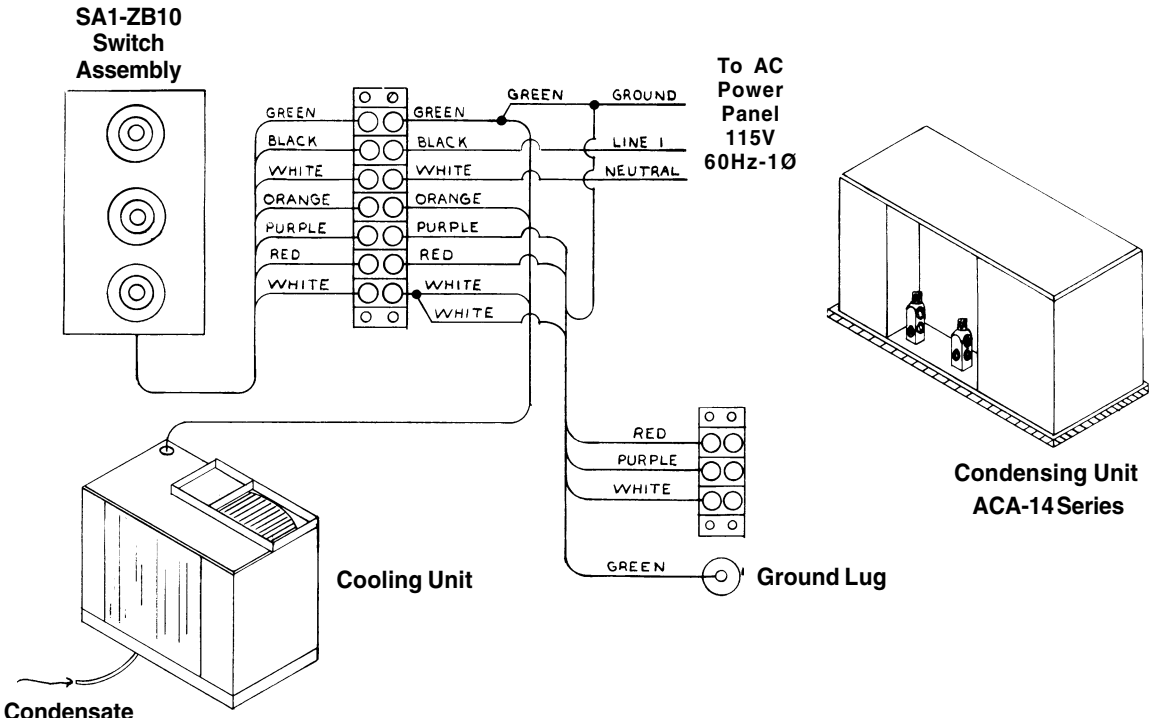
CHAPTER 9: System Charging Troubleshooting Guide

Pressures Suction	Pressures Discharge	Symptoms	Possible Cause	Remedy
Normal	Normal	Suction line sweating w/droplets up to compressor Compressor warm on top & hot on bottom Temp differential accross cooling coil is 16-20° F	Proper charged system	N/A
Low	Low	Suction line cool, not sweating Compressor hot on top and bottom Cooling coil temp. differential low System drawing very low amps	Low on charge	Low charge - frosty suction line Very low charge - suction line feels ambient to cool
		Suction line has small beads of moisture Compressor is cool to cold & may be sweating Normal to high cooling coil temp. differential	No load due to low evaporator temp.	Cooling cycle - low air flow or room temp. Heating cycle - low condenser air flow or outside air temp.
Low	High	Suction line cool to cold with frost or no sweat May have frost line at point of blockage Compressor hot Compressor may draw high amps Cooling coil temp. differential low	Kinked refrigerant line Blockage in refrigerant line	Check for kinked or pinched lines - remove any moisture or trash in refrigerant circuit. Verify base valves are open.
		Suction line cool to cold with frost or no sweat Cooling coil temp. differential low Compressor hot Compressor may draw high amps	Low charge/no condensing	Cooling mode - check outside air flow Heating mode - check inside air flow
		Suction line cool to cold with frost or no sweat May have frost line at point of blockage Compressor is hot Compressor may draws high amps Cooling coil temp. differential low	Non-condensable in refrigerant (air or moisture)	System must be evacuated and recharged
High	Low	Suction line ambient to cool Compressor is warm Compressor draws low amps Cooling coil temp. differential is low System exhibits marginal to zero performance Rapid rise in suction pressure & moderate rise in head pressure when condenser air is blocked	Defective component faulty comp. valves or reversing valve	Determine faulty component and replace
High	High	Suction line cool to cold with thin film of moisture Compressor cold and sweaty Cooling coil temp. differential is low System pressures may be anywhere on gauges High pressure switch trips Compressor draws high amps	Over charged system	Remove charge until suction pressure is about 50 psig - allow system to run until comp. gets warm - then recharge slowly
High	High	Suction line cool to ambient Compressor warm Cooling coil temp. differential low Compressor may trip circuit breaker	No condensing of refrigerant	Cooling mode - check condenser air flow Heating mode - check inside air flow
		Suction line cool to ambient Compressor warm Cooling coil temp. differential high	High load caused by hot living area temp. or high outside air	Condition should improve as room temp. is lowered. Should not trip breaker

