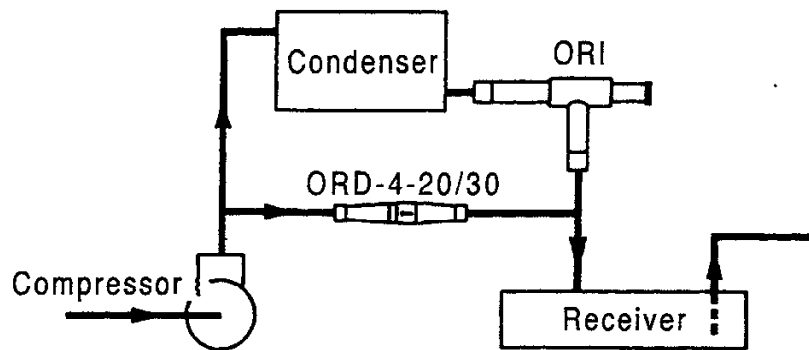


Figure 19. Dual Valve Piping Arrangement



Operation and Adjustment

Condensing units with dual valves require sufficient charge to partially flood the condenser during low ambient conditions.

Valve adjustment should be made with gauges connected to the discharge port of the compressor. Adjustments should be made during mild or low ambient conditions. Turning the valve stem "clockwise" on the ORI valve will increase the discharge pressure, while turning the valve stem "counterclockwise" will decrease the discharge pressure.

If adjustments are made during warm ambient conditions, it may not be possible to adjust the regulator valve as low as desired. Readjustment may be necessary once cooler conditions prevail.

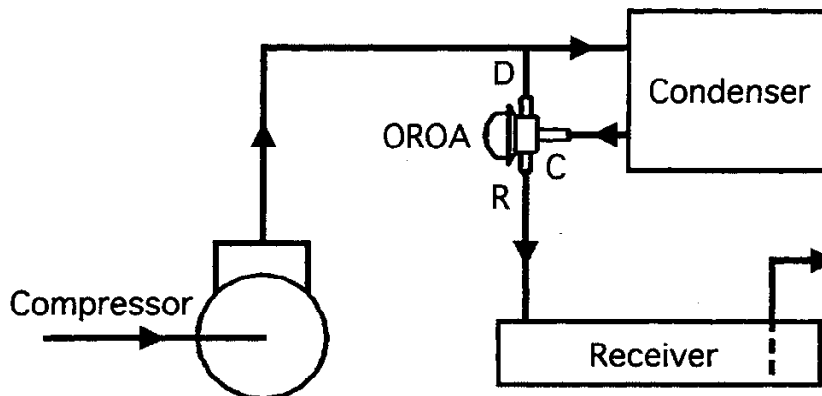
B. Single Valve System

The standard valve used on high pressure refrigerant systems controls the discharge pressure at approximately 180 PSIG.

There is no adjustment for this valve. On low pressure refrigerant systems the valve controls pressure at approximately 100 PSIG. For energy efficiency, the 100 PSIG valve is sometimes used on high pressure refrigerant systems. When this is done, refer to Table 1 on page 4 for expansion valve selections.

At condensing pressures above the valve setting, flow enters Port C and leaves Port R. When the condensing pressure falls below the valve setting, the valve modulates to permit discharge gas to enter Port D. Metering discharge gas into the refrigerant flow leaving the condenser produces a higher pressure at the condenser outlet, reduces the flow, and causes the level of liquid refrigerant to rise in the condenser. This "flooding" of the condenser with liquid refrigerant reduces the available condensing surface, holding the condensing pressure at the valve setting.

Figure 20. Single Valve Flooding Valve Piping Arrangement



C. Ambient Fan Cycle Control

This is an automatic winter control method which will maintain a condensing pressure within reasonable limits by cycling fan motors in response to outside air temperature. The thermostat(s) should be field adjusted to shut off the fan when the condensing temperature is reduced to approximately 90°F. Table 15 on page 30 lists approximate settings for several system T.D.'s. These settings are approximate as they do not take into account variations in load.

CAUTION: Under no circumstance should all condenser motors be allowed to cycle off on one control. At least one motor shall be wired to operate at all times. Under most circumstances, the condenser motor nearest the inlet header should remain on whenever the compressor is operating.

Suction Filters, Driers, Sight Glasses

There are two types of suction and liquid filter/driers used on **Heatcraft** units. Replaceable core and/or sealed units are used, dependent upon the option package ordered.

Suction filters, regardless of type, 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 to allow field measurement of pressure drop across the device. This allows plugged filters and elements to be identified very quickly and easily so they can be replaced when the pressure drop is excessive. Refer to the specific manufacturers' recommendation on servicing these units by make and model.

Liquid filter/driers, regardless of type, are always installed downstream of the receiver outlet service valve, and upstream of the liquid line solenoid valve (if supplied). Liquid line driers

may or may not have an access valve, dependent on the size and application. The basic servicing of these units is similar to suction filters. Liquid line driers should be replaced whenever there is evidence of excessive pressure drop across the filter, or the system becomes contaminated due to system leaks, compressor burnouts, acid formation, or moisture accumulation as indicated by the liquid line sight glass.

The sight glass is installed in the main liquid line assembly, downstream from the receiver outlet service valve, and immediately after the liquid line drier. The sight glass is designed to give a visual indication of moisture content in the system. Generally, it requires no field service. However, in cases of extreme acid formation in a system after a compressor burnout, the acid may damage the sensing element or etch the glass. This would require that the sight glass be replaced, along with the liquid line drier after any compressor motor burnout.

Table 14. Recommended Low Pressure Control Settings for Outdoor Air Cooled Condensing Units

*Minimum Temp. °F	R-22		R-502		R-404A/R-507		R-134a/R-12	
	Cut-In PSI	Cut-Out PSI	Cut-In PSI	Cut-Out PSI	Cut-In PSI	Cut-Out PSI	Cut-In PSI	Cut-Out PSI
50	70	20	80	30	90	35	45	15
40	55	20	65	30	70	35	35	10
30	40	20	50	30	55	35	25	10
10	30	10	40	20	45	25	13	0
0	15	0	20	5	25	7	8	0
-10	15	0	15	0	20	1	---	---
-20	10	0	10	0	12	1	---	---
-30	6	0	6	3" Hg.	8	1"Hg.	---	---

* Minimum ambient or box temperature anticipated, Hi pressure control setting: R-22 & R-502, 360 PSI; R-404A, R-507, 400 PSI; R-134, R-12, 225 PSI.

Table 15. Thermostat Settings

Models	Design T.D.	Thermostat Settings		
		T1	T2	T3
2-fan units:	30	60		
	25	65		
	20	70		
4-fan units:	15	75		
	30	60	40	
3-fan units:	25	65	55	
	20	70	60	
	15	75	65	
6-fan units:	30	60	50	30
	25	65	55	40
	20	70	65	50
	15	75	70	60

NOTE: Cycle pairs of fans on double wide units.

