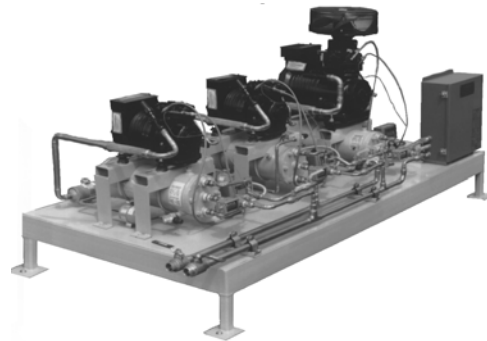
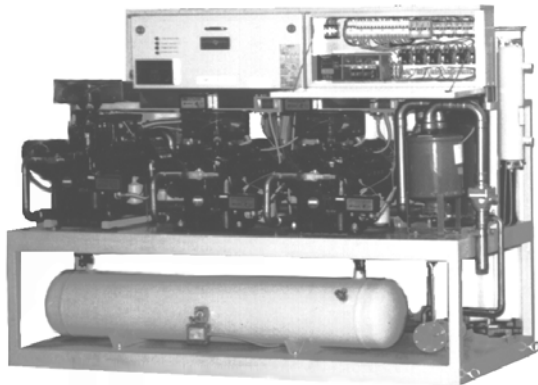
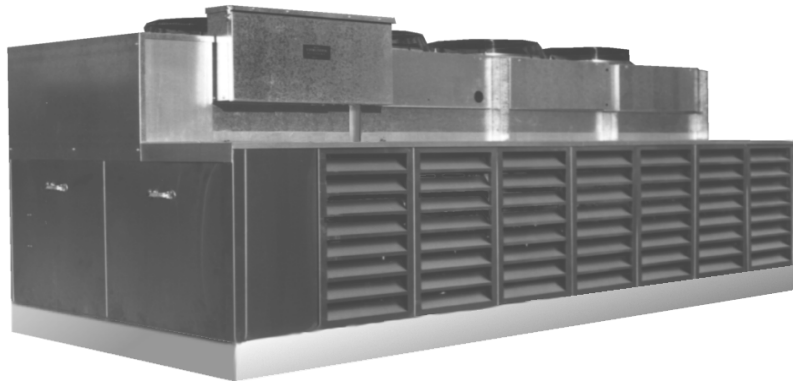
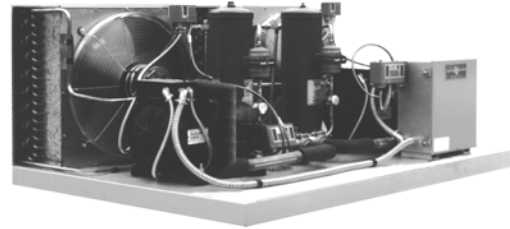
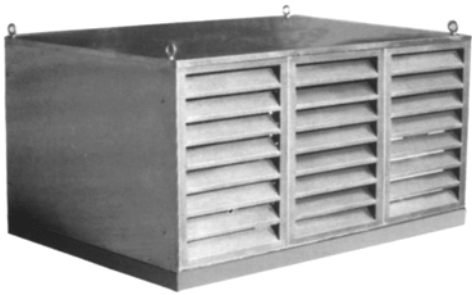




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# OPERATION & MAINTENANCE MANUAL



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## SERVICE MANUAL

A refrigeration condensing unit is a highly sophisticated piece of equipment. It has been designed to give many years of trouble-free operation with a minimum of maintenance. To a great extent, this is directly proportional to the care with which the original installation is performed.

### I. Receiving, Inspection and Setting

Upon receipt of equipment:

- A. Check for shortages and damages. Report any damages or shortages to the delivery carrier.

NOTE:

**Damaged material is the carrier's responsibility and cannot be returned without prior approval.**

- B. Lift condensing unit with pallet jack or fork lift. If rigged, use proper spreader bar to space lifting cable to protect unit from damage.
- C. After the unit has been set:
  - 1) Remove motor compressor mounting nuts.
  - 2) Install rubber grommets supplied on each mounting stud.
  - 3) Re-install mounting nuts making sure that compressor rides freely on its mounting springs.
  - 4) Check that unit is level to insure proper lubrication.

