



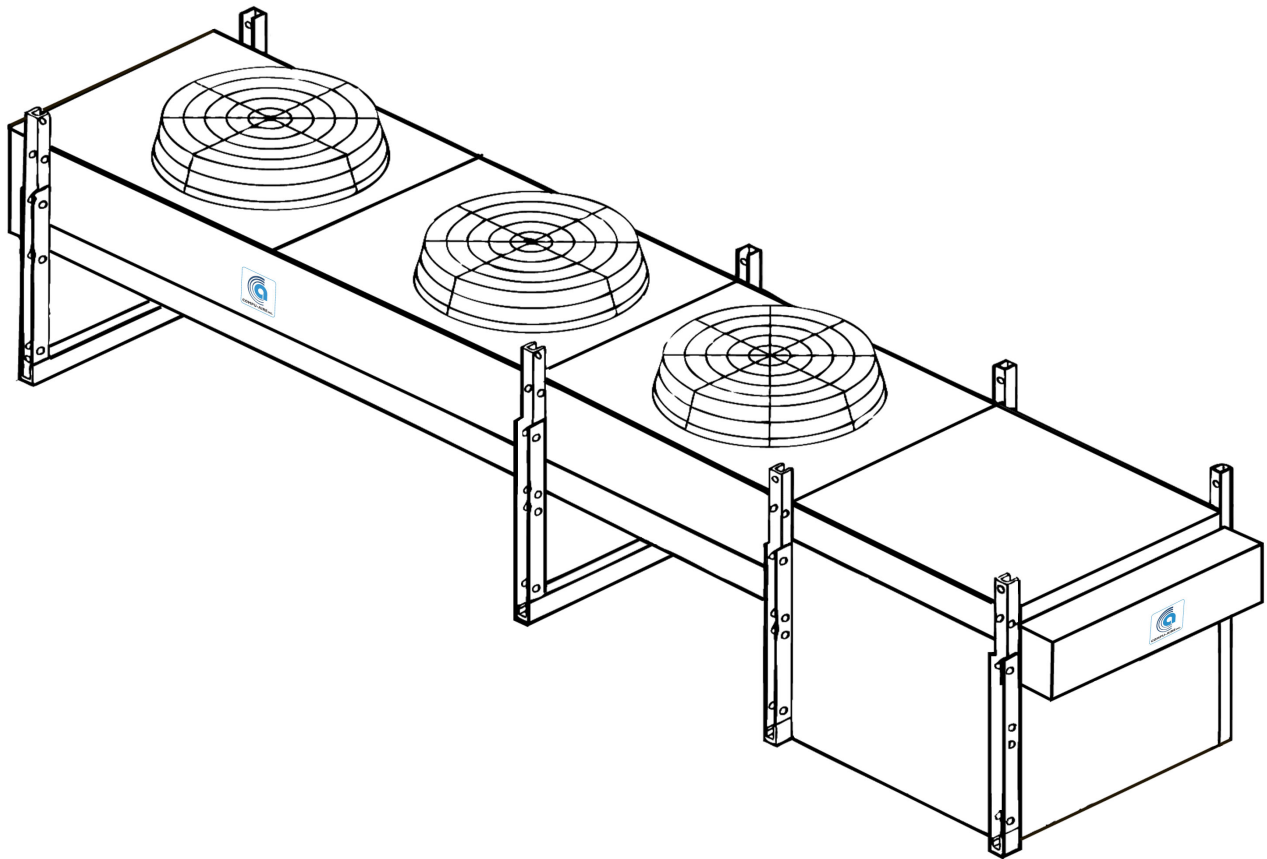
COMPU-AIRE INC.

Specialized Environmental Air Conditioning Systems

Installation and maintenance instructions:

Air-Cooled Condensing Units

ACCU



General Safety

IMPORTANT SAFETY NOTE

Only a qualified refrigeration mechanic who is familiar with refrigeration systems and components, including all controls should perform the installation and start-up of the system. To avoid potential injury, use care when working around coil surfaces (if applicable) or sharp edges of metal cabinets. All piping and electrical wiring should be installed in accordance with all applicable codes, ordinances and local by-laws.

WARNING

Always disconnect and lock off the main power supply on any system that will be worked on to avoid accidental start up of the equipment.

Inspection

Inspect all equipment before unpacking for visible signs of damage or loss. Check shipping list against material received to ensure shipment is complete. **IMPORTANT:** Remember, you, the consignee, must make any claim necessary against the transportation company. Shipping damage or missing parts, when discovered at the outset, will prevent later unnecessary and costly delays. If damage or loss during transport is evident, make claim to carrier, as this will be their responsibility, not that of the manufacturer. Should carton be damaged, but damage to equipment is not obvious, a claim should be filed for "concealed damage" with the carrier.

IMPORTANT: Check the electrical ratings on the unit to make sure they correspond to those ordered and to electrical power available at the job site. Save all shipping papers, tags, and instruction sheets for reference by installer and owner.

Handling, Placement and Installation

IMPORTANT: When selecting a location for the condensing unit, consideration should be given to the following:

- (a) Loading capacity of the floor or roof. Check building codes for weight distribution requirements.
- (b) Distance to suitable electrical supply.
- (c) Distance to the evaporator.
- (d) Adequate air circulation and ventilation.
- (e) Close proximity to water source and floor drains (water-cooled units)
- (f) Accessibility for maintenance.
- (g) Local building codes.
- (h) Adjacent buildings relative to noise levels.
- (i) Wishes of the end user / owner.