CAUTION: Fans closest to the headers should not be cycled on standard temperature or pressure controls. Dramatic temperature and pressure changes at the headers as a result of fan action can result in possible tube failure. Fan motors are designed for continuous duty operation.

Fan cycling controls should be adjusted to

maintain a minimum of (5) minutes on and (5) minutes off. Short cycling of fans may result in a premature failure of motor and/or fan blade.

Compressors operating below +18°F SST must have air flowing over the compressor at all times when the compressor is running.

Refrigeration Oils*

With the changes that have taken place in our industry due to the CFC issue, we have reevaluated our lubricants to ensure compatibility with the new HFC refrigerants and HCFC interim blends offered by several chemical producers. As a secondary criteria, it is also desirable that any new lubricant be compatible with the traditional refrigerants such as CFC-12, HCFC-22 or R502. This "backward compatibility" has been achieved with the introduction of the Polyol ester lubricants.

Table 16 below summarizes which oils/lubricants are approved for use in Copeland compressors:

Polyol Ester Lubricants

Hygroscopicity

Ester lubricants (POE) have the characteristic of quickly absorbing moisture from the ambient surroundings. This is shown graphically in Figure 21 where it can be seen that such lubricants absorb moisture faster and in greater quantity than conventional mineral oils. Since moisture levels greater than 100 ppm will result in system corrosion and ultimate failure, it is imperative that compressors, components, containers and the entire system be kept sealed as much as possible. Lubricants will be packaged in specially designed, sealed containers. After opening, all the lubricant in a container should be used at once since it will readily absorb moisture if left exposed to the ambient. Any unused lubricant should be properly disposed of. Similarly, work on systems and compressors must be carried out with the open time as short as possible. Leaving the system or compressor open during breaks or overnight **MUST BE AVOIDED!**

Color

As received, the POE lubricant will be clear or straw colored. After use, it may acquire a darker color. This does not indicate a problem as the darker color merely reflects the activity of the lubricant's protective additive.

Oil Level

During Copeland's testing of Polyol ester oil, it was found that this lubricant exhibits a greater tendency to introduce oil into the cylinder during flooded start conditions. If allowed to continue, this condition will cause mechanical failure of the compressor.

A crankcase heater is required with condensing units and it must be turned on several hours before start-up.

Oil level must not exceed 1/4 sight glass.

Figure 21. Hygroscopicity

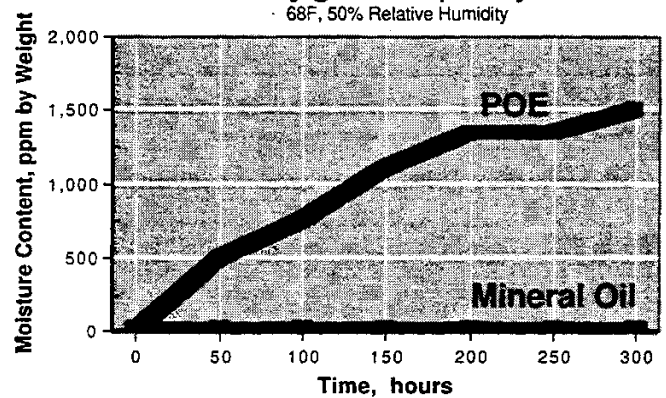


Table 16. Refrigeration Oils

Refrigeration Oils		Traditional Refrigerants CFC-12, HCFC-22, R502	Interims R401A, R401B, R402A (MP-39, MP-66, HP-80)	HFC's HFC-134a, R404A
POE's	Mobil EAL ARCTIC 22 CC	A	A	P
	ICI (Virginia KMP) EMKARATE RL 32CF	A	A	P
Mineral Oils	Suniso 3GS	P	PM	NOT ACCEPTABLE
	Texaco WF32	P	PM	
	Calumet R015 (Witco)	P	PM	
	Sontex 200-LT (White Oil)	(BR & Scroll Only)		
	Witco LP-200	P		
A/B	Zerol 200TD	AM	PM	NOT ACCEPTABLE
	Soltex Type AB-200		PM	

P = Preferred Lubricant Choice

A = Acceptable Alternative

M = Mixture of Mineral Oil and Alkyl Benzene (AB) with minimum 50% AB.

* (Reprinted from Copeland)

Mineral Oils

The BR and Scroll compressors use Sontex 200, a "white oil". This oil is not suitable for low temperature applications nor is it available through the normal refrigeration wholesalers. For field "top-off" the use of 3GS or equivalent, or Zerol 200TD is permissible, as long as at least 50% of the total oil charge remains Sontex 200.

Suniso 3GS, Texaco WF32 and Calumet R015 (yellow oils) are available through normal refrigeration wholesalers. These oils are compatible if mixed and can be used on both high and low temperature systems.

Polyol Ester Lubricants

The Mobil EAL ARCTIC 22 CC is the preferred Polyol ester due to unique additives included in this lubricant. ICI Emkarate RL 32S is an acceptable Polyol ester lubricant approved for use when Mobil is not available. These POE's **must** be used if HFC refrigerants are used in the system. They are also acceptable for use with any

of the traditional refrigerants or interim blends and are compatible with mineral oils. They can therefore be mixed with mineral oils when used in systems with CFC or HCFC refrigerants. These lubricants are compatible with one another and can be mixed.

Alkyl Benzenes

Zerol 200TD is an alkyl benzene (AB) lubricant. Copeland recommends this lubricant for use as a mixture with mineral oil (MO) when using the interim blends such as R-401A, R-401B and R-402A (MP39, MP66 and HP80). A minimum of 50% AB is required in these mixtures to assure proper oil return.

Shell MS 2212 is a 70/30 mixture of AB/MO. If this lubricant is used in a retrofit situation virtually all of the existing MO must be drained prior to refilling with the MS 2212 to assure a minimum 50% AB content.

