CANCOIL
THERMAL CORPORATION

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Condensing Unit
Installation and Operating Instructions

RCU Air Cooled Condensing Unit

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Section 1. Catalog Products Limited Warranty and General Information

For warranty information please contact your Cancoil sales representative.

Cancoil condensing units have been carefully designed to provide years of reliable performance. They include many features and options that provide stable, efficient year round operation for low, medium and high temperature refrigeration applications. The components have been thoughtfully laid out and are easily accessible should service be required. The wiring terminates at clearly marked terminals in the control panel and the controls are conveniently located for ease of adjustment. As with all refrigeration equipment, proper installation and set-up are required for maximum benefit.

Receiving Inspection - At delivery, inspect the equipment to make sure that the shipment is complete and there is no shipping damage. In the event of shipping damage or loss, note this on the delivery receipt and file a claim with the shipping company.

If concealed damage is found after delivery, immediately place a claim with the shipping company. Make arrangements for an inspector from the carrier to view the damage and make a determination as soon as possible.

Handling - Use proper equipment and technique when unloading and handling the condensing unit. Lift under the chassis with a forklift or with a spreader bar and hooks placed in the lifting holes provided in the unit. Do not use the refrigerant piping as a lift point.

Unit Placement and Mounting - Mount the unit in a level position to assure proper compressor functioning. The unit should be securely anchored to a structural base to prevent movement. Avoid locations that may allow freezing during compressor off cycles. Allow sufficient clearance around the unit for proper servicing and preventative maintenance. Follow all building codes and requirements regarding safe access to the equipment.

Please record the following information in the space provided. Please keep this document.

Installation Date ________________

Equipment Model No. ____________________ Equipment Serial No. ____________________
____________________ ____________________
____________________ ____________________
____________________ ____________________

Section 2. Refrigeration Piping

All refrigeration hookups and piping should be done by a licensed mechanical contractor in accordance with applicable codes and standards. Copper tubing must be refrigeration grade only. Piping must be kept clean and dry and free of all debris and chips. Use high temperature silver solder or equivalent alloy for brazing. DO NOT USE SOFT SOLDER. To avoid oxidation inside the piping, purge the system with dry nitrogen during the brazing process. Remove all flux from the joints after brazing.

Discharge Line - On RCU units, the discharge line should be sized to prevent excessive pressure drop (Table 3.). Horizontal pipe runs should be pitched downward with a rate of 1” drop per 10 feet of length. Inverted traps should be used at the end of vertical risers to prevent liquid and oil from draining back down to the compressor.

Suction Line - The suction line should be properly sized (Table 2.) and installed to insure oil return to the compressor. Horizontal pipe runs should be pitched downward with a rate of 1” drop per 10 feet of length. Vertical suction risers should be installed with a trap at the bottom and should have 1 additional trap per 20 feet of vertical rise. Vertical risers must be sized for proper oil return (Table 4.). Suction lines should be insulated to minimize external heat gain and condensation, which could drip on unprotected objects causing unforeseen damage.

Liquid Line - The liquid line should be sized to prevent excessive pressure drop and to assure a solid liquid column to the expansion valve (Table 1.). If the liquid line is routed through an area that will cause HEAT GAIN, it must be insulated.

Liquid Line Solenoid - The liquid line solenoid should be sized for the load and placed just ahead of the thermal expansion valve. In pumpdown systems, the liquid line solenoid is wired in series with the room thermostat.

Thermal Expansion Valve - The thermal expansion valve should be sized for the refrigerant and load at the minimum head pressure that is expected for the local operating conditions. Feeler bulbs should be located on horizontal runs and before any suction line traps.

Receivers - Receiver sizes for Cancoil condensing units are listed with the equipment specifications. The receivers are sized to hold the condenser winter charge plus the evaporator charge and up to 100 ft. of suction line charge. Contact your Cancoil sales representative if unsure about adequate receiver size.

Refrigeration Line Sizes - The following information may be used to size liquid, suction and hot gas lines and suction risers for Cancoil refrigeration systems. It is based on published industry practice. The data in the tables are all based on the evaporator BTUH, at the condition given. Line lengths are based on EQUIVALENT FEET OF PIPE; allowances for valves and fittings must be included when using these tables.