When all of the above points have been considered and a specific location has been chosen, it is advisable to obtain written approval of this location from the building and/or condensing unit owner. This may be a means of avoiding disagreement and expense at a later date.

A fully qualified and properly equipped crew with the necessary tackle and rigging should be engaged to locate the condensing unit in position. When lifting the unit, spreader bars and chafing gear should be used to prevent damage.

The unit should be placed on a base, which is level and even. Units should be lagged to sleepers or support base. Place unit where it will not be subject to damage by traffic or flooding. On critical installations where noise is liable to be transmitted through the floor structure, vibration isolators should be installed. Isolators should be installed under mounting base and may be rubber or cork or equal.

DO NOT USE THE SHIPPING SKID AS A PERMANENT BASE.

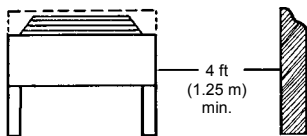
The condensing unit should be positioned to allow adequate space for performing service work.

SPECIAL NOTE FOR LARGE AIR COOLED CONDENSING UNITS: Vertical flow air cooled condensing units are large and heavy pieces of mechanical equipment and must be handled as such. A fully qualified and properly equipped crew with the necessary tackle and rigging should be engaged to locate the condensing unit into location. The unit can be lifted by means of lifting holes located in the base frame of the unit. Spreader bars should be used to prevent damage to the sides of the unit. Do not sling directly around the base of unit. The unit should be placed on a base which is level and even.

Air Cooled Condensing Unit Minimum Clearance (For Vertical Air Flow Units)

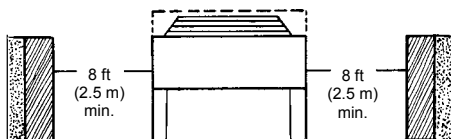
WALLS OR OBSTRUCTIONS

All sides of the unit must be a minimum of 4 feet (1.25 m) away from the wall or obstruction. Overhead obstructions are not permitted. If enclosed by three walls, the unit must be installed as indicated for units in a pit.



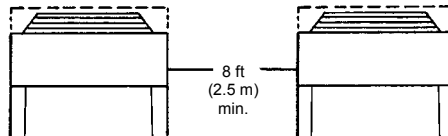
UNITS IN PITS:

The top of the unit must be level with, or above the top of the pit. In addition, a minimum of 8 feet (2.5 m) is required between the unit and the pit walls.



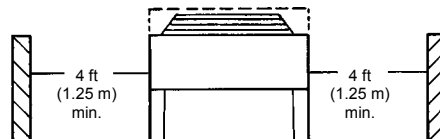
MULTIPLE UNITS

A minimum of 8 feet (2.5 m) is required between multiple units placed side by side. If placed end to end, the minimum distance between units is 4 feet (1.25 m).



LOUVERS / FENCES:

Louvers/fences must have a minimum of 80% free area and 4 feet (1.25 m) minimum clearance between the unit and the louver/fence. Height of louver/fence must not exceed top of unit.



Units equipped with spring-mounted compressors have shipping spacers that are designed to hold the compressor rigidly during transit to prevent possible damage. Before operating the unit, it is necessary to remove these spacers. To remove the shipping spacers, follow these steps:

- (a) Remove the upper nuts / washers.
- (b) Discard the shipping spacers.
- (c) Install the rubber cone washers (located in the electrical box).
- (d) Replace the upper mounting nuts / washers.
- (e) Allow 1/16 inch space between the mounting nuts / washers and the compressor foot.

On units equipped with rigid mounted compressors, check the compressor mounting bolts to insure they have not vibrated loose during shipping.

Electrical Information

WARNING

All wiring and connections to the unit must be made in accordance with national as well as local electrical codes and by-laws.

Electrical wiring should be sized in accordance with the minimum circuit ampacities shown on the unit nameplate and applicable electrical codes. The unit power connections are approved for copper wire only.

Connect the field power supply through a fused branch circuit disconnect switch. The entering service fuse must not exceed the maximum overcurrent protection (MOP) value on the unit data plate.

Field connected control circuit wires are terminated directly at the control circuit terminal block in accordance with the appropriate wiring diagram.

Voltage at the unit terminals must not vary more than the allowable variation during start-up and while under full load. If the voltage is normal at the supply with the compressor not running and drops considerably when the switch is closed and the motor is trying to start, there is a high resistance due to undersized wires or faulty connections. Voltage drop between inoperative and full load must not exceed 3% of line voltage. In addition, the phase imbalance at the motor terminals should be within 2% on three phase units.

Power	60 Hz Supply Allowable Variation	Power	50 Hz Supply Allowable Variation
115-1-60	103-127 V	100-1-50	90-110 V
208/230-1-60	197-254 V	200/220-1-50	190-242 V
208/230-3-60	187-254 V	200/220-3-50	180-242 V
460-3-60	414-506 V	380/400-3-50	342-440 V
575-3-60	518-632 V		

All systems should use a liquid line solenoid valve and should be energized by the room or fixture thermostat.

WARNING

Any deviation or change to the electrical components or wiring as supplied on the original equipment, or noncompliance with the voltage and phase balance requirements without written authorization will void the warranty.

Refrigerant Piping

WARNING

All local codes must be observed in the installation of refrigerant piping.