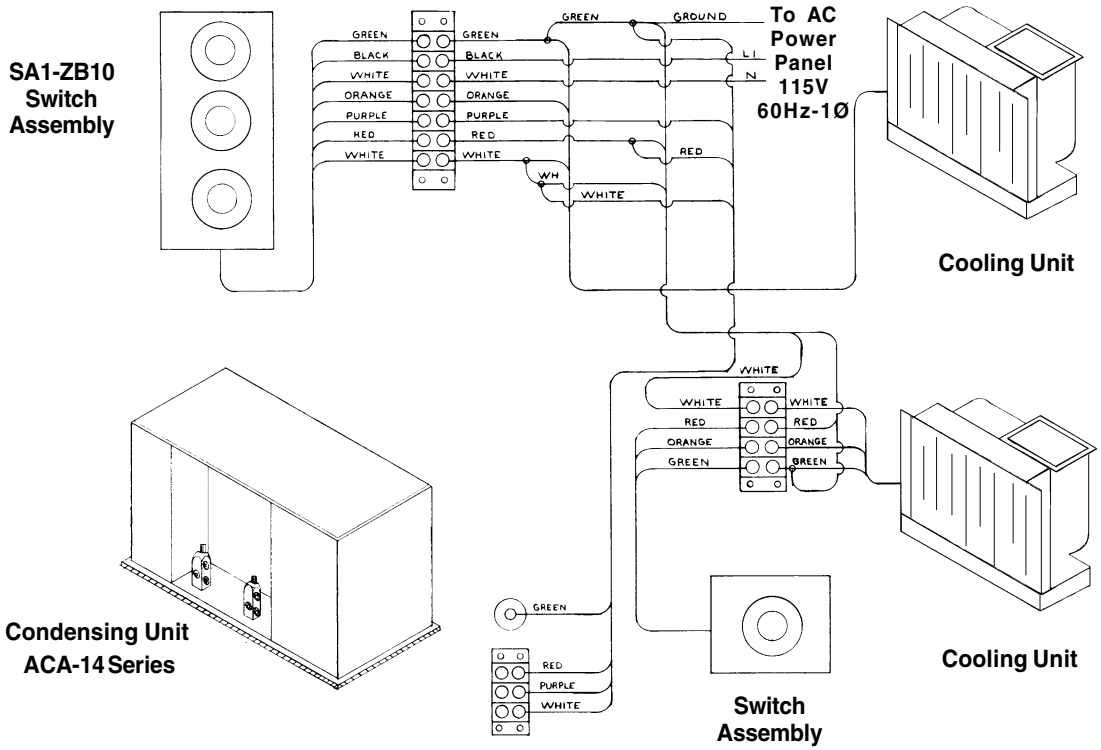
CHAPTER 10: Installation Wiring Diagrams