Suction Line sizes are based on a pressure drop equal to 2 degrees per 100 equivalent feet of tubing. Liquid and Hot Gas lines are based on 1 degree per 100 equivalent feet. Factors are provided for other pressure drops. Suction riser capacity is the MINIMUM allowable that will return oil up a vertical riser at the given condition.

Table 1. - Liquid Line Capacity

Line Size Copper	Liquid Line Btuh for 1 Degree Pressure Loss per 100 Feet of Tubing		
OD	R 134a	R 22	R 507
0.500	36000	45000	28000
0.625	70000	85000	52000
0.750	120000	150000	90000
0.875	180000	225000	140000
1.125	360000	450000	300000

Note:

use a 1.46 multiplier for 1 degree per 50'

use a 0.68 multiplier for 1 degree per 200'

Table 2. - Suction Line Sizes

Line Size Copper	Suction Line Btuh for 2 Degree Pressure Loss per 100 Equivalent Ft. of Tubing at Suction Temperature and Refrigerant												
	-40		-20		0			20			40		
OD	R 22	R 507	R 22	R 507	R 134a	R 22	R 507	R 134a	R 22	R 507	R 134a	R 22	R 507
0.500	-	-	-	-	-	-	-	-	4500	4600	4200	7000	6900
0.625	-	-	3800	3500	3200	6000	5600	5100	9100	8700	8000	13200	13000
0.750	-	-	6500	5900	5500	10200	9600	8800	15500	14800	13800	22500	22000
0.875	6000	5400	10000	9000	8500	16000	14500	13500	24000	23000	21000	35000	34000
1.125	12300	11000	20500	18500	17000	32000	30000	28000	48000	46000	43000	70000	68000
1.375	22000	19400	36000	32500	30000	56000	52000	48000	84000	80000	75000	121500	120000
1.625	34000	30000	56000	50500	48000	88000	83000	77000	133000	128000	118000	192000	190000
2.125	72000	63000	118000	105000	100000	185000	170000	160000	277000	265000	245000	397000	390000
2.625	126000	110000	210000	185000	175000	325000	300000	280000	490000	460000	430000	700000	680000
3.125	200000	175000	330000	295000	280000	520000	480000	450000	780000	740000	690000	-	-

Notes:

use a 1.46 multiplier for 2 degree per 50' of tubing

use a 0.68 multiplier for 2 degree per 200' of tubing

Table 3. - Discharge Line Sizes

Line Size Copper	Discharge Line Btuh for 1 Degree Pressure Loss per 100 Equivalent Ft. of Tubing at Suction Temperature and Refrigerant				
	-40		40		
OD	R 22	R 507	R 134a	R 22	R 507
0.5	10000	9000	4200	7000	6900
0.625	19000	17500	8000	13200	13000
0.75	32000	29000	13800	22500	22000
0.875	48000	44000	21000	35000	34000
1.125	100000	90000	43000	70000	68000
1.375	175000	155000	75000	121500	120000
1.625	275000	250000	118000	192000	190000
2.125	550000	500000	245000	397000	390000
2.625	1000000	900000	430000	700000	680000
3.125	-	-	690000	-	-

Notes:

use a 1.46 multiplier for 1 degree per 50'

use a 0.68 multiplier for 1 degree per 200'

Table 4. - Suction Riser Sizes

Line Size Copper	MINIMUM Suction Riser Btuh for Oil Return at Suction Temperature and Refrigerant												
	-40		-20		0			20			40		
OD	R 22	R 507	R 22	R 507	R 134a	R 22	R 507	R 134a	R 22	R 507	R 134a	R 22	R 507
0.5	900	700	1200	1000	1100	1400	1200	1300	1800	1500	1700	2200	1900
0.625	1700	1300	2300	1900	2100	2600	2200	2400	3300	2800	3100	4000	3600
0.75	2900	2300	3800	3200	3600	4500	3700	4100	5600	4800	5300	6900	6100
0.875	4500	3500	6000	5000	5600	7100	5800	6500	8800	7500	8300	10800	9600
1.125	9200	7200	12500	10300	11500	14500	12000	13300	18000	15400	17100	22200	19700
1.375	16500	12500	22000	18100	20200	25600	21100	23300	31600	27100	30100	39100	34600
1.625	26000	20000	34500	28600	31900	40500	33400	36900	50100	42900	47700	62000	54800
2.125	54000	41000	71000	59000	47600	60400	49800	55100	74700	64000	71100	92400	81800
2.625	70000	53000	90000	75800	84600	107400	88400	97900	132700	113700	126300	164200	145300
3.125	110000	83000	145000	120000	134000	170000	140000	155000	210000	180000	200000	260000	230000

Section 3. Electrical Wiring and Sequence of Operations

Cancoil condensing units use a pumpdown cycle to prevent liquid refrigerant from migrating to the low side of the system during "off" cycles. The following sequence of operations generally applies. Refer to the wiring diagram that was shipped along with the unit before attempting start-up or service. Additional copies of the wiring diagram are available from your Cancoil sales representative.