Table 17. System Troubleshooting Chart

PROBLEM	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Compressor will not run	<ol style="list-style-type: none"> 1. Main switch open. 2. Fuse blown. 3. Thermal overloads tripped. 4. Defective contactor or coil. 5. System shut down by safety devices. 6. No cooling required. 7. Liquid line solenoid will not open. 8. Motor electrical trouble. 9. Loose wiring. 10. Phase loss monitor inoperative. 	<ol style="list-style-type: none"> 1. Close switch. 2. Check electrical circuits and motor winding for shorts or grounds. Investigate for possible overloading. Replace fuse after fault is corrected. 3. Overloads are automatically reset. Check unit closely when unit comes back on line. 4. Repair or replace. 5. Determine type and cause of shutdown and correct it before resetting safety switch. 6. None. Wait until calls for cooling. 7. Repair or replace coil. 8. Check motor for open windings, short circuit or burn out. 9. Check all wire junctions. Tighten all terminal screws. 10. Refer to page 26.
Compressor noisy or vibrating	<ol style="list-style-type: none"> 1. Flooding of refrigerant into crankcase. 2. Improper piping support on suction or liquid line. 3. Worn compressor. 4. Scroll compressor rotation reversed. 	<ol style="list-style-type: none"> 1. Check setting of expansion valves. 2. Relocate, add or remove hangers. 3. Replace. 4. Rewire for phase change.
High discharge pressure	<ol style="list-style-type: none"> 1. Non-condensables in system. 2. System overcharges with refrigerant. 3. Discharge shutoff valve partially closed. 4. Fan not running. 5. Head pressure control setting. 6. Dirty condenser coil. 	<ol style="list-style-type: none"> 1. Remove the non-condensables. 2. Remove excess. 3. Open valve. 4. Check electrical circuit. 5. Adjust. 6. Clean.
Low discharge pressure	<ol style="list-style-type: none"> 1. Faulty condenser temperature regulation. 2. Suction shutoff valve partially closed. 3. Insufficient refrigerant in system. 4. Low suction pressure. 5. Variable head pressure valve. 	<ol style="list-style-type: none"> 1. Check condenser control operation. 2. Open valve. 3. Check for leaks. Repair and add charge. 4. See corrective steps for low suction pressure. 5. Check valve setting.
High suction pressure	<ol style="list-style-type: none"> 1. Excessive load. 2. Expansion valve overfeeding. 	<ol style="list-style-type: none"> 1. Reduce load or add additional equipment. 2. Check remote bulb. Regulate superheat.
Low suction pressure	<ol style="list-style-type: none"> 1. Lack of refrigerant. 2. Evaporator dirty or iced. 3. Clogged liquid line filter drier. 4. Clogged suction line or compressor suction gas strainers. 5. Expansion valve malfunctioning. 6. Condensing temperature too low. 7. Improper TXV. 	<ol style="list-style-type: none"> 1. Check for leaks. Repair and add charge. 2. Clean. 3. Replace cartridge(s). 4. Clean strainers. 5. Check and reset for proper superheat. 6. Check means for regulating condensing temperature. 7. Check for proper sizing.
Little or no oil pressure	<ol style="list-style-type: none"> 1. Clogged suction oil strainer. 2. Excessive liquid in crankcase. 3. Low oil pressure safety switch defective. 4. Worn oil pump. 5. Oil pump reversing gear stuck in wrong position. 6. Worn bearings. 7. Low oil level. 8. Loose fitting on oil lines. 9. Pump housing gasket leaks. 	<ol style="list-style-type: none"> 1. Clean. 2. Check crankcase heater. Reset expansion valve for higher superheat. Check liquid line solenoid valve operation. 3. Replace. 4. Replace. 5. Reverse direction of compressor rotation. 6. Replace compressor. 7. Add oil and/or through defrost. 8. Check and tighten system. 9. Replace gasket.
Compressor loses oil	<ol style="list-style-type: none"> 1. Lack of refrigerant. 2. Excessive compression ring blowby. 3. Refrigerant flood back. 4. Improper piping or traps. 	<ol style="list-style-type: none"> 1. Check for leaks and repair. Add refrigerant. 2. Replace compressor. 3. Maintain proper superheat at compressor. 4. Correct piping.
Compressor thermal protector switch open.	<ol style="list-style-type: none"> 1. Operating beyond design conditions. 2. Discharge valve partially shut. 3. Blown valve plate gasket. 4. Dirty condenser coil. 5. Overcharged system. 	<ol style="list-style-type: none"> 1. Add facilities so that conditions are within allowable limits. 2. Open valve. 3. Replace gasket. 4. Clean coil. 5. Reduce charge.

Maintenance

Evaporators

All evaporator units should be checked once a month or more often for proper defrosting because the amount and pattern of frosting can vary greatly. It is dependent on the temperature of the room, the type of product being stored, how often new product is brought into the room and percentage of time the door to the room is open. It may be necessary to periodically change the number of defrost cycles or adjust the duration of defrost.

Condensing Units / Evaporators

Under normal usage conditions, maintenance should cover the following items at least once every six months.

1. Check and Tighten **ALL** electrical connections.
2. Check all wiring and insulators.

3. Check contactors for proper operation and for worn contact points.
4. Check all fan motors. Tighten motor mount bolts/nuts and tighten fan set screws.
5. Clean the condenser coil surface.
6. Check the refrigerant and oil level in the system.
7. Check the operation of the control system. Make certain all safety controls are operating properly.
8. Check that all defrost controls are functioning properly.
9. Clean the evaporator coil surface.
10. Clean the drain pan and check the drain pan and drain line for proper drainage.
11. Check the drain line heater for proper operation, cuts and abrasions.
12. Check and tighten all flare connections.

Table 18. Evaporator Troubleshooting Chart

SYMPTOMS	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Fan(s) will not operate.	<ol style="list-style-type: none"> 1. Main switch open. 2. Blown fuses. 3. Defective motor. 4. Defective Timer or defrost thermostat. 5. Unit in defrost cycle. 6. Coil does not get cold enough to reset thermostat. 	<ol style="list-style-type: none"> 1. Close switch. 2. Replace fuses. Check for short circuits or overload conditions. 3. Replace motor. 4. Replace defective component. 5. Wait for completion of cycle. 6. Adjust fan delay setting of thermostat. See Defrost Thermostat Section of this bulletin.
Room temperature too high.	<ol style="list-style-type: none"> 1. Room thermostat set too high. 2. Superheat too high. 3. System low on refrigerant. 4. Coil iced-up. 	<ol style="list-style-type: none"> 1. Adjust thermostat. 2. Adjust thermal expansion valve. 3. Add refrigerant. 4. Manually defrost coil. Check defrost controls for malfunction.
Ice accumulating on ceiling around evaporator and/or on fan guards venturi or blades.	<ol style="list-style-type: none"> 1. Defrost duration is too long. 2. Fan delay not delaying fans after defrost period. 3. Defective defrost thermostat or Timer. 4. Too many defrosts. 	<ol style="list-style-type: none"> 1. Adjust defrost termination thermostat. 2. Defective defrost thermostat or not adjusted properly. 3. Replace defective component. 4. Reduce number of defrosts.
Coil not clearing of frost during defrost cycle.	<ol style="list-style-type: none"> 1. Coil temperature not getting above freezing point during defrost. 2. Not enough defrost cycles per day. 3. Defrost cycle too short. 4. Defective Timer or defrost thermostat. 	<ol style="list-style-type: none"> 1. Check heater operation. 2. Adjust Timer for more defrost cycles. 3. Adjust defrost thermostat or Timer for longer cycle. 4. Replace defective component.
Ice accumulating in drain pan	<ol style="list-style-type: none"> 1. Defective heater. 2. Unit not pitched properly. 3. Drain line plugged. 4. Defective drain line heater. 5. Defective Timer or thermostat. 	<ol style="list-style-type: none"> 1. Replace heater. 2. Check and adjust if necessary. 3. Clean drain line. 4. Replace heater. 5. Replace defective component.

