Options Section....

CONDENSING SECTION

SYSTEM CHARGING (DEHUMIDIFIERS WITH CONDENSING UNITS):

The factory installed condensing units are shipped fully charged. The condensing units are pumped down and all service valves closed prior to shipment. All service valves must be opened before the condensing units may be operated. Be careful not to over-tighten the valves or damage to the seat and packing gland may result and the valve may leak refrigerant.

If the condensing unit is supplied with a crankcase heater, power should be supplied to the condensing unit for at least 5 hours before the condensing unit is put into operation. This will evaporate any liquid refrigerant that may have condensed in the compressor crankcase.

Compressor shipping hold down bolts (spring mounted compressors) should be loosened until compressor swings free on its isolators.

START-UP:

This is a continuation of the "system charging" and must be performed before condensing unit(s) may be left operating and unattended. This will involve checking and adjusting of all safety and operating controls (pressure and temperature controls have been set at factory, however; it is still desirable to confirm that settings are correct and controls function properly). Do not attempt to reset safety controls without some means of stopping the equipment in the event of extreme high or low pressure/temperature conditions that could damage the equipment. If controls fail to function at set points, determine cause and correct. **(Jumping or bypassing any safety control other than for testing purposes is dangerous to personnel and equipment, and nullifies the equipment warranty)**.

NOTE: a qualified technician should perform Adjustments to the refrigeration equipment.

High-pressure control - connect a gauge to the compressor discharge service valve. Stop condenser airflow by stopping fans on air-cooled equipment. Control should open immediately when discharge pressure reaches control set point.

Low pressure (Pump-down) control - connect a gauge to the compressor suction service valve. Throttle liquid line service valve to lower suction pressure at the compressor. Compressor should pump-down and de-energize when suction pressure reaches "cut-out" setting of control. Open liquid line service valve and observe rise in pressure at compressor suction connection. Compressor should be energized when pressure reaches "cut-in" setting of control.

Oil pressure control (if applicable) - connect the wires between terminals T1 and T2. Compressor should run approximately 90 seconds and cycle off. Remove jumper and reset control. Check operating oil pressure. This is the differential between oil pump discharge pressure and suction pressure and should be a minimum of 10 psig. Also, after several hours running time, check oil level in compressor. Proper level is approximately 1/4 level on oil sight glass.

Thermal expansion valve - Check super-heat setting and adjust if necessary. The amount of super-heat is found by measuring the temperature and the pressure of the suction gas at the leaving side of

the evaporator (coil). The difference between the gas temperature and the saturation temperature that corresponds to the suction pressure is the amount of super-heat.

Hot gas by-pass - Connect gauge to compressor suction service valve. Throttle liquid line service valve to lower suction pressure at compressor. Hot gas regulator should begin to open as suction pressure approaches design suction pressure. This should be done before unit has pulled down to design conditions.

PERIODIC MAINTENANCE

ONCE A WEEK: (Equipment supplied with condensing units)

1. Check compressors oil level. If low, allow the compressor to operate continuously at full load for 3 to 4 hours, checking the oil level at 30-minute intervals. If level remains low, add oil.

2. Observe the oil pressure. The oil pressure gauge reading should be approximately 20 to 35 PSI above the suction pressure gauge reading.

3. Stop the compressor and check the shaft seal for excessive oil leakage. If found, check the seal with a refrigerant leak detector (open compressor only).

4. Check the general operation conditions, system pressures, refrigerant sight glass, etc.

5. Check reactivation inlet temperatures.

6. Check process and reactivation pressure drops.

7. Check inlet filters.

8. Check the condition of the air filters and air handling equipment. Clean or replace filters, as necessary.

ONCE A MONTH (REPEAT ITEMS 1 THROUGH 8):

9. Lubricate the fan and motor bearings, as necessary. Obtain and follow the manufacturer's lubricant specifications and bearing care instructions.

10. Check fan belt tension and alignment.

11. Tighten all fan sheaves and pulleys. If found to be loose, check alignment before tightening.

12. Check condition of condensing equipment:

    A. *Air cooled* - observe condition of condenser coil. Clean as necessary.

    B. *Water cooled* - check cooling tower water. If algae or scaling are evident, water treatment is needed. Clean towers sump strainer screen.