<u>Refrigeration Cycle</u> - The refrigeration cycle operates as follows:

1. Power is supplied through the main disconnect switch to the compressor contactor, evaporator and condenser fan contactors, heater contactors (as required) and the control circuit.
2. The evaporator fans operate continuously, except during periods of forced defrost. On electric defrost units, the defrost heaters are OFF during refrigeration.
3. The room thermostat closes when the room temperature rises above the set point.
4. The liquid line solenoid is energized. It opens and allows liquid to flow to the evaporator. The suction pressure rises.
5. The low-pressure control closes when the suction pressure rises above the setpoint. *Note: In extreme low ambient conditions, the liquid pressure may be insufficient to close the low-pressure control at its normal setting. If this occurs frequently, an additional low ambient start kit is required.*
6. The oil safety closes (if applicable).
7. The compressor contactor closes.
8. The compressor motor and condenser fan motor(s) start simultaneously. The room temperature drops as refrigeration continues.
9. The room thermostat opens when the room temperature reaches the setpoint. Power to the liquid line solenoid is interrupted and it closes. The refrigerant flow into the evaporator stops.
10. The compressor continues to operate, "pumping down" the system. The low-pressure control opens when the suction pressure falls below the cutout setting.
11. The compressor contactor opens and the compressor and fan motor(s) stop. The room temperature will begin to rise and the cycle repeats.

<u>Off Cycle, Air Defrost</u> - When the room temperature is 34 degrees and higher, the air temperature is sufficient to remove the frost from the fins during the compressor "off" cycle. If the compressor run time is more than 18 hours a day, a timer should be installed to force the compressor off to allow the coil to defrost.

<u>Electric Defrost Cycle</u> - When the room temperature is below 34 degrees, the air temperature is not sufficient to remove the frost from the coil during the compressor "off" cycle. Left to accumulate, the frost will close the space between the cooling fins and the refrigeration unit will soon lose its ability to "keep up" with the load. The electric defrost cycle operates as follows.

1. The time clock initiates the cycle at the predetermined setting on the dial. Typically, two defrosts per 24 hrs are sufficient. Heavier frost loads may require an extra defrost period.
2. Two switches on the timer act simultaneously to open the circuit to the liquid line solenoid and enable the defrost heaters. When the compressor pumps down and the compressor contactor opens, the defrost heaters are energized.
3. As the heaters raise the temperature of the evaporator to 32 degrees, the frost begins to melt. The temperature of the evaporator will begin to rise as the defrosting continues.
4. When the coil temperature reaches the setpoint on the defrost termination control (about 55 degrees) it closes. This reverses the position of the two switches acting in the timer (Step 2).
5. The heaters are de-energized.
6. The heater safety remains closed. (If the defrost termination would have failed, the heater safety would have opened at about 75 degrees, terminating the defrost).
7. When the thermostat calls for cooling, the liquid line solenoid opens. When the suction pressure rises above the setting on the low pressure control, the compressor and condenser fan motors start.
8. The evaporator fan delay remains open until the coil temperature reaches about 35 degrees. At that point it closes and the evaporator fans start. This delay prevents warm air from being discharged into the room.
9. The system resumes the normal refrigeration cycle until another defrost is initiated by the timer.

<u>Hot Gas Defrost Cycle</u> – Please contact your Cancoil sales representative for Hot Gas Defrost O & I.

Section 4. Leak Testing and Charging

All hook-up, evacuation, testing and charging work must be done by a licensed refrigeration contractor. ***Proper procedures must be followed at all times to prevent venting of harmful refrigerants to the environment.***

Leak Testing - The system should be leak tested after all pipe connections have been made. Leak test at 175 PSIG (or higher if required by local code) with all flow control valves in the system open. A mixture of refrigerant (35 PSIG) and nitrogen (to the test pressure) should be used with an electronic leak detector. Leaks should be marked, isolated and repaired.