Diagram 1. Typical Wiring Diagram for Multiple Evaporators with Heater Limit Defrost and Evaporator Fan Contactors.

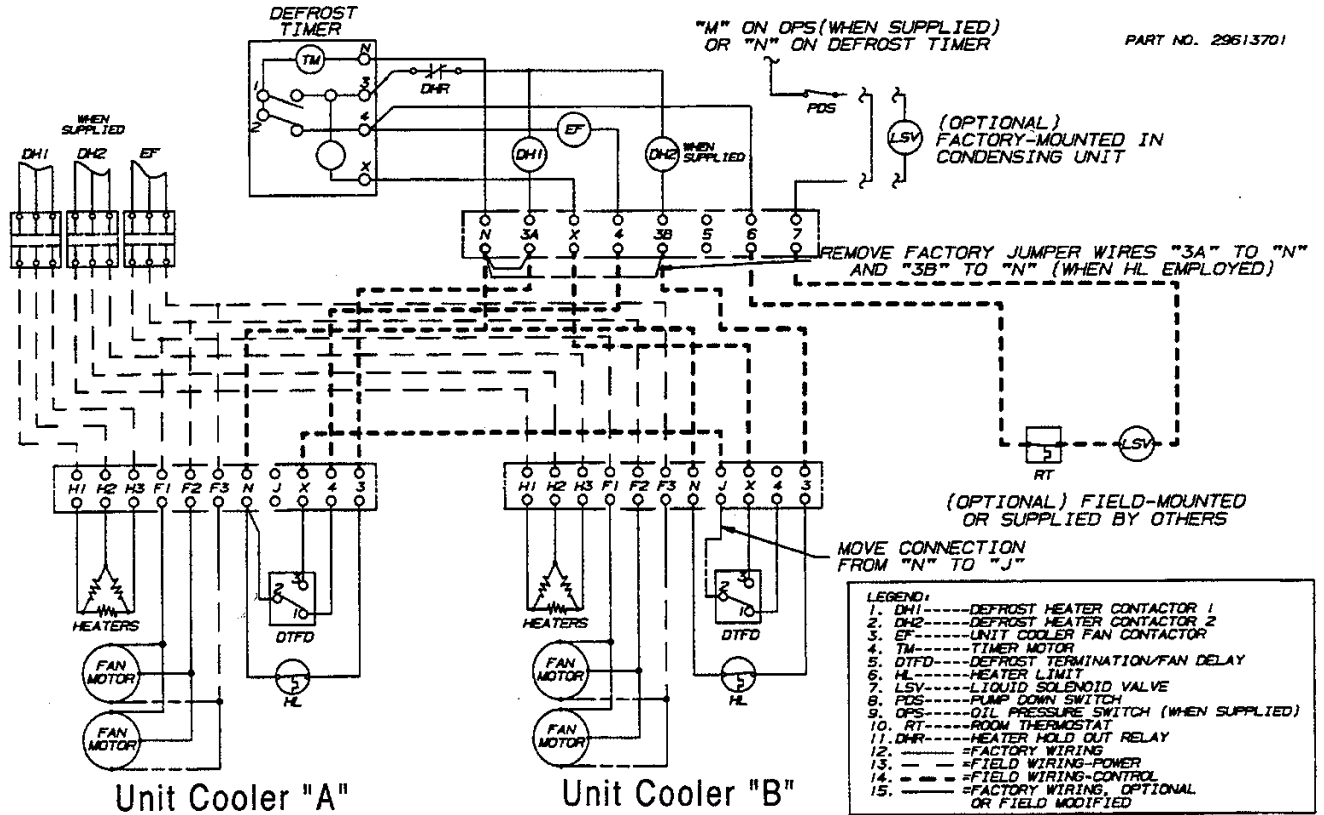


Diagram 2. Typical Wiring Diagram for Multiple Evaporators without Heater Limit Defrost and Evaporator Fan Contactors.