IMPORTANT PIPING NOTE

Appropriate line sizing practices must be used throughout the installation of the refrigeration system. Special consideration must be taken when the condensing unit is installed above the evaporator. **REFRIGERATION GRADE COPPER TUBING MUST BE USED FOR PIPING SYSTEMS.**

Piping practice and line sizing charts as recommended by A.S.H.R.A.E. or other reputable refrigeration standards must be followed to ensure minimum pressure drop and correct oil return. An inert gas such as dry nitrogen should be passed through the piping during welding or brazing operations. This reduces or eliminates oxidation of the copper and formation of scale inside the piping. For specific piping requirements refer to your local distributor or sales representative.

Correct line sizing is most critical because of the several factors involved:

- (a) Minimum pressure drop to ensure efficient compressor performance.
- (b) Sufficient gas velocity to maintain proper oil return to the compressor under all load conditions.
- (c) Elimination of conditions on multiple evaporators whereby oil may log in an idle evaporator.

Suction lines should be sized on the basis of a maximum total pressure drop equivalent to a 2°F (1.1°C) change in saturated temperature. At 40°F (4.4°C) suction temperature, this is approximately 3 psig (20.7 kPa) for R-22 and R-407C.

Horizontal liquid lines should be sized on a basis of a maximum pressure drop equivalent to a 2°F (1.1°C) drop in the sub-cooling temperature. If the lines must travel up vertically then adequate sub-cooling must be provided to overcome the vertical liquid head pressures. A head of two feet of liquid refrigerant is approximately equivalent to 1 psig (6.9 kPa). Liquid line velocities should not exceed 300 fpm (1.52 m/s). This will prevent possible liquid hammering when the solenoid valve closes.

Pressure Loss of Liquid Refrigerant in Liquid Line Risers

(Expressed in Pressure Drop PSIG and Subcooling Loss °F)

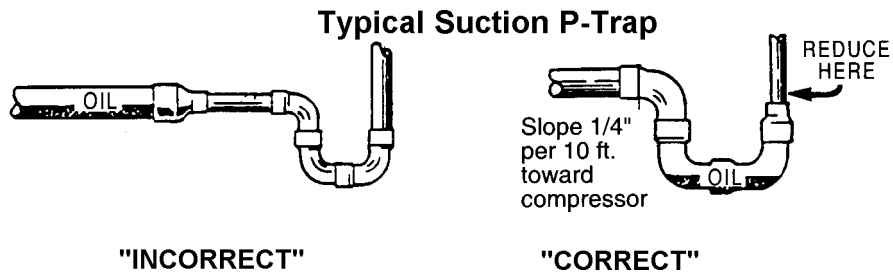
Refrigerant	Liquid Line Rise in Feet									
	10'		15'		20'		25'		30'	
	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F
R-407C	4	1.6	7.3	2	9	3.1	12.1	3.8	14.5	4.7
-										
Refrigerant	-									
	40'		50'		75'		100'			
	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F		
R-407C										
R-407C	19.4	6.2	24.2	8.0	36.3	12.1	48.4	16.5		
N/A										

Based on 110 °F liquid temperature at bottom of riser.

At the temperatures encountered in the condenser, receiver and liquid line a certain amount of oil is always being circulated with the refrigerant through the system by the compressor. However, at the evaporator temperature, and with the refrigerant in a vapor state, the oil and refrigerant separate. This oil can only be returned to the compressor by gravity or by entrainment in the suction gas. Roof installations leave no alternative but by entrainment for oil return, so suction gas velocity and correct line sizing to maintain this velocity are imperative. Care must be taken not to oversize the suction line in the desire for maximum performance.

Gas velocity in vertical suction lines must not be less than 1,000 fpm (5 m/s) and preferably 1,250 to 1,500 fpm (6 to 8 m/s).

Important: A suction trap must be installed at the base of all suction risers of four (4) feet or more in order to trap oil and allow entrainment in the suction gas.



LOW AMBIENT CONTROL OPTIONS:

A) FAN SPEED CONTROL (Low ambient control up to -200 F) The Fan speed control provides an infinite number of speed variation(s) on specially designed permanent split-capacitor motor(s). Controller varies the quantity of air passing through the air-cooled condenser by directly sensing the refrigerant pressure. Fan speed control provides air delivery in direct proportion to heat rejection requirements of the system. This is to maintain optimum system capacities and pressures in widely varying operating ambient(s). As ambient temperature drops, the refrigerant pressure will also drop. As the ref. pressure drops, this will be sensed by the pressure transducer and the air quantity will be reduced by reducing the motor (fan) speed. Fan Speed Controller Refrigerant Connection: The fan speed control requires that the capillary be connected to the hot gas header through the shraeder fitting provided.

Also, for multi-fan unites) there are thermostats for each condenser fan motor with the exception of the control motor (variable-speed). The thermostats should be set in accordance with wiring diagram provided with the unit.

B) HEAD PRESSURE CONTROL VALVE (Low ambient control below -200 F)

This type of low ambient control includes head pressure control valve(s) and the receiver(s) package. The receiver(s) are installed in separate enclosure(s). The enclosure(s) are shipped loose for field installation at the condenser. The head pressure control valve(s) are installed on the condenser or shipped separately for field installation on the air-cooled condenser. Upon receipt of these items should be checked against the packing list and stored inside the building until they are ready to be installed.

Operation: During periods of low ambient temperatures the condensing temperature falls until it approaches the setting of the head pressure control valve, which throttles towards a closed setting, thus restricting the flow of the liquid from the condenser. This causes the refrigerant to back up in the condenser and reduces the effective condenser surface. The check valve opens after the head pressure control has offered enough restriction and then causes the differential between the condensing pressure and the receiver pressure to exceed 20 psig. The hot gas flowing through the check valve serves to heat the cold liquid being passed by the limitizer valve. Thus, the liquid reaches the receiver warm and with sufficient pressure to assure proper expansion valve operation. The check valve and limitizer valve modulate the flow automatically to maintain proper condensing pressures.