Evacuation - Proper evacuation and charging are critical for proper system performance, especially when using the newer refrigerants and ester oils, which have a high affinity for water. Use a good vacuum pump designed specifically for this duty. DO NOT USE THE COMPRESSOR AS A VACUUM PUMP, OR START THE COMPRESSOR WHEN IT IS UNDER A VACUUM.

Connect the vacuum pump to both the high side and the low side of the system with 1/4” minimum ID Copper tubing. Evacuate the system for at least 2 hours and to a pressure of 250 microns. Isolate the system with a hand valve to check the pressure.

Refrigeration Oil - Before starting the system, check to make sure that the compressor crankcase contains the right kind of refrigeration oil and is charged with the proper amount. Add oil if necessary before starting the compressor.

Charging - Before starting the unit, check all electrical and mechanical connections for looseness that may have occurred during shipment. Tighten any loose connections. The following charging procedure should be followed.

1. Make sure the compressor floats freely on its mounting and that any shipping clamps have been removed and that any rubber grommets have been properly installed.
2. Set the high and low-pressure controls according to the recommendation in Section 6.
3. Make sure that all flow valves in the system are open.
4. With the compressor off, charge the system through the liquid line service valve until the system pressure equals the pressure in the charging cylinder.
5. With the compressor running, add refrigerant vapor through the suction service valve to the desired amount. The sight glass leaving the condenser should be full (clear). See Section 6 for operating charge and pumpdown capacity.

Section 5. Start-up and Check Out Procedures

1. Check the supply voltage when the system is operating. It must be within 10% of the unit nameplate voltage.
2. Check the amperage on the compressor. It must be less than the value listed on the unit nameplate. The amperage on each leg must agree within 2%.
3. Check the liquid line sight glass leaving the receiver. It should indicate a dry condition and full charge. If the sight glass is bubbling, check for leaks and adjust the charge.
4. Check the crankcase heater to make sure that it is working during compressor off cycles. IT IS HOT!
5. Check the operating control settings. See Section 6.
6. Check the oil level in the compressor sightglass after several hours of operation. The sightglass should indicate half full. If not, adjust the oil level as necessary until the sight glass indicates half full. When adding oil, make sure to use the proper type for the refrigerant (many of the newer refrigerants require ester oil).
7. Check the room thermostat setting and adjust if necessary.
8. Check the superheat setting at the expansion valve after the room has reached its final temperature. If necessary, adjust the expansion valve to provide about 5- 6 degrees superheat at the evaporator.
9. Check the defrost timer setting (if applicable) for the number of defrosts and the correct time of day. Adjust the fail safe to 30 minutes.
10. Check the operation of the defrost cycle. When the evaporator coil has become frosted, manually initiate a defrost. Check all evaporator defrost heaters and controls to assure that they are functioning properly, and that the evaporator is clear of frost and ice before the unit returns to refrigeration. Make sure that the evaporator fan delay is functioning properly when the unit returns to refrigeration. The drain line heater should

be working and the drain line should be free of obstructions. The evaporator drain pan should drain freely during defrost. Set the timer to the correct time of day when the defrost checkout is complete.

11. Check the operation of the pumpdown cycle. When the room thermostat is satisfied. The liquid line solenoid should close and the compressor should continue to operate until the low pressure control cuts out. If the compressor continues to run, check the low pressure control setting.

12. Check the system head pressure, see Section 6.

Section 6. Controls and Adjustment

The following table summarizes the controls and options typically found on Cancoil condensing units. Even though many units are ordered fully equipped with all the standard features, some units are specially configured for a particular application or specific location. These may have been built without some features, or may have additional options installed. It is important to inspect each unit at start-up and before service or maintenance to determine which components have been installed. For information on adjusting these special units, contact your Cancoil sales representative.

Table 5. – Condensing Unit Low Ambient Features & Control Options

Condensing Unit Feature	Condensing Unit Model RCU
Crankcase Heater	opt
Adjustable High Pressure Control	std
Adjustable Low Pressure Control w/pumpdown control system	std
Adjustable Condenser Head Pressure Control Valve	std
Heated & Insulated Receiver	opt

The following paragraphs describe the function and adjustment of the various components.

Crankcase Heater – Heats the compressor crankcase to prevent liquid refrigerant from condensing during compressor “off” cycles. Heater is inactive when compressor is operating. Non-adjustable.