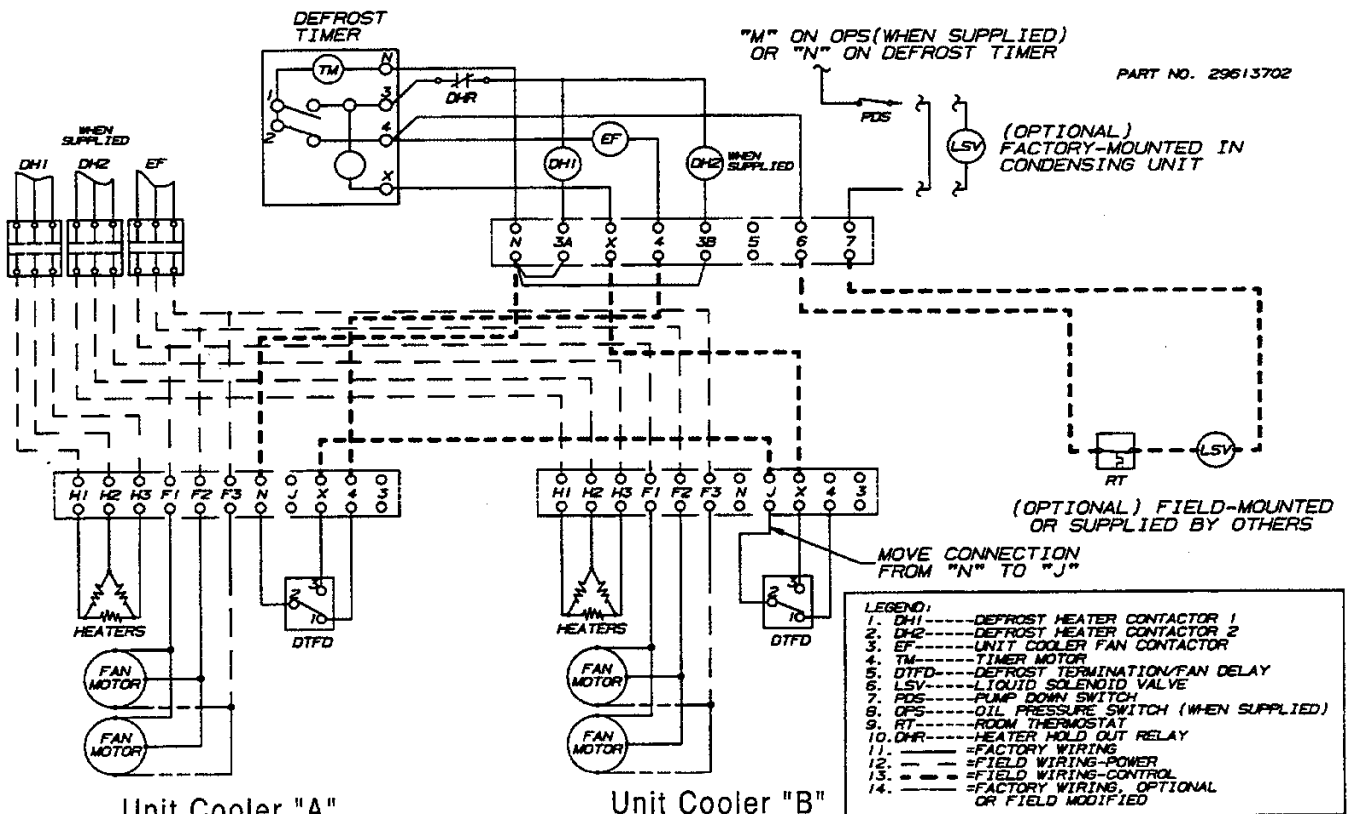


Diagram 3. Typical Wiring Diagram for Single Evaporator / Single Phase Voltage Defrost and Evaporator Fan Contactors.

PART NO. 29613715

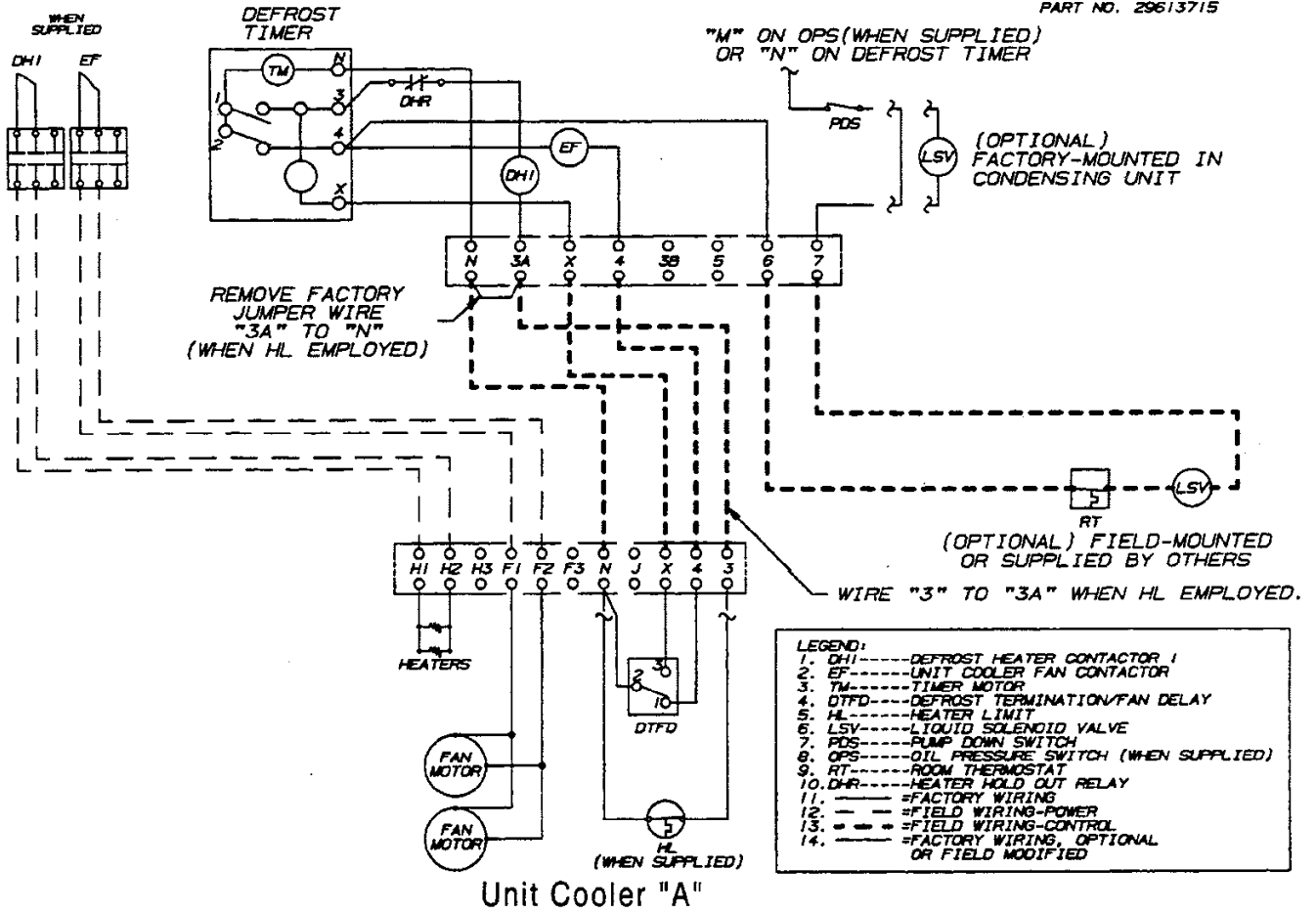


Diagram 4. Typical Wiring Diagram for Single Evaporator Defrost and Evaporator Fan Contactors.