Installation of Head Pressure Control Valve: There is one head pressure control valve on each of the limitizer system. These control valves, or limitizer valves as they are called, can be installed in a horizontal or a vertical line, whichever application permits easy adjustment and accessibility to either valve. Care should be taken to install the valves with the flow in the proper direction. It is

important that head pressure control valve be protected by wrapping the valve with a wet cloth to keep the body of valve at a temperature below 2500 F. It is important to keep the flame away from the valve body, to insure that nobody damage is done to the valve. The valve should not be subjected to pressure in excess of 250 psig during the leak testing procedure. The limitizer valves are factory set to maintain 180 psig. The Head Pressure Control Valves are hermetically sealed therefore, when a valve comes inoperative, it must be replaced. There are two types of malfunctions that may occur. (I) Failure to open or (II) failure to close. If particles of solder are in the system, they can restrict the orifice of the valve and cause the valve to malfunction. If this occurs, gently tap the valve, this will possibly allow the particles to flow through the valve. Since a synthetic material is used in the construction of the valve, damage to this will cause hot gas to leak constantly. If this occurs, the valve must be replaced.

Liquid Receiver(s) Installation: Liquid receiver(s) are factory installed in the separate enclosure(s). These enclosure(s) need to be field installed on side(s) of the air-cooled condenser. Also, the liquid receiver(s) need to be field piped. Install a Refrigerant Sight Glass (By Others immediately after the Liquid Receiver Outlet. Only the sight glass at the receiver outlet should be used to determine if the additional refrigerant must be added.

Liquid Receiver(s) are wrapped with the Self Regulating Heating Cable and insulated. Provide 240Vac Power Supply to the Heating Cable as shown in the wiring diagram.

System Accessories

In order to ensure trouble free operation of the refrigeration system it is important that the following system accessories be reviewed and installed.

- (a) A **LIQUID LINE SOLENOID VALVE** must be installed at the evaporator. Installing a solenoid valve will allow all of the refrigerant to be pumped out of the low side (evaporator and suction line) when the thermostat has been satisfied. This reduces the risk of refrigerant migrating or flooding back to the compressor. Locating the solenoid at the evaporator (instead of the condensing unit) will minimize the pump-down time and refrigerant capacity required by the receiver.
- (b) A **SUCTION LINE FILTER** (sealed or replaceable core) when used are always installed upstream of the compressor suction service valve and any accumulators or other options that may be installed. Suction filters are equipped with "Schrader" type access valves that allow plugged filters and elements to be identified quickly when the pressure drops get too high. Refer to the specific manufacturer's recommendation for servicing.
- (c) A **SUCTION TO LIQUID HEAT EXCHANGER** should be used if a system requires long liquid lines from the receiver to the evaporator or if the liquid has to rise vertically upward any distance. It can help prevent excessive frosting on the compressor body and increase superheat in the suction line reducing the possibility of liquid refrigerant from returning to the compressor.
- (d) A **PHASE / VOLTAGE MONITOR** protects the system against phase loss (single phasing), phase reversal (improper sequence), high voltage and low voltage (brownouts).

Leak Testing

IMPORTANT: All system piping, including the condensing unit and accessories should be thoroughly tested for leaks prior to start up and charging. The system should be initially pressurized to a maximum of 150 psig (1136 kPa) with dry nitrogen to ensure that the system is free of major leaks. With the system free of major leaks, a more detailed leak check should be performed. Discharge the initial dry nitrogen charge and add enough refrigerant to raise the system pressure up to 10 psig (170 kPa) (tracer amount). Add dry nitrogen to increase the system pressure to a maximum of 150 psig (1136 kPa). It is recommended that an electronic leak detector be used when checking for leaks because of its greater sensitivity to small leaks. As a further check it is recommended that this pressure be held for a minimum of 12 hours and then rechecked. The system must be leak free for satisfactory operation.

IMPORTANT ENVIRONMENTAL NOTE

When conventional leak detection methods are employed using HCFC or CFC tracer gas, all of the tracer gas must be reclaimed and disposed of in a proper manner.

Evacuation and Dehydration

When the system is completely free of refrigerant leaks, an evacuation of the entire system should be completed by using a "high vacuum" pump. This evacuation, if completed correctly, will ensure long life for the system as well as elimination of moisture and non-condensable gas problems. **Moisture problems causing compressor failure will void warranty. Follow the recommended procedure carefully.**

CAUTION

Do not use the refrigeration compressor to evacuate the system. Never start the compressor or perform a megger insulation test while the system is in a vacuum.

Dehydration Procedure

Use only a "high vacuum" pump capable of drawing a vacuum of 100 microns. Change the vacuum pump oil frequently. Gauges or vacuum measuring instruments should be suitable to measure conditions at any stage of the process in order to give the operator indications of progress. For specific recommendations, refer to the vacuum pump supplier for these instruments.