Adjustable High Pressure Control – Prevents the system from operating at conditions that could be unsafe or cause damage to the compressor. The high pressure control should be adjusted as follows:

Table 6. – High Pressure Control Adjustment

Refrigerant	Cut in	Cut out
R 134a	115	245
R 22	175	350
R 404a	220	400
R 507	220	400

Adjustable Low Pressure Control w/ Pumpdown Control System – The low pressure control prevents the system from operating at conditions that could cause damage to the compressor. The pumpdown control system prevents liquid refrigerant from condensing in the evaporator and/or suction line during compressor “off” cycles. The low pressure control should be adjusted as follows:

Table 7. – Low Pressure Control Adjustment

Temperature (minimum of ambient or refrigerated space)	Low Pressure Control Adjustment					
	R 134a		R 22		R 404a/ R507	
	cut in	cut out	cut in	cut out	cut in	cut out
20 and above	18	3	40	20	55	35
0	4	0	22	5	32	10
-10	*	*	14	0	24	5
-20	*	*	8	0	16	0
-30	*	*	3	0	9	0
-40	*	*	*	*	5	0

* - consult factory when vacuum setting is required

Head Pressure Controls - The condensing temperature (head pressure) normally rises and falls with changes in the outdoor ambient. During low ambient conditions, it is often necessary to artificially maintain a minimum head pressure for stable system operation. This is especially true if the suction pressure must be accurately controlled or if the expansion valve requires a minimum pressure differential for proper operation. The following table lists the condensing temperature vs. pressure for several common refrigerants. The condensing temperature range on RCU units will typically vary between 15 and 25 degrees above the outdoor ambient temperature.

Table 8. - Refrigerant Pressure vs. Condensing Temperature

Condensing Temperature	Approx. Head Pressure (PSIG)			
	R 134a	R 22	R 404a	R 507
70	71	121	149	154
80	87	144	176	180
90	104	168	210	204
100	124	196	244	237
110	146	226	281	272
120	171	260	322	312

Condenser Fan Cycling - If the air cooled condenser has fan cycling controls installed, they should be adjusted according to the manufacturers recommendations. Typical values for ambient fan cycling are illustrated in the following table.

Table 9. - Typical Condenser Ambient Fan Cycling Control Adjustment

Number of Fans or Pairs of Fans	Ambient Fan Cycling Setpoint for Fan (Pair) Number ……						Minimum Outdoor Ambient
	1	2	3	4	5	6	
1	n/a	n/a	n/a	n/a	n/a	n/a	80
2	n/a	80	n/a	n/a	n/a	n/a	67
3	n/a	73	80	n/a	n/a	n/a	57
4	n/a	67	75	80	n/a	n/a	50
5	n/a	62	71	76	80	n/a	44
6	n/a	57	67	73	77	80	40

Head Pressure Control Valve – If the outdoor temperature falls below the minimum outdoor ambient shown in Table 9, a head pressure control valve may be required. This valve will maintain stable head pressure in operating conditions down to about – 40 degree condenser ambient.

The control functions by allowing some of the hot gas to bypass the condenser whenever the head pressure falls below the setpoint. This causes liquid refrigerant to back up into the condenser tubes, flooding some of the tube surface. The condenser capacity is reduced and the head pressure rises. During periods of warm outdoor temperature, the liquid returns to the refrigerant receiver, and the condenser returns to full capacity.

On units with adjustable controls, the factory setting is 120 psig. The setting is increased by turning the adjusting stem clockwise, and decreased by turning it counter clockwise. Approximately 15 - 20 psi change in head pressure results from 1 complete turn of the adjusting stem. Refrigerant gauges should be used when setting the control valves. (See Table 8 for condensing temperature vs. pressure).

Refrigerant Operating Charge - In order for the head pressure control valve to function properly during low ambient conditions, there must be sufficient refrigerant charge in the receiver to flood the condenser and still maintain a liquid seal at the receiver outlet.

During summer operation, the receiver must be sufficiently large to hold the condenser winter charge plus the normal system pumpdown charge.

The following table lists summer operating charge for the compressor unit and the receiver pumpdown capacity for RCU condensing units.