PART NO. 29613703

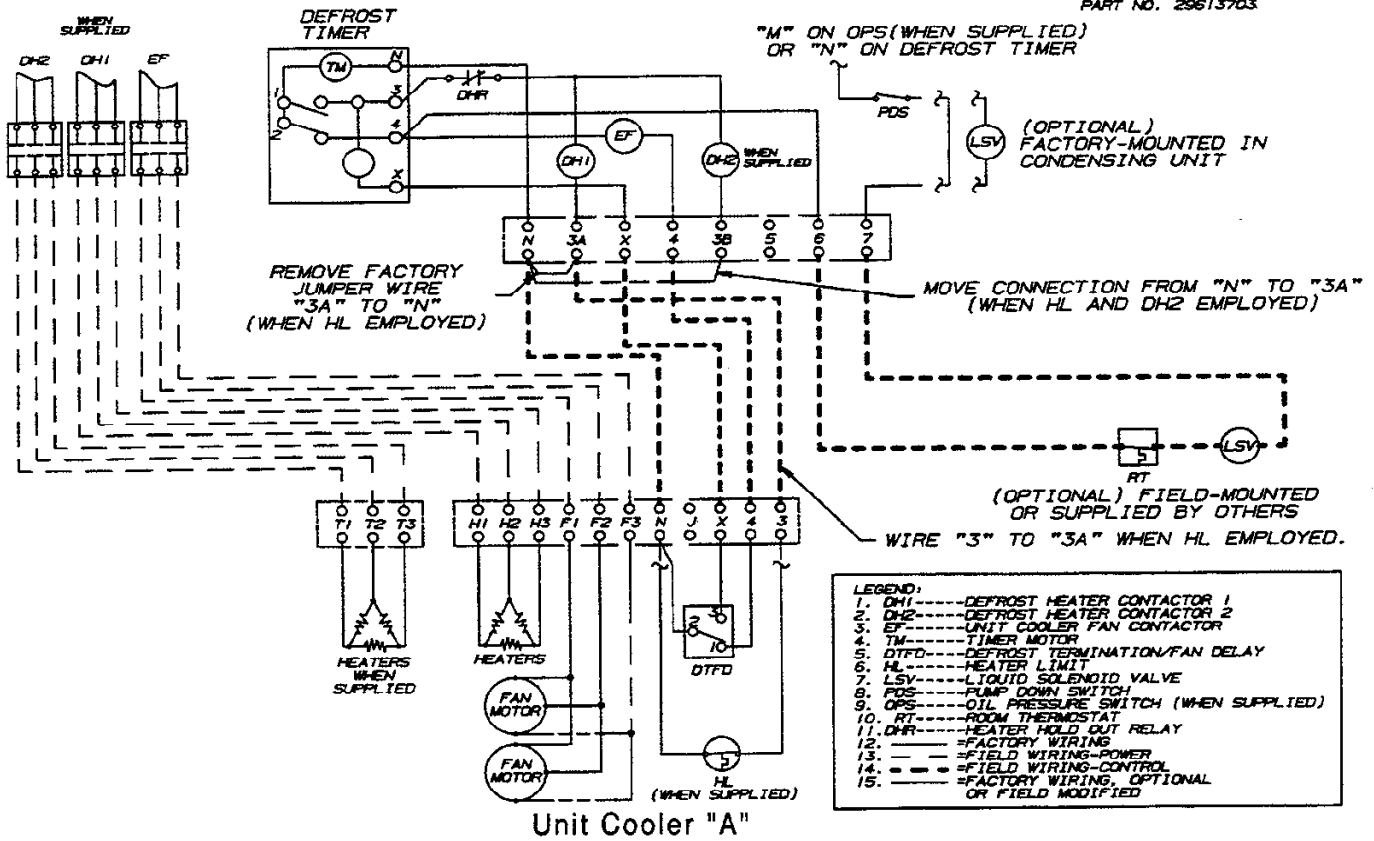


Diagram 5. Typical Wiring Diagram for Multiple Evaporators with Defrost Timer Only.

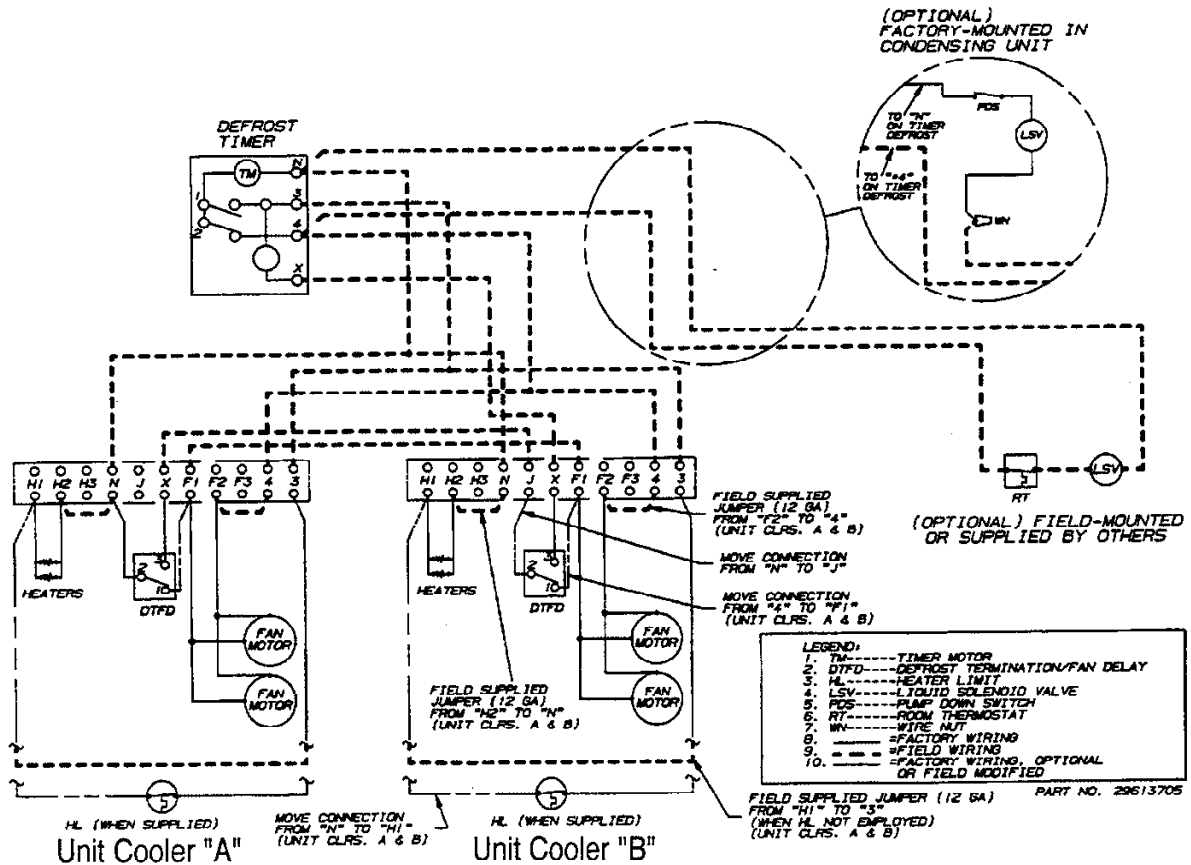


Diagram 6. Typical Wiring Diagram for Single Evaporator with Defrost Timer Only.