Index of Diagrams

Cooling Only Systems Built and Installed Through 1989

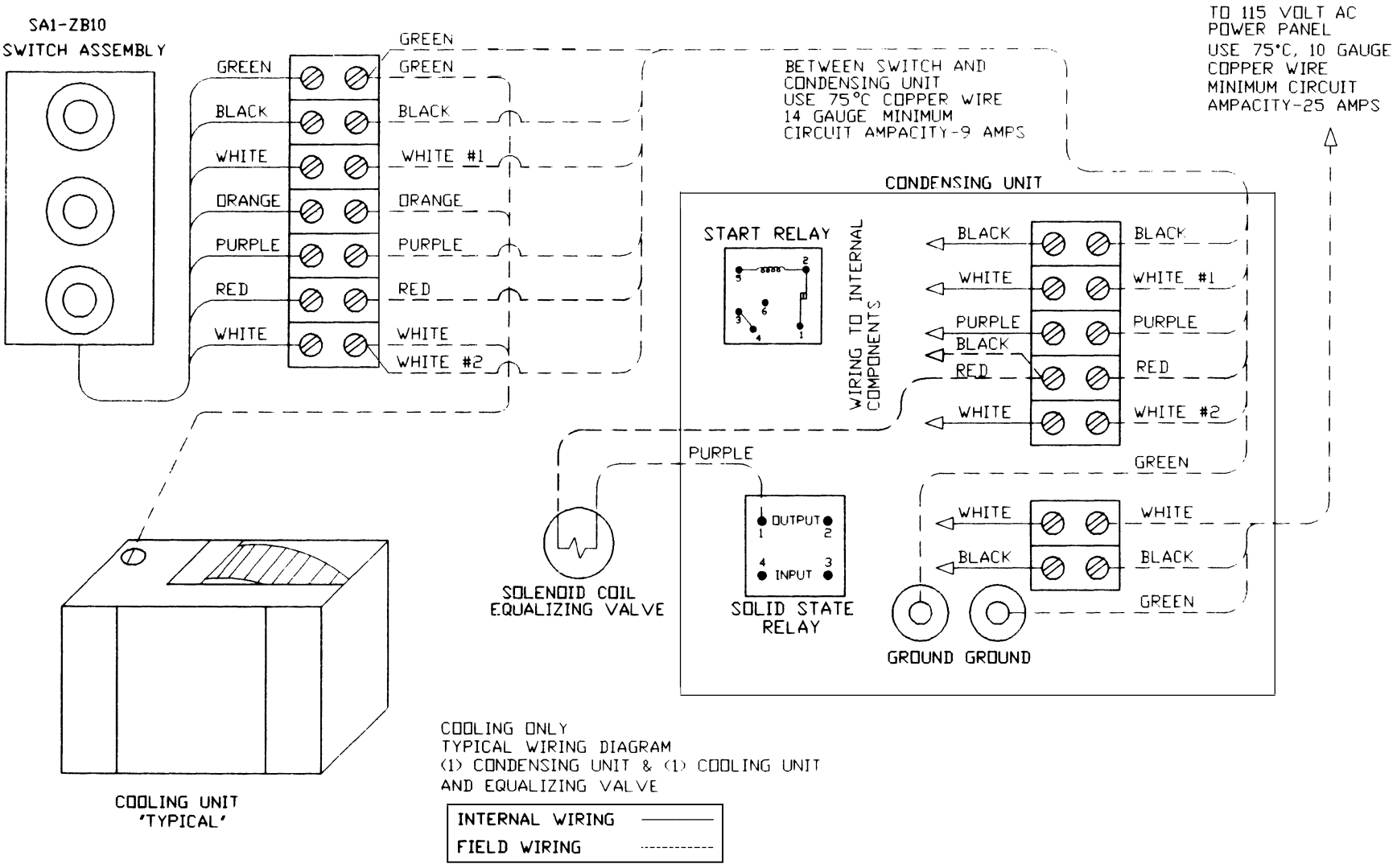


Typical Wiring Diagram: (1) Condensing Unit & (1) Cooling Unit



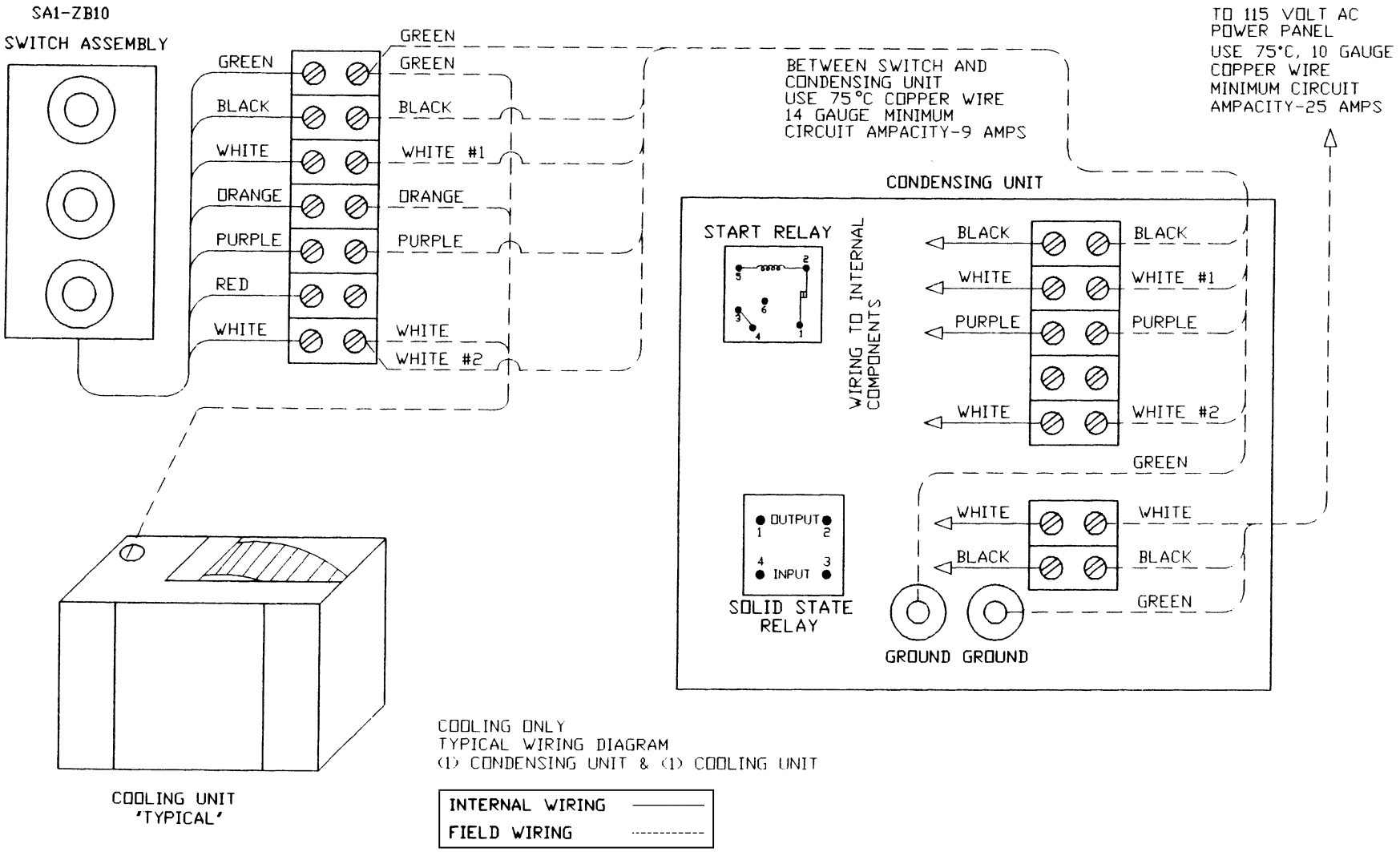
Typical Wiring Diagram: (1) Condensing Unit & (2) Cooling Units