Copper jumper lines should be used to interconnect both high and low-pressure sides of the system. These lines should be at least 3/8" O.D. in order to handle the light density vapor at high vacuum obtained at completion of operation. Lines smaller than 3/8" O.D. will slow down the process considerably as well as making final system vacuum questionable. The entire system temperature should be over 60 °F (16 °C) for evacuation to be effective. If the temperature is less than 60 °F (16 °C) the final vacuum should be 50 microns. Double evacuation with a "sweeping" of dry nitrogen is recommended. First evacuation should be to at least 750-micron depth. When this point is reached, break the vacuum with refrigerant or dry nitrogen to melt any moisture, which may have frozen during the first vacuum stage.

IMPORTANT ENVIRONMENTAL NOTE

When conventional leak detection methods are employed using HCFC or CFC tracer gas, all of the tracer gas must be reclaimed and disposed of in the proper manner.

Reclaim any tracer gas from the system and re-evacuate to a final vacuum of at least 100 microns at a minimum 60 °F (16 °C) system temperature. With this degree of evacuation, all moisture and non-condensables will be removed from the entire system.

Line Insulation

After the final system leak test is complete, it is important that all refrigerant lines exposed to high ambient conditions must be insulated to reduce the heat pick-up and prevent the formation of flash gas in the liquid lines. Suction lines should be insulated with 3/4 inch wall insulation, Armstrong "Armaflex" or equal. To prevent rupture due to condensate re-freezing, all suction vibration eliminators on low temperature systems **must be completely insulated**. Liquid lines exposed to high ambient temperatures should be insulated with 1/2 inch wall insulation or better. Any insulation that is to be located in an outdoor environment should be protected from UV exposure to prevent deterioration of the insulating value.

Refrigerant Charging

Condensing units must be charged only with the refrigerant for which they were designed. The type of refrigerant to be used is specified on the name plate of the unit. Installing a liquid line drier between the service gauge and the liquid service port when charging a unit will ensure the refrigerant supplied to the system is clean and dry. This is especially important when charging a low temperature system. Blend type refrigerants (400 series, i.e. R404A) **must not be vapor charged** unless the cylinder is completely emptied into the system.

Weigh the refrigerant drum before and after charging in order to keep an accurate record of the weight of refrigerant put into the system.

IMPORTANT REFRIGERANT CHARGING NOTE

Overcharging a system can result in poor system performance, personal injury and / or compressor damage. **DO NOT** charge strictly by the holding capacity of the receiver. **DO NOT** assume that bubbles in a sight glass, when located at the condensing unit, indicates the system is undercharged.

Note: *To estimate the total system requirement, refer to the manufacturer's evaporator and condensing unit specifications on typical operating charges and include the amount for the liquid lines (see tables below). Allow an extra 10% to 15% safety factor. Ensure the receiver can handle the required charge during the pump down mode. (Refer to the condensing unit brochure pump down specifications).*

Break the vacuum by charging liquid refrigerant into the receiver side only (charge through the receiver outlet valve gauge port with the valve in the open position). Close the valve and then continue to charge through the gauge port feeding the liquid line and evaporator. Start the compressor and continue to charge.

Refrigerant may be added at the compressor through the compressor suction service valve **in gas form only**. When liquid charging is used, a liquid charging valve must be installed. While charging the system, special attention should be paid to the oil level in the compressor.

If charging to the "bubble" method (observing liquid line sight glass), always use a sight glass located directly before the TXV (thermostatic expansion valve) for the final indicator.

On units that use an adjustable flooded condenser pressure-regulating valve the proper adjustment must be set. Sporlan set their controls at 120 psig (929 kPa). These controls should be re-adjusted to the following pressures:

185 psig (1377 kPa) for R-22/R-407C (2 1/2 turns in clockwise for ORI-6, 4 turns in for ORI-10)
Refer to Sporlan's installation instructions for further details.

System Start-up Check List

IMPORTANT START-UP NOTE

Only a qualified refrigeration mechanic who is familiar with compressor performance and the function and adjustment of all controls and components should start up the compressor. Finishing up work on the installations should be planned so that a qualified mechanic is on the job for at least the first full day that the unit is in operation.

Before any refrigeration system is started, the following items should be checked:

- (1) Check that all electrical and refrigeration connections are tight.
- (2) Check compressor crankcase oil level (if equipped with sight glass). It should be from 1/8 to 1/2 full in the sight glass.
- (3) Insure that compressor shipping spacers (spring mounted compressors) or hold down nut (solid mounted compressors) are properly in place.
- (4) Check that the compressor discharge and suction shut-off valves are open.
- (5) Ensure that the high and low pressure controls (see table below) pressure regulating valves, oil pressure safety controls and any other safety controls are adjusted properly.
- (6) Check that the room thermostat or microprocessor is set for normal operation and adjust if required.
- (7) Check all motors, fans and pump bearings in the condenser and evaporator. If they are the type that require oil or grease, make sure that this is attended to in accordance with the tag, which will be attached. Fan blades and pumps should be checked for correct rotation, tightness and alignment. Air should draw air through the condenser (air cooled condensing unit models).
- (8) Electric and hot gas evaporator fan motors should be temporarily wired for continuous operation until the room temperature has stabilized.
- (9) Observe the system pressures during the charging and initial operation process. **DO NOT** add oil while the system is low on refrigerant charge unless the oil level is dangerously low.
- (10) Continue to charge the system until it has enough charge for proper operation. **DO NOT OVERCHARGE THE SYSTEM.** Note that bubbles in the sight glass may not necessarily mean a shortage of refrigerant. It could be caused by a restriction.
- (11) **DO NOT** leave the system unattended until the system has reached its normal operating condition and the oil charge has properly adjusted itself to maintain the proper level in the sight glass.
- (12) Compressor performance, and that of all of the moving components, should be watched carefully throughout the first operating cycle and then checked periodically during the first day of operation. **Careful attention to details at this time will pay dividends in trouble-free performance of the entire system.**
- (13) Check that the wiring diagrams, instructions bulletins etc. are read and attached to the unit for future reference. Ensure that the Warranty Activation Certificate is filled in and either faxed or mailed back to the number or address provided.