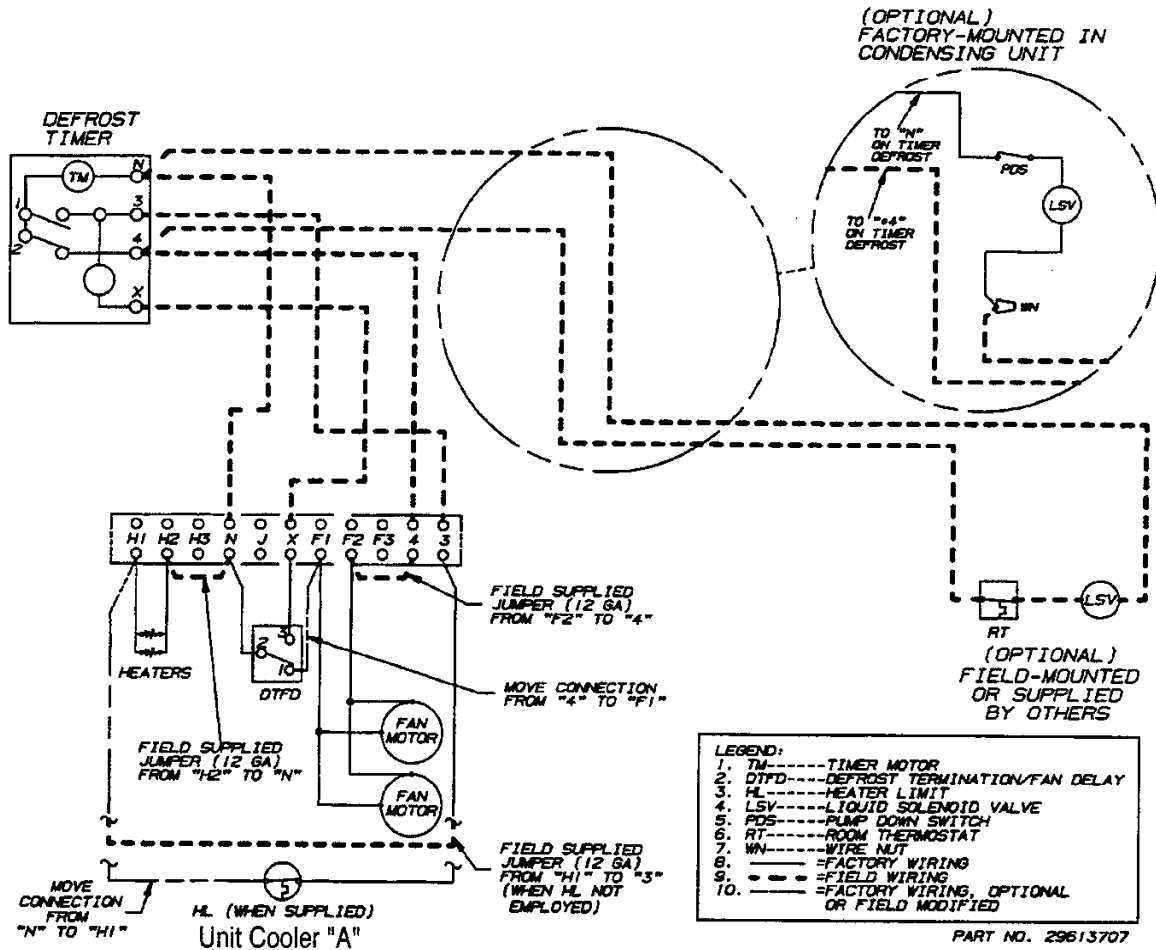


Diagram 7. Typical Wiring Diagram for Multiple Evaporators Defrost and Evaporator Fan Contactors with Unit Cooler Holdout Relay.

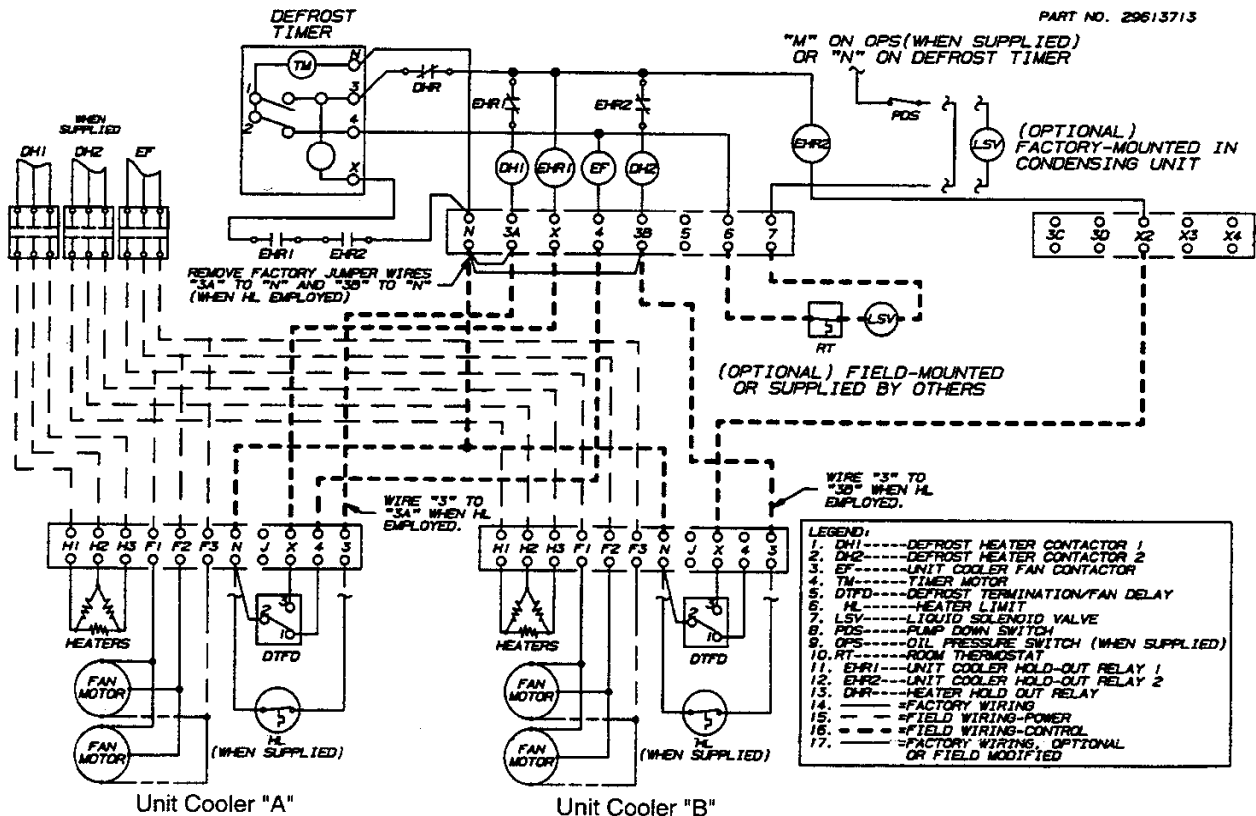
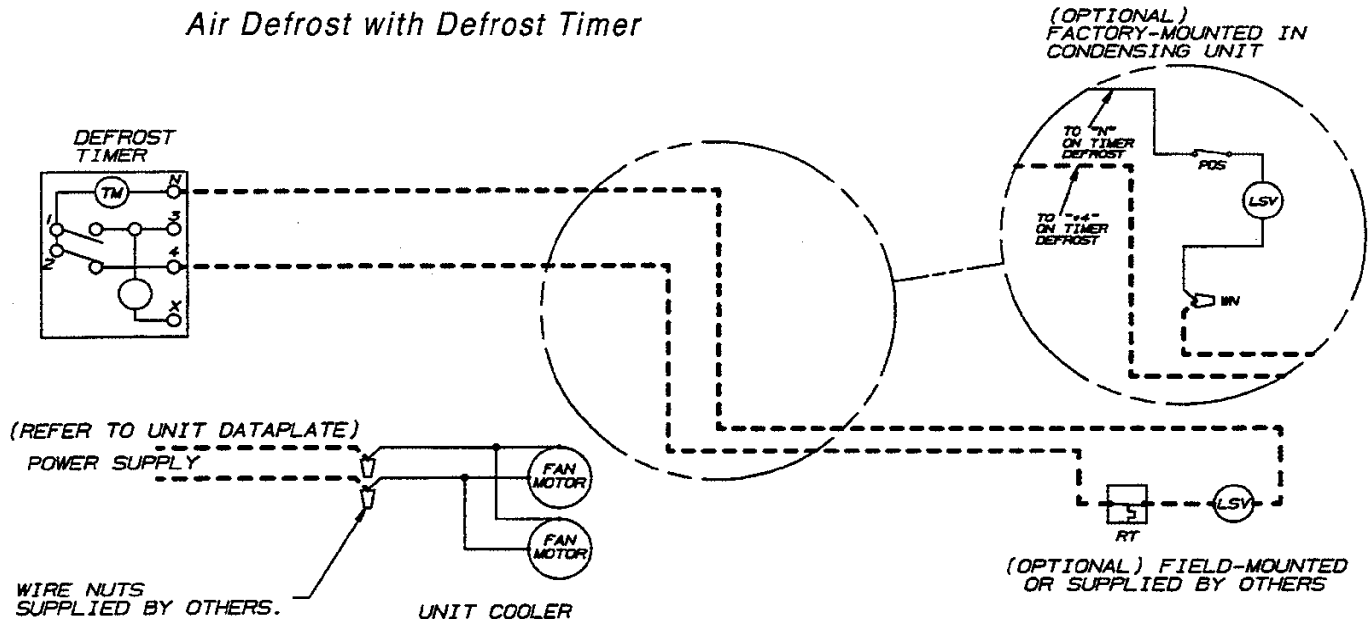
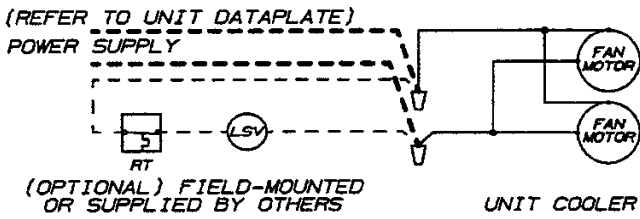