### II. In-Warranty Parts and Procedures

When an in-warranty part replacement is required, notification is to be by letter. A Return Material Tag for the return of the inoperative part must be filled out and attached to the part.

### **III. Compressor Guarantee Policy (Optional)**

#### **FIVE YEAR PROTECTION POLICY PROCEDURE FOR CLAIMS**

To properly process your five-year warranty for condensing units, we must have the following:

- A. Original order on which the units were purchased from RDT, INC.
- B. The condensing unit serial number from which the defective compressor was removed.
- C. Invoice and credit memo containing serial number of replacement compressor.

#### **DEDUCTION FROM PAYMENTS**

If the above is adhered to, there should be no reason why any organization would make deductions from remittances.

### **IV. Recommendations**

- A. Do not remove factory seals until unit is ready to be connected.
- B. Inspect all tubing, valves and fittings to insure cleanliness.
- C. Use refrigerant grade tubing and fittings only.
- D. Evacuate system before charging (see Evacuation Section).
- E. Check for correct electrical supply to condensing unit.  
Check voltage at motor-compressor terminals with unit running at full load and during start-up to insure that it is plus or minus 10% nameplate rating.

### **V. Ventilation**

- A. Ventilation of machine room installation must be designed to protect the condensing unit from both high and low temperatures.
- B. Outdoor mounted condensing units and remote condensers should be installed to insure proper air circulation.

- 1) Vertical flow remote condensers should be high enough off the ground or roof to insure adequate air flow.
- 2) Multi condensing unit/condenser configurations should be laid out so as to prevent the re-circulating air from one condenser to another.

## **VI. Refrigerant**

- A. Use only refrigerant specified on unit.
- B. Do not mix refrigerants in any one system.

## **VII. Electrical**

- A. Check that voltage, phase and frequency of electrical supply meets with the specification indicated on the motor compressor nameplate.
- B. Check the voltage at start-up and during operating conditions must meet nameplate voltage plus or minus 10%; if limits are exceeded, check with power company.

**CAUTION:** Excessive or reduced voltage can result in motor failure.

## **VII. Water Cooled Systems**

- A. Select water pipe sizes, circulating pump and cooling tower capacities to provide adequate water supply to maintain desired condensing temperatures. Capacities are based on a clean water supply of approximately three gallons per minute per ton (12,000 BTU) at a nominal temperature of 80° F.
- B. After cooling system is completed, clean and flush using a solution of water and Tri-Sodium Phosphate or any other commercial detergent. Allow pump to run for several hours. Drain system and clean strainers.

## **IX. Refrigerant Piping**

- A. Use refrigerant grade copper tubing only.
- B. Install permanent suction line filters.
- C. Install P-type oil traps at the base of each suction riser.

- D. Suction line should have a slope of one-half inch for every ten feet of run approaching the condensing unit.
- E. The following should be observed when brazing:
- 1) Use a high temperature silver solder on discharge line connections near compressor. Use a suitable silver solder alloy or 95/5 solder on all other connections.
  - 2) Use a silver solder with a low melting temperature (900° F to 1200° F) when connecting vibration eliminators to avoid internal joint damage, when connecting any dissimilar materials and/or steel hand valves.  
**CAUTION:** Most vibration eliminators are assembled with "Silfos" (melting temperature 1300° F)
  - 3) Avoid excessive use of soldering paste or flux to prevent internal contamination.
  - 4) Insulate all suction lines where condensation can occur.
  - 5) Insulate liquid lines in high ambient temperature areas to prevent formation of flash gas.

## **X. Leak Check**

After all connections are made, perform the following:

- A. Pressure system with dry nitrogen to 175 psig.  
**WARNING:** When pressure testing above 150 psi, remove expansion valve(s) and install temporary bypass.
- B. With an accepted leak detector, check and repair any leaks.
- C. Evacuate system to one PSIA (27.9" Mercury vacuum) or less and seal for twelve hours.
- D. If vacuum decreases, pressurize system again and repair leaks. Evacuate system again for twelve hours.

NOTE: Check all flare nuts for leaks, tighten as required.

- E. Repeat procedure until vacuum holds for twelve hour period.

NOTE: Pressures given are minimum recommended valves. Specified local codes that differ should take precedence.