ONCE A YEAR (REPEAT ITEMS 1 THROUGH 12):

13. Drain all circuits of the water condensing system. Inspect the condenser piping and clean any scale or sludge from the tubes of the condenser.

14. If a cooling tower or evaporative condenser is used, flush the pumps and sump tank. Remove any rust or corrosion from the metal surfaces and repaint.

15. Inspect all motor and fan shaft bearings for signs of wear. Check shafts for proper endplay adjustment.

16. Replace worn or frayed fan belts.

17. Clean all water strainers.

18. Check condition of access panel gasketing.

19. Check the condition of the ductwork.

20. Check the condition of the electrical contacts of all contactors, starters and controls.

21. Check desiccant media, media seal, and drive belt condition.

SEASONAL SHUTDOWN:

In preparation for seasonal shutdown, it is advisable to pump down the system and valve-off the bulk of the refrigerant charge that might be lost due to any minor leak on the low-pressure side of the system.

1. Close the liquid line shutoff valve at the condenser and start the system. When the suction pressure drops to the cutout setting of the low-pressure control, the compressor will stop.

2. Open the compressors electrical disconnect switch, to prevent the compressor from restarting and then front seat the compressor discharge and suction valves.

3. Using a refrigerant leak detector, check the condenser and liquid receiver, if used, for refrigerant leaks.

4. Valve-off the supply and return water connections of a water-cooled condenser. Allow the condenser to remain full of water during the off season. A drained condenser shell is more likely to rust and corrode than one that is full of water.

    A. If the condenser will be subjected to freezing temperatures, drain the water and refill with an antifreeze solution.

5. Drain the cooling tower or evaporative condenser, if used, flush the sump and paint any rusted or corroded areas.

6. Open the systems master disconnect switch and padlock in the open position.

SEASONAL START-UP:

1. Perform all annual maintenance on the air handling system and other related equipment.

2. Fill the water sump of the cooling tower or evaporative condenser, if used.

3. Open the shutoff valves of a water-cooled condenser.

4. Make certain that the liquid line solenoid valve(s) is on automatic control.

5. Open the liquid line shutoff valve.

6. Back seat the compressor suction and discharge valves.

7. Close the systems master electrical disconnect switch.

8. Start the system.

9. After the system has operated for 15 to 20 minutes, check the compressor oil level sight glass, oil pressure and the liquid line sight glass. If satisfactory, readjust the system temperature controller to the proper temperature setting.

HOT GAS BYPASS SYSTEMS

SYSTEM CAPACITY CONTROL (UNITS WITH CONDENSING UNITS):

On all Bry-Air dehumidifiers equipped with refrigeration equipment, it is desirable to limit the minimum evaporating pressure during periods of low load. This prevents coil icing and avoids operating the compressor at a lower suction pressure than it was designed for. Several methods are used to achieve this result: integral cylinder unloading, hot gas bypass, or both.

BYPASS TO EVAPORATOR INLET WITH DISTRIBUTOR:

The primary advantage of this method is that the system thermostatic expansion valve will provide the liquid required for de-superheating. Also, the evaporator serves as an excellent mixing chamber for the bypassed hot gas and the liquid-vapor mixture from the expansion valve. This ensures a dry vapor reaching the compressor suction. Oil return from the evaporator is also improved since the velocity in the evaporator is kept high by the hot gas.

BYPASS TO SUCTION LINE WITH LIQUID INJECTION VALVE:

With this method, hot gas is bypassed directly into the suction line downstream of the main thermostatic expansion valve's bulb. An auxiliary thermostatic expansion valve, commonly called a de-superheating thermostatic expansion valve or a liquid injection valve, is required.

The purpose of this valve is to supply enough liquid refrigerant to cool the hot discharge gas to the recommended suction temperature. The liquid injection valve is matched to the hot gas bypass valve at the factory and adjusted. However, it may be field adjusted if necessary.