Table 10. - RCU Unit Charge

Compressor Unit Model and Nominal HP		
RCU Models	Operating (LBS.)	Pumpdown (LBS.)
5 H2/M2	7.8	31
8 & 10 H2/M2	15.5	62
15 H2/M2	23.5	94
20, 25 & 30 H2/M2	32	128
35 & 40 H2/M2	40.5	162
50 H2/M2	45	180
60 H2/M2	56.8	227
4 & 6 L2	9.8	39
8, 10 & 12 L2	15.5	62
15, 22 & 29 L2	23.5	94
31 L2	32	128

Notes:

Table values are for R 22 and may be used for R 134a
Multiply by .88 for R 404a/ R 507

To assure sufficient charge for winter conditions, and to avoid nuisance high pressure trips in summer conditions, the extra refrigerant required to flood the condenser should be weighed into the system. Do this when the system is operating with its summer charge. Make sure that all condenser fans are “on” when adding the extra winter charge.

Heated and Insulated Receiver – Maintains receiver pressure during low ambient conditions. Recommended for extended “off” cycles in low ambient conditions, or whenever the ambient temperature corresponds to a vacuum pressure for the refrigerant.

Section 7. Troubleshooting

Problem	Possible Causes	Corrective Action
Compressor will not run	1. Disconnect switch open 2. Blown fuse 3. Compressor motor protector open 4. Compressor contactor defective 5. Thermostat is open 6. Low pressure control is open 7. Defrost timer is open 8. Liquid line solenoid is closed 9. Compressor motor problem 10. Loose wiring	1. Close disconnect 2. Determine cause for blown fuse. Repair problem and replace fuse. 3. Allow time for motor protector to reset (automatic). When compressor restarts, check for cause and repair. 4. Replace 5. If room temperature is above setpoint, check thermostat. 6. Check setting on low pressure control. 7. Check timer for proper operation, replace if necessary 8. Check solenoid operation, holding coil. Replace coil if defective 9. Check motor and motor circuit for possible causes 10. Check all wire terminals. Tighten if necessary.
Compressor runs but is noisy or vibrates severely	1. Liquid refrigerant is returning to the crankcase 2. Compressor hold down nuts too tight or shipping clamps still installed. 3. Compressor is worn	1. Check expansion valve superheat setting and adjust if necessary. If system has liquid/ suction heat exchanger, make sure it is not ruptured. 2. Loosen hold down nuts until compressor floats on springs. Make sure shipping clamps are removed. 3. Replace when necessary
Head pressure is TOO HIGH	1. System has been overcharged with refrigerant 2. Non-condensibles in system 3. condenser coil is dirty 4. Condenser fans off 5. Compressor discharge service valve	1. Remove and recover refrigerant. DO NOT VENT TO ATMOSPHERE 2. Remove non-condensibles and recover refrigerant 3. clean condenser coil with non-corrosive cleaning agent. Take care to avoid damage to the fins when cleaning 4. Check setting on fan cycling thermostat. Check fuses and fan electrical circuit. 5. Fully open valve
Head pressure is TOO LOW	1. Low head pressure system 2. Condenser fan cycling thermostat mis-adjusted 3. Refrigerant charge too low 4. Compressor valves damaged	1. No problem 2. Check setting and re-adjust 3. Check system for leaks and repair. Check system for “flooding charge” requirement for low ambient conditions. Add charge as required. 4. Replace compressor.
Suction pressure is TOO LOW	1. Refrigerant charge is low 2. Evaporator is “iced up” 3. Liquid line filter/ drier is plugged 4. Suction filter is plugged 5. Thermal expansion valve not properly feeding refrigerant	1. Check system for leaks. Repair. Add refrigerant as required. 2. FULLY defrost coil. Check defrost system and adjust/ repair as required 3. Replace filter/ drier 4. Replace suction filter (core) 5. Check expansion valve size, superheat and operation. Adjust or repair as required. Check circuits to determine if coil is feeding evenly. Check for proper oil return (below)
Oil level is too low or Oil pressure too low	1. Insufficient oil charge in system 2. Oil is not returning to system 3. Compressor is short cycling 4. Too much liquid in compressor crankcase 5. Worn compressor	1. Add oil of proper type to bring glass to 1/2 full. 2. Check system piping for traps. Check thermal expansion valve setting for excessive superheat. Check evaporator for proper feeding. Repair as re-quired. 3. Check low pressure control setting. Adjust if required. 4. Check crankcase heater for operation. Check TXV setting. Check for leaking liquid line solenoid. Check liquid suction heat exchanger for internal leak. Repair or replace as required. 5. Replace