## **XI. Evacuation**

The following procedure should be repeated three times to remove any moisture scale, dirt, etc.:

- A. Blow out all lines using dry nitrogen or carbon dioxide.

**CAUTION:** Pressure should not exceed 250 psig.

- B. Re-connect all lines and leak test all connections (See Leak Check).
- C. Connect vacuum pump to evacuation valves on condensing unit using copper tubing or high vacuum hose.
- D. Operate pump to a vacuum of 1500 microns (.06 inches of Mercury) absolute.  
NOTE: Use a high vacuum gauge calibrated in microns.
- E. At 1500 microns, introduce dry nitrogen into the system until pressure reads 0 psig.
- F. On third evacuation, reduce pressure to 500 microns (.02 inches of Mercury) absolute. System is now ready to be charged.

## **XII. Check-Out and Start-Up**

After system has been evacuated, perform the following:

- A. Check that all electrical connections are tight.
- B. Check that compressor oil level is slightly above center of sight glass.
- C. Check that compressor mounting grommets are installed, mounting nuts are secure and compressor rides free on mounting springs.
- D. Check high and low pressure controls, water valves, pressure regulating valves, oil pressure safety controls, fixture thermostat, and all other controls. Adjust as necessary.

- E. Check that proper refrigerant is being used.
- F. Check that fixture or coil circulating fans are operating.
- G. Close circuit breaker and place condensing unit in operation.
- H. Charge system with refrigerant.
- I. Continue charging system until bubbles in liquid line sight glass disappear.  
**CAUTION:** Do not over-charge. Bubbles in sight glass can also be due to a restriction.
- J. After system is fully charged, check oil level and adjust as necessary.

### **XIII. Operational Check**

After system has been running for twelve hours, perform the following check-out procedure:

- A. Check compressor head and suction pressures. Correct if necessary.
- B. Check liquid line sight glass. If refrigerant level is low, check and correct any leaks and recharge system.
- C. Check compressor oil level.
- D. Check expansion valves for proper operation.
  - 1) Check that feeler bulbs are in positive contact with suction line.  
**CAUTION:** If super heat setting is too high, it can cause liquid slugging in compressor.
- E. Check line voltage and amperage.
  - 1) Voltage must be within plus or minus 10% of nameplate voltage.
  - 2) On three phase compressors, check each phase for balanced load.
- F. Check all condenser and evaporator fan motors for the following:
  - 1) Proper rotation
  - 2) Secure mounting and proper alignment
  - 3) Proper lubrication (as required)
- G. Check high pressure controls as follows:
  - 1) Connect accurate gauge to monitor head pressure.
  - 2) With condensing units running, stop condenser air flow (stop water flow on

water cooled units).

3) Check that cut-out occurs at proper pressure. Adjust as necessary.

4) High pressure controls cut-out settings are as follows:

| <b>Refrigerant:</b> | <b>R-22</b> | <b>R-404a</b> |
|---------------------|-------------|---------------|
| Air cooled          | 350 psig    | 400 psig      |
| Water cooled        | 300 psig    | 325 psig      |

H. Re-check operation of all safety controls. Adjust as necessary.

I. Check defrost time clock settings per fixture manufacturer's recommendations. Adjust as necessary.

J. Where applicable, check fan cycling or head pressure controls for proper operation.

K. On water cooled systems:

5) Check water valves and adjust as necessary for proper condensing temperature.

6) Check water pumps for proper rotation.

### **RE-STARTING**

A. The following are possible causes for shut down with pump down inoperative:

- 1) Stoppage or overload, oil safety, high head or other lockout device.
- 2) Disconnect switch inadvertently pulled.
- 3) Power failure.
- 4) New installation with charged system.

B. If any of the above result in long off cycle, liquid refrigerant may flood the evaporator or compressor crankcase. It is necessary to carefully clear these components of liquid to prevent damage to the compressors. This can be accomplished by doing the following:

- 1) Close liquid solenoid or receiver outlet valve.
- 2) Stop evaporator fans.
- 3) Reset those controls which may have tripped.
- 4) Operate the compressor in very short bursts, starting with 1 or 2 seconds and gradually increasing these periods until the liquid is cleared out.