CAUTION

Extreme care must be used when starting a compressor for the first time after the system has been charged. During this time liquid refrigerant may have migrated to the compressor crankcase, creating a condition that could cause the compressor damage due to slugging. Energizing a crankcase heater (if so equipped) 24 hours prior to start-up is recommended. If the compressor is not equipped with a crankcase heater, directing a 500 watt heat lamp or other safe heat source on the lower shell or crankcase of the compressor for approximately thirty minutes is recommended.

WARNING

Three phase scroll compressors must be checked for correct rotation. During the initial start up, observe the suction and discharge gauges to ensure the suction pressure drops and the discharge pressure rises.

Checking Superheat

IMPORTANT SYSTEM BALANCING NOTE

To obtain maximum system capacity and insure trouble free operation it is necessary to check both the compressor and evaporator superheat.

Compressor Superheat

Compressor suction superheat must be checked. To check the superheat at the compressor the following steps should be followed:

- (1) Measure the suction pressure at the suction service valve of the compressor. Determine the saturated temperature corresponding to this pressure from a "Pressure- Temperature" chart.
- (2) Measure the suction temperature of the suction line about 6 inches (15 cm) back from the compressor suction valve using an accurate thermometer.
- (3) Subtract the saturated temperature (from step 1) from the actual suction line temperature (from step 2). This difference is the **actual superheat at the compressor**.

System capacity decreases as the suction superheat increases. For maximum system capacity, the suction superheat should be kept as low as is practical. The superheat at the compressor should range within 20 to 45 °F (11.2 to 25.2 °C) Superheat.

NOTE: Too low of a suction superheat can result in liquid being returned to the compressor. This can cause dilution of the oil and eventually cause failure of the bearings and rings through wash out as well as liquid slugging.

NOTE: Too high of a suction superheat will cause excessive discharge temperatures which cause a break down of the oil and will result in piston ring wear, piston and cylinder wall damage.

If adjustment to the suction superheat is required, it should be done either by adjusting the thermostatic expansion valve at the evaporator, the use of liquid to suction heat exchanger or suitable use of suction line insulation.

Evaporator Superheat

Once the refrigerated space is at its design temperature or close to design temperature, the evaporator superheat must be checked. To check the suction superheat at the evaporator the following steps should be followed:

- (1) Measure the suction pressure in the suction line at the bulb location by either,
 - (a) A gauge in the external equalizer line will indicate the pressure directly and accurately.
 - (b) A gauge directly in the suction line near the evaporator or directly in the suction header will suffice.
- (2) Measure the temperature of the suction line at the point where the thermostatic expansion valve bulb is clamped to the suction line.
- (3) Convert the pressure obtained in step 1 above to a saturated evaporator temperature from a "Pressure-Temperature" chart.
- (4) Subtract the saturated temperature (from step 1) from the actual suction line temperature (from step 2). This difference is the **actual superheat at the evaporator**.

The superheat at the evaporator should be a minimum of 6 to 10 °F (3.4 to 5.6 °C) for systems with a 10 °F (5.6 °C) design TD (temperature difference) to a maximum of 12 to 15 °F (6.7 to 8.4 °C) for systems with a higher operating TD.

Low temperature applications (freezers) should be set at superheats of 4 to 6 °F (2.2 to 3.4 °C).

TD = Box temperature – evaporating temperature.

System Operational Check List

When the system has been running trouble free for an extended time (two weeks or more) and design conditions are satisfied, the following check list should be followed:

- (1) Check that compressor **discharge and suction pressures** are operating within the allowable design limits for the compressor. If not, take the necessary corrective action.
- (2) Check the liquid line sight glass and expansion valve operation. If there is an indication that the system is low on refrigerant, thoroughly **check the system for leaks before adding refrigerant**.
- (3) Check the **level of the oil** in the compressor sight glass (if so equipped). Add oil as necessary.
- (4) The thermostatic expansion valve must be checked for **proper superheat settings**. The sensing bulb must have positive contact with the suction line and should be insulated. Valves operating at a high superheat setting results in low refrigeration capacity. Low superheat settings can cause liquid slugging and compressor bearing washout. (Refer to the section on compressor and evaporator superheats)
- (5) Check the **voltage and amperage** readings at the compressor terminals. Voltage reading must be within the recommended guidelines. Normal operating amperages can be much lower than the compressor nameplate values.
- (6) To check the **high pressure control setting** it is necessary to build up the head pressure to the cut-out point of the control. This can be done by stopping the condenser fan(s) (air cooled condensing units) or pump and watching the pressure rise on a high pressure gauge to make sure the high pressure control is operating at the setting.
- (7) Check the **low pressure settings** by throttling the compressor shut-off valve and allowing the compressor to pump down. This operation must be done with extreme caution to avoid too sudden a reduction in crankcase pressure, which will cause oil slugging and possible damage to the compressor valves. Close the valve a turn at a time while watching the compound gauge for change and allowing time for the crankcase pressure to equalize with the pressure control bellows pressure. The slower the pressure is reduced, the more accurate will be the check on the pressure control setting.
- (8) Recheck all **safety and operating controls** for proper operation and adjust as necessary.
- (9) Check **defrost controls for initiation and termination settings**, and the length of defrost period. Set the fail safe on the time clock at the length of defrost plus 25 %.
- (10) If the system is equipped with winter head pressure controls (fan cycling or flooded valves), **check for operation**.
- (11) Fill in the **Service Log** in the back of this Installation Manual.