Diagram 8. Typical Wiring Diagram for Single Evaporator with and without Defrost Timer.

Air Defrost with Defrost Timer



Air Defrost without Defrost Timer



LEGEND:	
1. TM	---TIMER MOTOR
2. LSV	---LIQUID SOLENOID VALVE
3. PDS	---PUMP DOWN SWITCH
4. RT	---ROOM THERMOSTAT
5. WN	---WIRE NUT
6. ---	=FACTORY WIRING
7. - - -	=FIELD WIRING

PART NO. 29613714

Notes

Service Record

A permanent data sheet should be prepared on each installing contractor's files. If another firm is to handle service and installation, with a copy for the owner and the original for the maintenance, additional copies should be prepared as necessary.

System Reference Data

The following information should be filled out and signed by Refrigeration Installation Contractor.

Date System Installed: _____

Installer and Address: _____

Condensing Unit

Unit Model#: _____

Unit Serial #: _____

Compressor Model #: _____ Compressor Model #: _____

Compressor Serial #: _____ Compressor Serial #: _____

Electrical _____ Volts _____ Phase _____

Voltage at Compressor L1 _____ L2 _____ L3 _____

Amperage at Compressor L1 _____ L2 _____ L3 _____

Evaporator(s)

Quantity _____

Evaporator Model #: _____ Evaporator Model #: _____

Evaporator Serial #: _____ Evaporator Serial #: _____

Electrical _____ Volts _____ Phase _____

Expansion Valve Manufacturer/Model _____

Ambient at Start-Up _____ °F

Design Box Temperature _____ °F _____ °F

Operating Box Temperature _____ °F _____ °F

Thermostat Setting _____ °F _____ °F

Defrost Setting _____ / day _____ minutes fail-safe _____ / day _____ minutes fail-safe

Compressor Discharge Pressure _____ °F _____ °F

Compressor Suction Pressure _____ °F _____ °F

Suction Line Temperature @ Comp. _____ °F _____ °F

Discharge Line Temperature @ Comp. _____ °F _____ °F

Superheat at Compressor _____ °F _____ °F

Suction Line Temperature @ Evaporator _____ °F _____ °F

Superheat at Evaporator _____ °F _____ °F

Evacuation: # times _____ Final Micron _____ # Times _____ Final Micron _____

Evaporator Drain Line Trapped Outside of Box: yes no

Since product improvement is a continuing effort at Heatcraft, we reserve the right to make changes in specifications without notice.

HEATCRAFT®

Refrigeration Products

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CONDENSING UNITS AIR & WATER COOLED

Electrical Requirements

- Voltage
- Phase
- Amp draw
- Wire Size
- Check motor rotation

Piping

- Size
- "P" Trap for riser that exceeds 8ft.
- If water cooled piping must be protected from freezing
- Check for leaks
- 175 psig

Model no. _____

Serial no. _____

Comments:

CONDENSING UNITS

BLH7.5H2 thru BLH40H2 & JDL50.H2 & JDL60.H2 (Air Cooled Units)

- Check voltages and amp draws
- Check discharge and suction pressures
- Check liquid, suction and crank case temperatures
- Check oil pressure
- Change oil per factory specs
- Check superheat
- Check oil sight glass
- Check refrigerant site glass
- Check for oil and refrigerant leaks
- Check for loose fastener and worn components
- Check fan cycling controls
- Clean and or replace filters and dryers
- Perform as acid test

WSO5H2 thru WSO40H2 (Water Cooled Units)

- Check voltages and amp draws
- Check discharge and suction pressures
- Check liquid, suction and crank case temperatures
- Check oil pressure
- Change oil per factory specs
- Check superheat
- Check oil sight glass
- Check refrigerant site glass
- Check for oil and refrigerant leaks
- Check for loose fastener and worn components
- Check cooling water
- Clean and or replace filters and dryers
- Perform as acid test