SKB-208 Cooling Only Systems Built and Installed From 1989 - June 1996



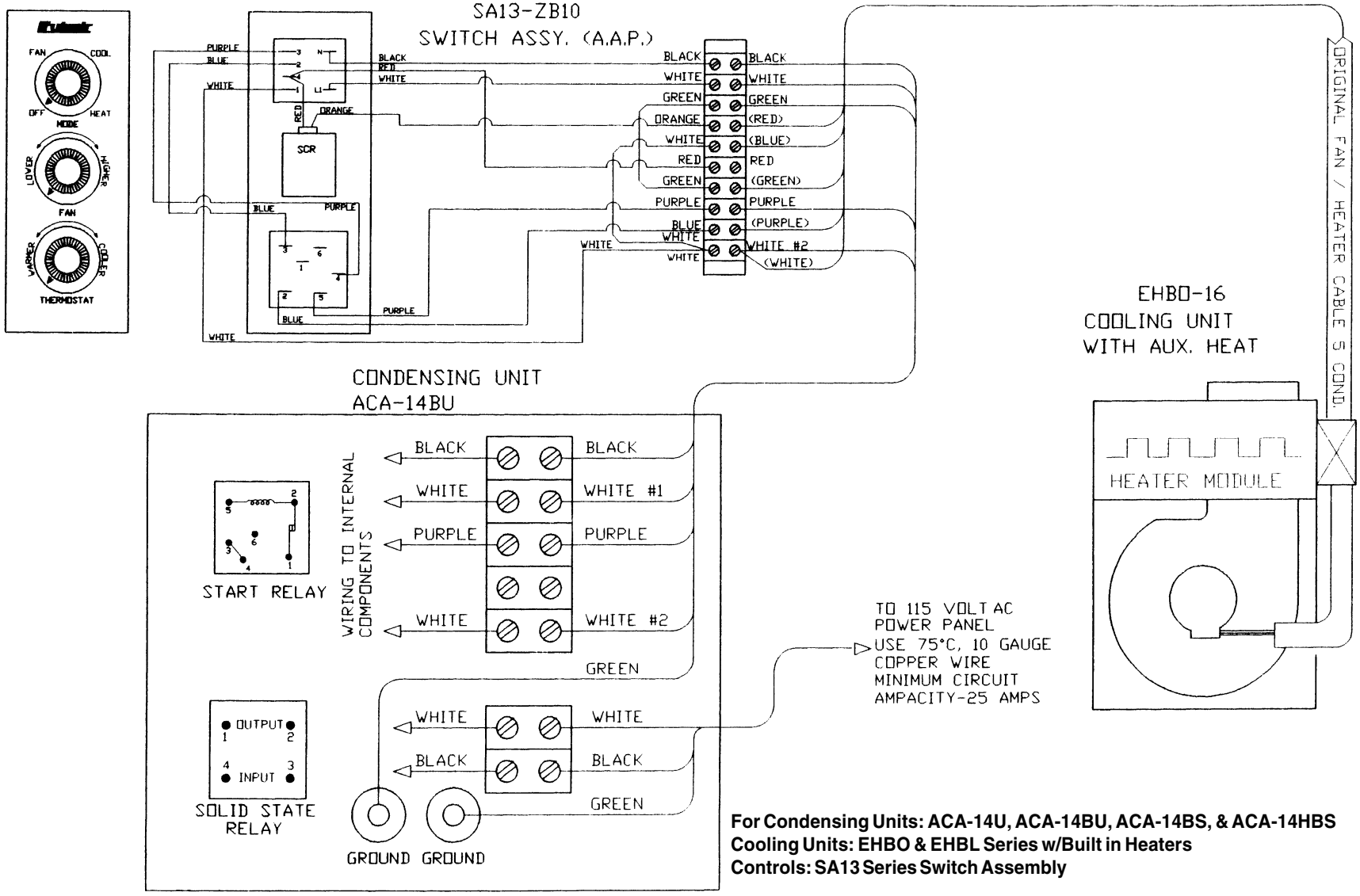
For Condensing Units:
ACA-14U, ACA-14BU
Controls: SA1 Series Switch Assembly

SKB-208A Cooling Only Systems Built and Installed From 1989 - Current Production



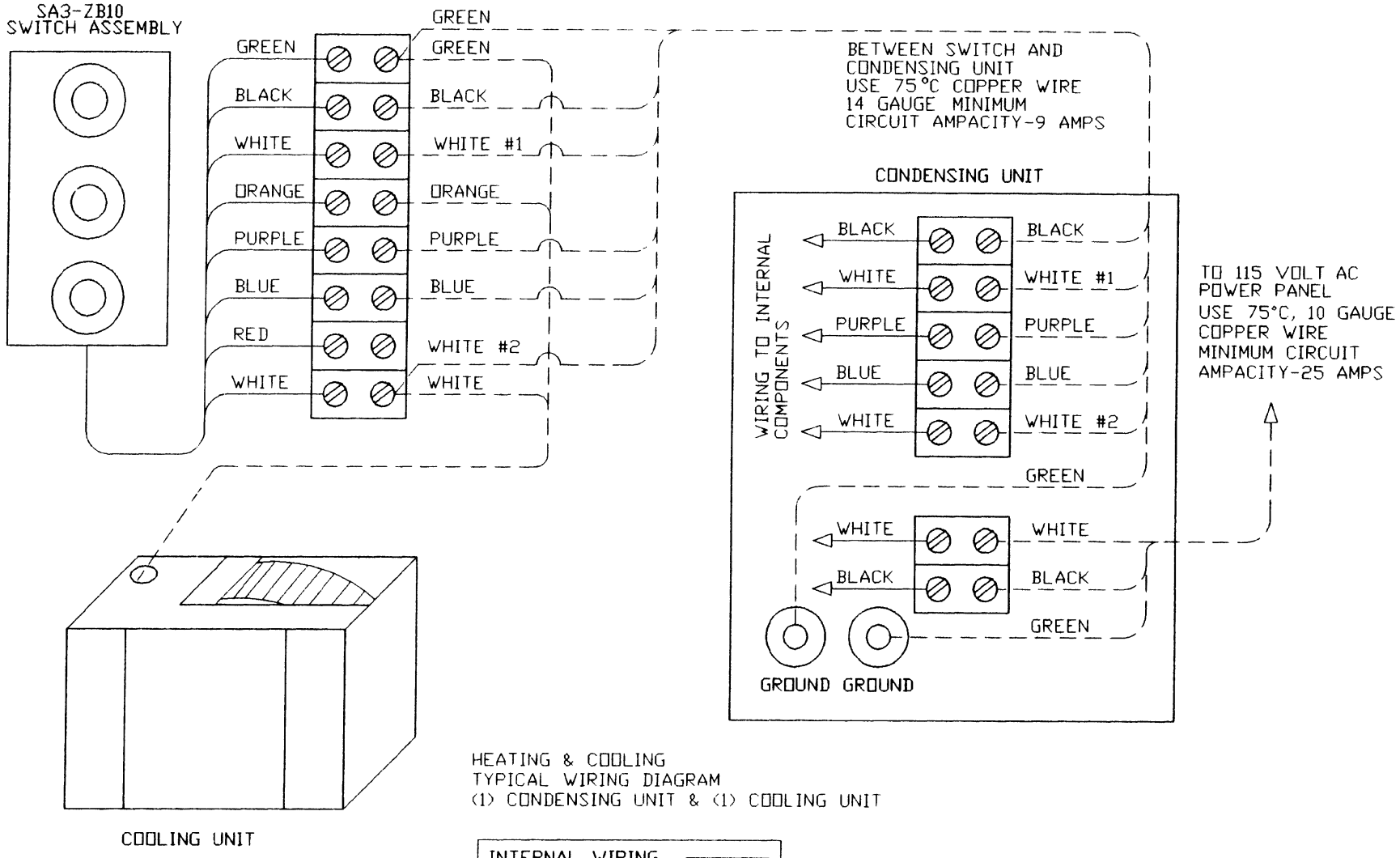
For Condensing Units: ACA-14U, ACA-14BU, ACA-14BS, & ACA-14HBS
Controls: SA1 Series Switch Assembly