**WARNING:** Use compressor on-off switch to accomplish this. Stop the machine instantly if knocking is observed.

- 5) Watch the oil level and suction pressure carefully. Rapid boiling of refrigerant in the crankcase may lower the oil level dangerously. Add oil if necessary. Do not operate continuously at extra low vacuum.
- 6) After liquid refrigerant is boiled off, re-start evaporator fans and re-open liquid solenoids. Attend the system just as you would during initial start-up.

**WARNING:** Do not just turn machines on and walk away.

## **XIV. Maintenance**

### **AIR COOLED CONDENSERS**

- A. Brush and vacuum clean all air-cooled condensers every four to six months to remove all accumulations of dust, dirt, leaves, and other debris. Where air cooled condensers must operate in unusually dusty locations, cleaning should be done as often as conditions dictate.

**WARNING:** Check that main disconnect switch is in the off position before cleaning the condensers.

- B. Lubricate fan motors with a few drops of oil every three to six months.

### **WATER COOLED CONDENSERS**

- A. On open systems, where fresh water is continuously added, clean build up of deposits on a regularly scheduled basis to prevent continuous operation at excessive head pressures.
- B. Remove scaling and liming by flushing the condenser with an inhibited acid type cleaner as directed by the condenser manufacturer.

### **ELECTRICAL AND PIPING CONNECTIONS**

- A. Check all electrical connections periodically to be sure they are tight.
- B. Check refrigerant and water connections (on water cooled units). Whenever it is necessary to add refrigerant, a careful leak check of all refrigerant connections should be made.

## **CRANKCASE LUBRICATION**

- A. Check that oil level in the motor compressor crankcase is at the center of the sight glass at all times. Add oil as required.
- B. If oil is dirty, or discolored, check for the following:
  - 1) Contaminants such as moisture, air, etc. trapped in the system – If discoloration is not severe, replace new liquid line filter-drier. If the discoloration is severe, replace oil and liquid line filter-drier.  
**NOTE:** If the oil is still dirty, replace the filter-drier again.
  - 2) Excessive system pressure drop or improper control settings allowing motor compressors not so designed to operate in a vacuum with the result that the motor compressor overheats due to lack of suction cooling and the oil discolors. Re-adjust settings.
  - 3) Insufficient air cooling or restricted air blast on a suction cooled motor compressor operating below 0° F saturated suction temperature causing overheating. Correct improper air cooling.

## XV. Troubleshooting

| Problem   | Reason  | Solution  |
|---|---|---|
| Compressor does not run   | Motor line open   | Close start or disconnect switch  |
|   | Fuse blown  | Replace fuse  |
|   | Tripped overload  | See electrical section  |
|   | Control contacts dirty or jammed in open position           | Repair or replace   |
|   | Piston seized   | Remove motor compressor head. Look for broken valve and jammed parts.   |
|   | Frozen compressor or motor bearings                         | Repair or replace   |
|   | Control in "off" position because of cold location          | Use thermostatic control or move control to warmer location   |
|   | Defective starting component (single phase compressor only) | Locate and replace  |
| Unit short cycles   | Control differential set too closely                        | Widen differential  |
|   | Discharge valve leaking                                     | Correct condition   |
|   | Motor compressor overload                                   | Check for high head pressure, tight bearings, seized pistons, clogged air or water cooled condenser or water shut off |
|   | Refrigerant shortage  | Repair leak and recharge  |
|   | Cycling on high pressure cut-out                            | Check water supply  |
| Compressor will not start - "hums" intermittently (cycling on overload) | Improperly wired  | Check wiring against diagram  |
|   | Low line voltage  | Check main line voltage   |
|   | Relay contacts not closing                                  | Check by operating manually. Replace relay if defective.  |
|   | Open circuit in starting winding                            | Check stator leads. If leads are all right, replace stator.   |