System Troubleshooting

The following System Troubleshooting Guide lists the most common types of malfunctions encountered with refrigeration systems. These simple troubleshooting techniques can save time and money minimizing unnecessary downtime and end-user dissatisfaction.

Contact the factory or your local sales representative for further information or assistance.

System Troubleshooting Guide	
Condensing Unit Problem	Possible Causes
Compressor will not run. Does not try to start.	<ol style="list-style-type: none"> 1. Main power switch open. 2. Fuse blown or tripped circuit breaker. 3. Thermal overloads tripped. 4. Defective contactor or coil. 5. System shut down by safety devices. 6. Open thermostat or control. No cooling required. 7. Liquid line solenoid will not open. 8. Loose wiring.
Compressor hums, but will not start.	<ol style="list-style-type: none"> 1. Improperly wired. 2. Low line voltage. 3. Loose wiring. 4. Defective start or run capacitor. 5. Defective start relay. 6. Motor windings damaged. 7. Internal compressor mechanical damage.
Compressor starts, but trips on overload protector.	<ol style="list-style-type: none"> 1. Improperly wired. 2. Low line voltage. 3. Loose wiring. 4. Defective start or run capacitor. 5. Defective start relay. 6. Excessive suction or discharge pressure. 7. Tight bearings or mechanical damage in compressor. 8. Defective overload protector. 9. Motor windings damaged. 10. Overcharged system. 11. Shortage of refrigerant. 12. Suction or discharge pressure too high. 13. Inadequate ventilation. 14. Operating system beyond design conditions.
Compressor short cycles.	<ol style="list-style-type: none"> 1. Low pressure control differential set too low. 2. Shortage of refrigerant. 3. Low airflow at evaporator(s). 4. Discharge pressure too high. 5. Compressor internal discharge valves leaking. 6. Incorrect unit selection (oversized).
Start relay burns out.	<ol style="list-style-type: none"> 1. Improperly wired. 2. Low or high line voltage. 3. Short cycling. 4. Improper mounting of relay. 5. Incorrect start or run capacitor. 6. Incorrect relay.
Contact welded stuck on start relay	<ol style="list-style-type: none"> 1. Short cycling. 2. No bleed resistor on start capacitor.
Start capacitor burns out	<ol style="list-style-type: none"> 1. Improperly wired. 2. Short cycling. 3. Low line voltage. 4. Relay contacts sticking. 5. Incorrect capacitor. 6. Start winding remaining in circuit for prolonged period.

Condensing Unit Problem	Possible Causes
Compressor noisy or vibrating.	<ol style="list-style-type: none"> 1. Flood back of refrigerant. 2. Improper piping support on the suction or discharge lines. 3. Broken or worn internal compressor parts. 4. Incorrect oil level. 5. Scroll compressor rotating in reverse (three phase). 6. Improper mounting on unit base.
Discharge pressure too high.	<ol style="list-style-type: none"> 1. Non-condensables in the system. 2. System overcharged with refrigerant. 3. Discharge service valve partially closed. 4. Condenser fan not running. 5. Dirty condenser coil.(air-cooled condensers) 6. Dirty tubes. .(water-cooled condensers) 7. Defective or improperly set water regulating valve. (water-cooled condensers) 8. Defective or improperly set flooded head pressure control.
Discharge pressure too low.	<ol style="list-style-type: none"> 1. Low suction pressure. 2. Cold ambient air. 3. Suction service valve partially closed. 4. Shortage of refrigerant. 5. Defective or improperly set water regulating valve. (water-cooled condensers) 6. Defective or improperly set flooded head pressure control.
Suction pressure too high.	<ol style="list-style-type: none"> 1. Excessive load. 2. Compressor internal valves broken. 3. Incorrect unit selection (undersized). 4. Improper TXV bulb charge.
Suction pressure too low.	<ol style="list-style-type: none"> 1. Shortage of refrigerant. 2. Evaporator dirty or iced up. 3. Clogged liquid line filter drier. 4. Clogged suction line filter or compressor suction strainers. 5. Expansion valve malfunctioning. 6. Condensing temperature too low. 7. Improper TX valve selection. 8. Evaporator distributor feed problems.
Low or no oil pressure.	<ol style="list-style-type: none"> 1. Low oil level. (trapped oil in evaporator or suction line) 2. Clogged suction oil strainer. 3. Excessive liquid refrigerant in the crankcase. 4. Worn oil pump. 5. Oil pump reversing gear sticking in the wrong position. 6. Worn bearings. 7. Loose fitting on oil line. 8. Pump housing gasket leaking.
Compressor loses oil.	<ol style="list-style-type: none"> 1. Refrigerant leak. 2. Short cycling. 3. Excessive compressor ring blowby. 4. Refrigerant flood back. 5. Improper piping or traps. 6. Trapped oil in evaporator.
Compressor runs continuously	<ol style="list-style-type: none"> 1. Excessive load. 2. Too low of a system thermostat setting or defective thermostat. 3. Shortage of refrigerant. 4. Leaking compressor internal valves. 5. Malfunctioning liquid line solenoid. 6. Incorrect unit selection (undersized).