SKB-690 Cooling w/Auxiliary Electric Heating Systems
Built and Installed From 1996 - Current Production



For Condensing Units: ACA-14U, ACA-14BU, ACA-14BS, & ACA-14HBS
Cooling Units: EHBO & EHBL Series w/Built in Heaters
Controls: SA13 Series Switch Assembly

No. 825-06 Reverse Cycle Heat Pump Systems
Built and Installed From 1990 - Current Production



HEATING & COOLING
TYPICAL WIRING DIAGRAM
(1) CONDENSING UNIT & (1) COOLING UNIT

INTERNAL WIRING ———
FIELD WIRING - - - -

For Condensing Units: ACAH-14B & ACAH-14BU
Controls: SA3 Series Switch Assembly

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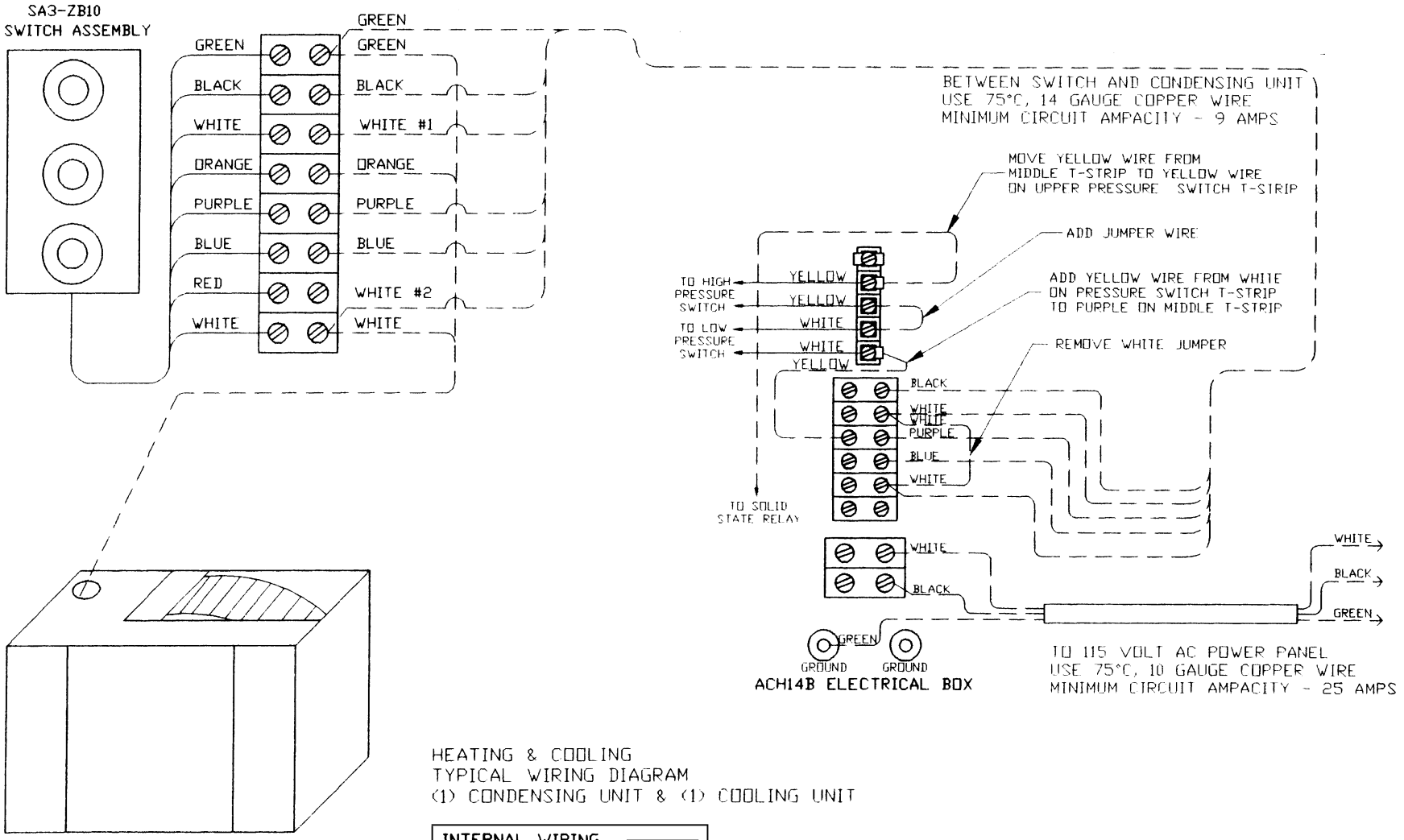
No. 825-06A Reverse Cycle Heat Pump Systems
Built and Installed From 1991 - Current Production