| <b>Problem</b>   | <b>Reason</b>                                | <b>Solution</b>   |
|--|--|---|
| Cont'd<br>Compressor will not start - "hums"<br>intermittently (cycling on overload) | Stator winding grounded                      | Check stator leads. If leads are all right, replace stator.                           |
|  | High pressure discharge                      | Eliminate cause of excessive pressure. Make sure discharge shut-off valve is open.    |
|  | Tight compressor                             | Check oil level - correct binding   |
| Unit operates long or continuously   | Refrigerant shortage                         | Repair leak and recharge  |
|  | Control contacts sticking in closed position | Clean points or replace control   |
|  | Dirty condenser                              | Clean condenser   |
|  | Air in system                                | Purge   |
|  | Compressor inefficient                       | Check valves and pistons  |
|  | Improper wiring                              | Check wiring and correct if necessary   |
| Fixture temperature too high   | Refrigerant shortage                         | Repair leak and recharge  |
|  | Control set too high                         | Reset control   |
|  | Control wiring loose                         | Check wiring to control   |
|  | Expansion valve or strainer plugged          | Clean and replace   |
|  | Compressor inefficient                       | Check valves and pistons  |
|  | Expansion valve set too high                 | Lower setting   |
|  | Iced or dirty coil                           | Defrost or clean  |
|  | Unit too small                               | Add unit or replace   |
|  | Clogged or small gas lines                   | Clear clogging or increase line size  |
|  | Oil logged system                            | Remove excess oil, check refrigerant charge   |
| Head pressure too high   | Refrigerant overcharged                      | Reclaim   |
|  | Air in system                                | Purge   |
|  | Dirty air cooled condenser                   | Clean (clean area around air cooled condenser and inspect for air borne dirt source). |
|  | Clogged water cooled condenser               | Clean or replace condenser  |

| <b>Problem</b>                   | <b>Reason</b>   | <b>Solution</b>  |
|----------------------------------|---|--|
| Cont'd<br>Head pressure too high | Insufficient water or high water temperature                              | Check water valves and inspect cooler  |
|                                  | Recirculating cooling air   | Seal off unit from other machines and provide intake isolated from air outlet  |
|                                  | High side restriction   | Remove blockage  |
|                                  | Head pressure control valve set incorrectly                               | Re-adjust  |
| Head pressure too low            | Refrigerant shortage  | Repair leak and recharge   |
|                                  | Compressor suction or discharge valves inefficient                        | Clean or replace leaky valve plates  |
|                                  | Cold ambient or cold water  | No remedy as efficiency is increased. However, if condensing temperature is below 85° F expansion valve will not be able to feed properly and some form of head pressure control must be provided. |
|                                  | Head pressure control valve set wrong or no head pressure valve installed | Re-adjust or install a head pressure control valve.  |
| Noisy unit                       | Insufficient compressor oil   | Add oil to proper level  |
|                                  | Tubing rattle   | Bend tubes away from contact   |
|                                  | Mountings loose   | Tighten  |
|                                  | Oil slugging or refrigerant flooding back                                 | Adjust oil level or refrigerant charge. Check expansion valve for leak or oversized orifice.   |
|                                  | Unbalanced fan or defective fan motor.                                    | Replace bent or broken fan blades. Check motor bearings.   |
| Compressor loses oil             | Shortage of refrigerant   | Repair leak and recharge   |
|                                  | Gas:Oil ratio low   | Add 1 pt. oil for each 10 lbs. Of refrigerant added to factory charge.   |
|                                  | Plugged expansion valve or strainer                                       | Clean or replace   |
|                                  | Oil trapping in lines   | Drain tubing toward compressor   |
|                                  | Short cycling   | Refer to part "B"  |
|                                  | Superheat too high at compressor suction                                  | Change location of expansion valve bulb or adjust valve to return wet gas to compressor  |
| Frosted or sweating suction line | Expansion valve admitting excess refrigerant                              | Adjust expansion valve   |
| Hot liquid line                  | Shortage of refrigerant   | Repair leak and recharge   |
|                                  | Expansion valve open too wide   | Adjust expansion valve   |

| <b>Problem</b>                                 | <b>Reason</b>  | <b>Solution</b>   |
|--|--|---|
| Frosted liquid line                            | Receiver shut-off valve partially closed or restricted | Open valve or remove obstruction  |
|  | Clogged dehydrator or strainer                         | Replace clogged part  |
| Unit in vacuum. Frost on expansion valve only. | Ice plugging expansion valve orifice                   | Apply hot wet cloth to the expansion valve. If suction pressure now increases, there is moisture in the system and a drier should be installed in the line. |
|  | Plugged expansion valve                                | Clean strainer or replace expansion valve   |