System Troubleshooting Guide

Fixture Problem	Possible Causes
Room temperature too high.	<ol style="list-style-type: none"> 1. Defective room thermostat or improper differential / setting. 2. Malfunctioning liquid line solenoid valve. 3. Insufficient air across evaporator coil (iced up coil, product blocking evaporator, fan blade / motor problem). 4. Improper evaporator superheat (low refrigerant charge, plugged TXV strainer, poor TXV bulb contact, incorrect TXV setting). 5. Malfunctioning condensing unit.
Room temperature too low.	<ol style="list-style-type: none"> 1. Defective room thermostat or improper differential / setting. 2. Malfunctioning liquid line solenoid valve.
Ice accumulating on ceiling.	<ol style="list-style-type: none"> 1. Defrost on too long (improper setting / defective termination thermostat, improper setting / defective time clock). 2. Too many defrosts per day. 3. Fans not delayed after defrost (improper setting / defective fan delay thermostat).
Evaporator coil not clear of ice after defrost.	<ol style="list-style-type: none"> 1. Defrost on too short (improper setting / defective termination thermostat, improper setting / defective time clock). 2. Electric heaters defective / miswired / low voltage. 3. Not enough defrosts per day. 4. Air defrost evaporator operating at too low of temperature (require electric defrost). 5. Defective / miswired interlock at compressor contactor. 6. Defective defrost contactor or coil.
Ice building up in drain pan.	<ol style="list-style-type: none"> 1. Improper slope in pan. 2. Blocked drain line (unheated , not insulated). 3. Electric heater in drain pan defective / miswired / low voltage). 4. Not enough defrosts per day. 5. Lack of or improper P-trap in drain line.
Evaporator fans will not operate.	<ol style="list-style-type: none"> 1. Main power switch open. 2. Fuse blown or tripped circuit breaker. 3. Defective contactor or coil. 4. Room temperature too high (fan delay thermostat open). 5. Fan delay thermostat improper setting / defective. 6. Defective fan motor (low voltage / tripped on thermal overload). 7. Defective time clock. 8. Normal mode during defrost cycle (electric defrost type evaporator).

IMPORTANT TROUBLESHOOTING NOTE

Before any components are changed on the refrigeration system, the cause of the failure must be identified. Further problems will exist unless the true cause or problem is identified and corrected.

Customer Instructions

Completely fill in Warranty Activation Certificate **located inside of the back cover** of this Installation and Maintenance Manual. The top (white) copy should be faxed or mailed per the instructions on this form. The (pink) copy is for the installing contractor's files and the (yellow) copy is to be left attached inside of the Installation and Maintenance Manual for the owner / end user's future reference.

Give the owner / end user instructions on normal operation of the system. Explain electrical characteristics, location of disconnect switches as well as other safety precautions. Advise on keeping equipment area clean and free of debris. If system has operational features, point these out to the operator.

Maintenance Program

In order to ensure that the refrigeration system runs trouble free for many years, a follow-up maintenance program (consisting of a minimum of two inspections per year) should be set up. A qualified refrigeration service mechanic should carry out this semi-annual inspection. The main power supply **must be disconnected and locked off** to avoid accidental start up of the equipment.

- (1) Check electrical components and tighten any loose connections.
- (2) Check all wiring and electrical insulators.
- (3) Check contactors to ensure proper operation and contact point for wear.
- (4) Check that fan motors (if applicable) are operational, ensure fan blades are tight and all mounting bolts are tight.
- (5) Check oil and refrigerant levels in the system.
- (6) Ensure that the condenser surface (if applicable) is cleaned and free of dirt and debris.
- (7) Check the operation of the control system. Make certain that all of the safety controls are operational and functioning properly.
- (8) Check all refrigeration piping. Make sure that all mechanical joints and flare nuts are tight.

Service Parts Availability

Genuine replacement service parts should be used whenever possible. Parts may be obtained by contacting your local sales representative or authorized distributor. Contact us 562.945.8971

WARRANTY

General Warranty Policy

We warranty this Compu-Aire, Inc. computer room unit to be free from defects in material and workmanship; our obligation being limited to repairing or replacing at our factory any part (except as noted below) within one year from the date of shipment to the original purchaser. Parts to be returned to us PREPAID. Proof of start-up date must be submitted to the factory.

This warranty is effective only if the unit has been installed in accordance with our instructions and connected to proper and adequate electric, water and drain services, correctly dehydrated and placed into operation by a competent service representative.

Fan motor and compressor warranty is covered by original manufacturer's warranty and any repair or replacement should be made by the local authorized service facility as listed the telephone book.

Maintenance and service such as replacing filters, humidifier cylinder, infra-red lamps, float valve assemblies, belts, cleaning, lubrication, calibration and adjusting are NOT INCLUDED in this warranty.

Replacement or repair parts shall be shipped from the factory pre-paid and invoiced for the full amount. Upon receipt of warranted parts within 30 days with prepayment of the component and which our inspection discloses the parts are defective, and show no signs of misuse, alterations, or abuse, full credit will be issued.

Compu-Aire, Inc. does not assume any responsibility for the labor expense for changing defective parts or replacement of any refrigerant or other cooling medium such as glycol etc.

All parts and goods are thoroughly inspected and packed to meet the requirements of railroad freight classifications bureaus, and under standard shippers risk, when they leave our factory. SHOULD GOODS ARRIVE DAMAGED, call the agents attention to damage, and have same noted on freight bill. For concealed damage, demand immediate inspection from agent of the shipping company and insist on a notation being made on freight bill.