Wiring Changes Required When System is Controlled by SA3-Z Series

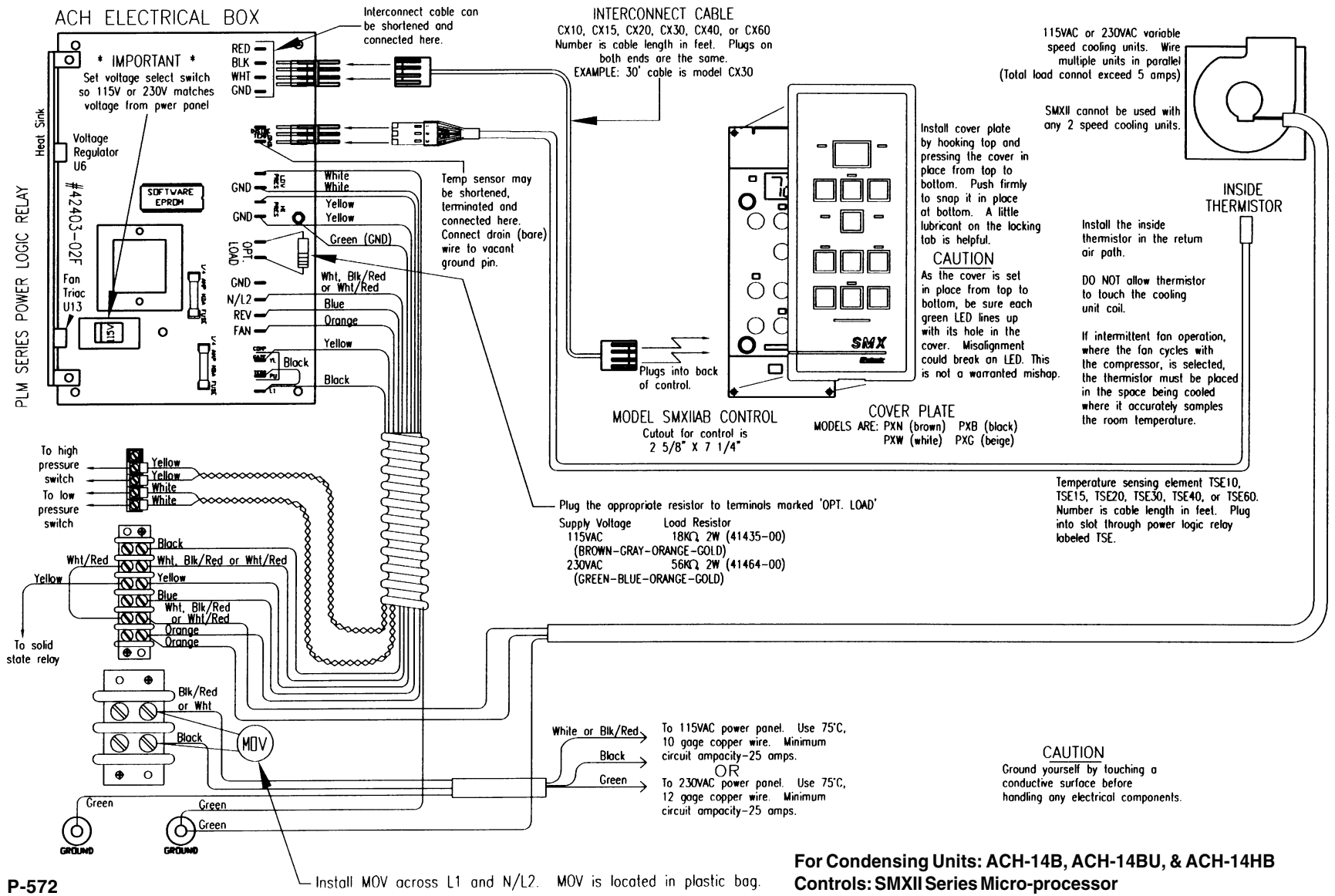


HEATING & COOLING
TYPICAL WIRING DIAGRAM
(1) CONDENSING UNIT & (1) COOLING UNIT

INTERNAL WIRING	———
FIELD WIRING	- - - - - - - - - -

For: Condensing Units: ACH-14B, ACH-14BU, & ACH-14HB
Controls: SA3 Series Switch Assembly

No. 825-15 Reverse Cycle Heat Pump Systems
Built and Installed From 1991 - Current Production



For Condensing Units: ACH-14B, ACH-14BU, & ACH-14HB
Controls: SMXII Series Micro-processor

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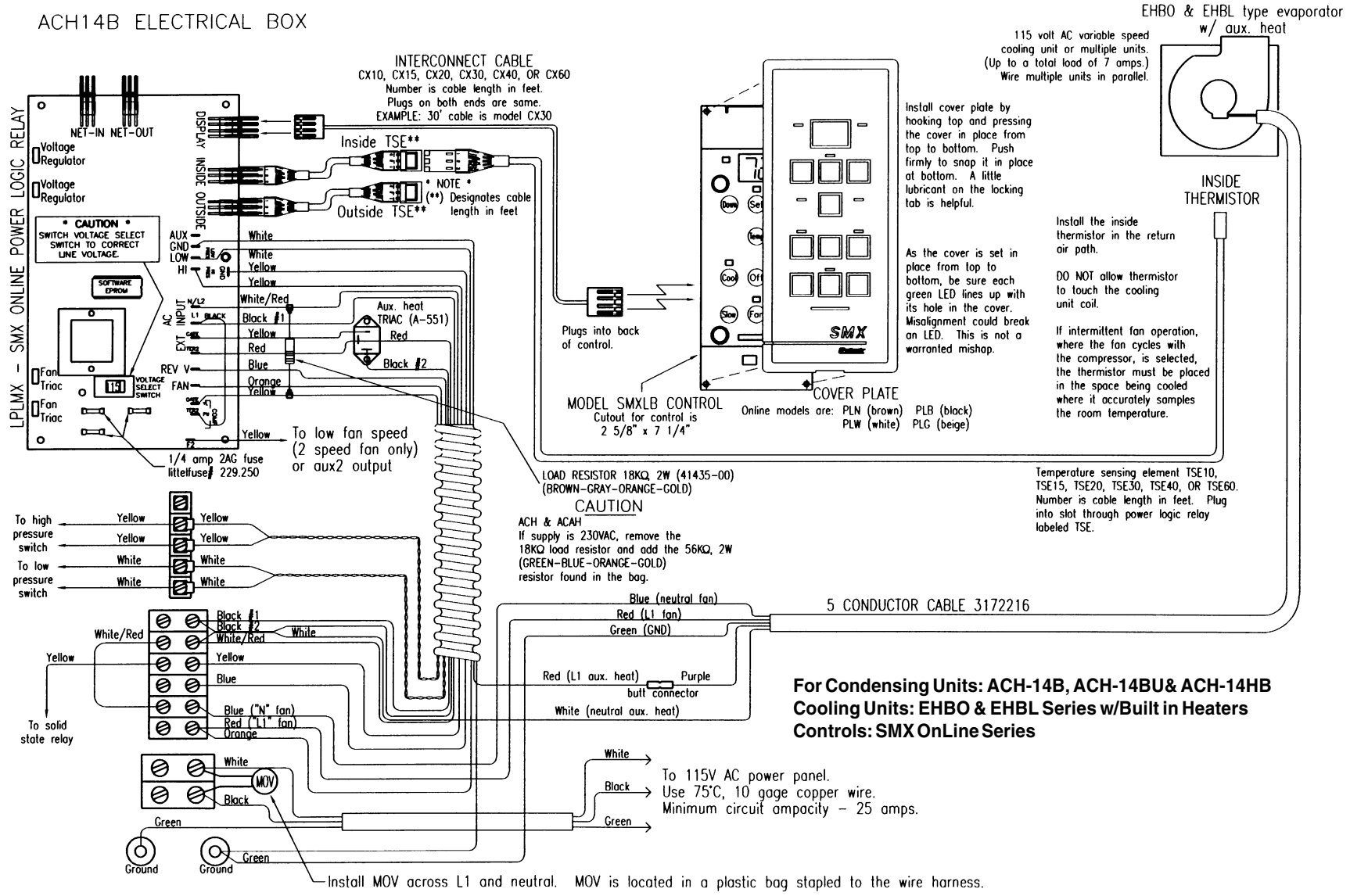
No. 082550 Reverse Cycle Heat Pump w/Auxiliary Electric Heating Systems Built and Installed From June 1997 - Current Production



For Condensing Units: ACH-14B, ACH-14BU& ACH-14HB
Cooling Units: EHBO & EHBL Series w/Built in Heaters
Controls: SMX OnLine Series

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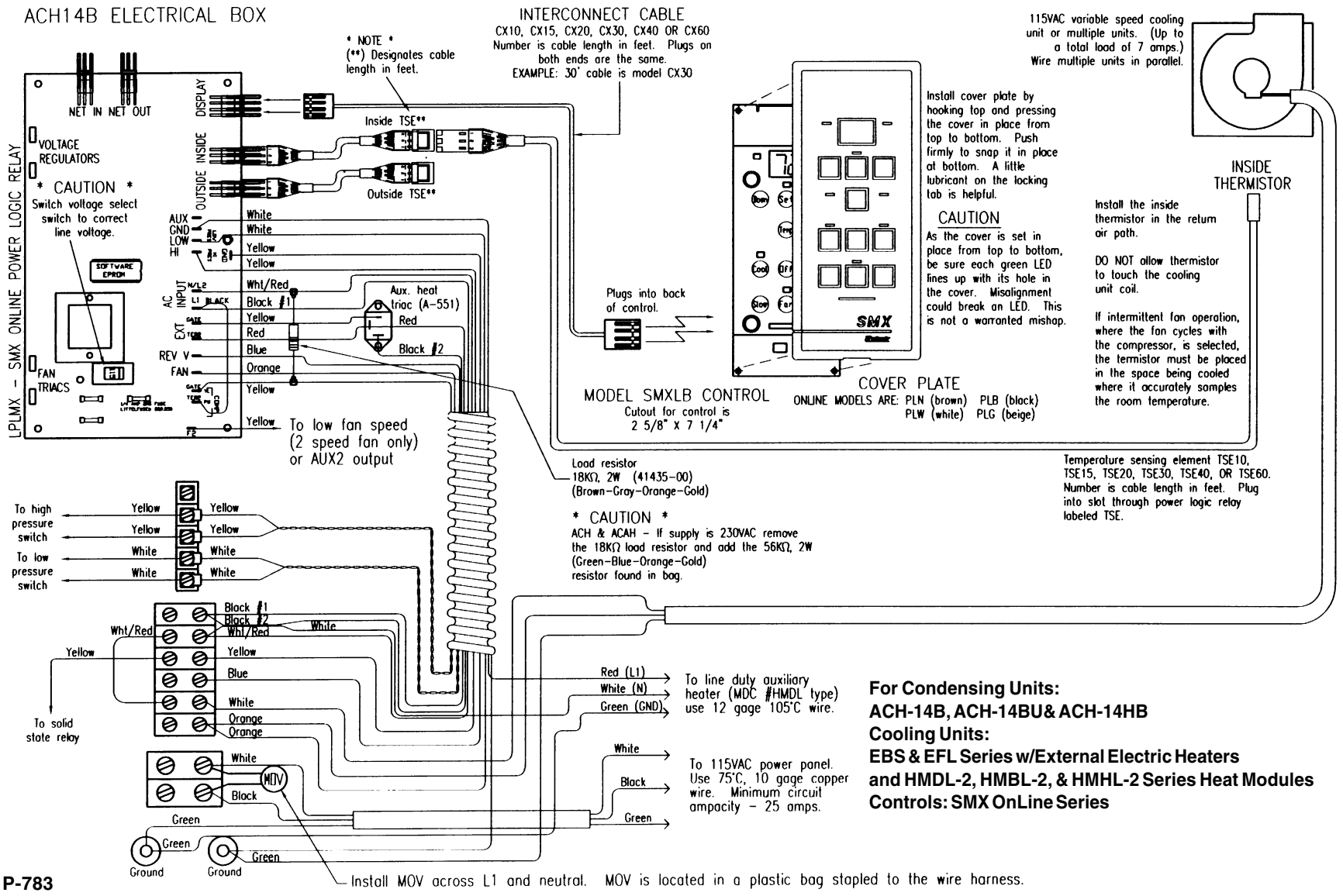
No. 082551 Reverse Cycle Heat Pump w/Auxiliary Electric Heating Systems Built and Installed From June 1997 - Current Production



For Condensing Units:
ACH-14B, ACH-14BU& ACH-14HB
Cooling Units:
EBS & EFL Series w/External Electric Heaters and HMDL-2, HMBL-2, & HMHL-2 Series Heat Modules
Controls: SMX OnLine Series

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Notes

WARNING

Taylor Made Environmental, Inc. (TME) manufacturers of Cruisair, Grunert, Marine Air and Sentry Products, makes the following safety warnings concerning the application, installation, use and care of its products. Although these warnings are extensive, there may be specific hazards which may arise out of circumstances which we have not outlined herein. Use this as a guide for developing an awareness of potential hazards of all kinds. Such an awareness will be a key factor in assuring your SAFETY and comfort.

ELECTRICITY - Many TME products operate on 115, 230 or 440 volt AC power. Such voltages can be LETHAL; therefore, the chassis, cabinets, bases, etc., on all components must be grounded together and connected to the vessel's grounding system. Sparks can occur as switches, thermostats and relays open and close in the normal operation of the equipment. Since this is the case, ventilating blowers for the removal of hazardous fumes or vapors should be operated at least 5 minutes before and during operation of any TME product or group of TME products. All electrical connections must be covered and protected so accidental contact cannot be made by persons using the equipment, as such contact could be LETHAL.

ELECTROLYSIS - Electrical leakage of any component can cause electrolytic deterioration (electrolysis) of thru-hull components which could result in leakage serious enough to sink a vessel which could result in loss of life. All TMES components must be kept clean and dry and checked periodically for electrical leakage. If any electrical leakage is detected, the component should be replaced or the fault causing the leakage corrected before the component is put back into service.

GAS - CRUISAIR, MARINE AIR and GRUNERT components utilize R134a refrigerant, tetrafluoro-ethane or R404A, R125/R143a/R134 (44%/52%/47%) which are non-toxic, non-flammable gases; however, these gases contain no oxygen and will not support life. Refrigerant gas tends to settle in the lowest areas of the compartment. If you experience a leak, evacuate all personnel, and ventilate area. Do not allow open flames in the area of leaks because refrigerant gas, when burned, decomposes into other potentially LETHAL gases. Refrigerant components operate at high pressure and no servicing should be attempted without gloves, long-sleeved clothing and eye protection. Liquid refrigerant gas can cause severe frost burns to the skin and eyes.

VENTILATION - To cool or heat air, CRUISAIR, MARINE AIR and GRUNERT components are designed to move air through a heat exchanger by a blower or propeller fan. This design necessarily produces a suction on one side of the air handling component and a pressure on the other side. Air handling components must be installed so that the suction-pressure action does not: (1) pressurize an area to the extent that structural failure occurs which could cause harm to occupants or bystanders, or (2) cause a suction or low pressure in an area where hydrogen gas from batteries, raw fuel vapor from fuel tanks, carbon monoxide from operating propulsion engines, power generators or heaters, methane gas from sewage holding tanks, or any other dangerous gas or vapor could exist. If an air handling unit is installed in such a manner that allows potentially lethal gases or vapors to be discharged by the air handling unit into the living space, this could result in loss of life.

Maximum protection against the introduction of dangerous gases or vapors into living spaces can be obtained by providing living spaces which are sealed from all other spaces by use of airtight bulkheads and decks, etc., and through the introduction of clean air into the living space. Bear in mind that the advent of air conditioning, whether it be for cooling or for heating, naturally leads to the practice of closing a living space tightly. Never close all windows and doors unless auxiliary ventilating systems, which introduce clean outside air into the living space, are used. Always leave enough window and door openings to provide adequate ventilation in the event potentially lethal gases or fumes should escape from any source.

CONDENSATE - All cooling units produce water condensate when operating on the cooling cycle. This water must be drained from the cooling unit overboard. If condensate is allowed to drip on a wooden structure, rotting or decay and structural failure may occur which could result in loss of life. If condensate is allowed to drip on electrical components, deterioration of the electrical components could result in hazardous conditions. When an air conditioning system is in operation, condensate drains may be subjected to negative pressure. Always locate condensate drains as far as possible from points where engine waste and other dangerous gases are exhausted so no such dangerous gases can be drawn into the condensate drains.

Warning

Never sleep in a closed area on a boat when any equipment, which functions as a result of the combustion of a volatile fuel, is in operation (such as engines, generators, power plants, or oil-fired heaters, etc.) At any time, the exhaust system of such devices could fail, resulting in a build-up of LETHAL gases within the closed area.

Warning Revised: 7-6-99

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