A suction line accumulator is installed downstream of the bypass connection with the auxiliary thermostatic expansion valve bulb down stream of the accumulator to ensure a good mixture of bypassed hot gas and liquid-vapor.

NOTE: On systems with remote condensers, special care must be taken in the system piping to accomplish satisfactory oil return to the compressor from the low side.

HEAD PRESSURE CONTROL:

In order to achieve proper system operation, it is necessary that adequate discharge pressures be maintained to insure that the expansion valve will feed correctly to prevent low suction conditions. The expansion valve is sized

to meet capacity requirements at a pressure differential between discharge pressure and design suction pressure. If discharge pressure is allowed to drop below a point which will not maintain this design differential, the suction will also drop due to "starving" of the evaporator. When this happens, nuisance tripping of low-pressure control, or low evaporator temperature, will occur.

Normal system design will allow satisfactory operation with discharge pressure down to approximately 180.3 PSI (95° F).

On air cooled equipment, a number of methods are used to maintain this minimum discharge pressure:

FAN CYCLING - For applications where ambient temperatures are not extreme, the condenser fan(s) is cycled on/off in response to condenser pressure.

FAN SPEED CONTROL - A fan speed control device activated by a temperature or pressure sensor controls the condenser fan motor speed in response to the saturated condensing temperature or discharge line pressure. For outdoor temperatures down to - 20° F, it maintains condensing temperature at 100 $\pm$10° F.

On water-cooled equipment, discharge pressures are much easier to control. The most common method would be by the use of condenser water regulating valve directly sensing discharge pressure.

TROUBLE SHOOTING GUIDE FOR UNITS WITH DX COOLING

Complaint	Symptoms	Probable Cause	Recommended Action	Ref. Note
A. Compressor fails to start	1. Electric circuit test shows no voltage on line side of motor starter	a. Power failure.	a. Check for blown fuse or broken lead.	
		b. Disconnect switch open.	b. Determine why switch was opened. If everything is satisfactory, close switch.	
	2. Electric circuit test shows voltage on line side but not on motor side of fuse.	Fuse blown.	Replace fuse. Check load on motor.	
	3. Electric circuit tester glows but not at full brilliance.	Low voltage.	Check with voltmeter. If low, call power company.	
	4. Full voltage at motor terminals but motor will not run.	Burned out motor.	Repair or replace.	
	5. Inoperative motor starter.	Burned out holding coil or broken contacts.	Repair or replace.	
	6. Compressor will not operate.	Frozen compressor due to locked or damaged mechanism.	Overhaul compressor.	
	7. Resetting high-pressure switch can restart system.	See complaint G.	See complaint G.	
	8. Resetting oil failure protection control switch can restart compressor. Compressor runs for a short time and again stops.	Oil failure protection control switch has cut out.	Check oil level, oil pressure, wiring and control.	
	9. Starter will not pull in.	a. Overload contacts open.	a. Determine cause of failure. Reset overload contacts.	
		b. Open control circuit.	b. Locate open control, determine cause.	

TROUBLE SHOOTING GUIDE FOR UNITS WITH DX COOLING

Complaint	Symptoms	Probable Cause	Recommended Action	Ref. Note
B. Compressor "Short Cycles"	1. Normal operation except too frequent stopping and starting.	Intermittent contact in electrical control circuit.	Repair or replace faulty control.	
	2. Normal operation except too frequent stopping and starting on low-pressure controls switch.	a. Low-pressure control differential set too close.	a. Reset differential in accordance with job conditions.	
		b. Lack of refrigerant.	b. Repair refrigerant leak and recharge.	1
		c. Reduced airflow. 1) Dirty coil 2) Dirty air filters 3) Broken fan belt 4) Improper fan belt tension.	c. Clean coil, filters and check fan drive.	
	3. Suction pressure too low, frosting at filter-drier.	Restricted liquid line filter-drier.	Replace core.	2
	4. Compressor will not load or unload. Cuts out on low-pressure switch.	Inoperative compressor unloading system.	Repair or replace faulty control.	
C. Compressor looses oil.	1. Oil level too low.	Insufficient oil charge.	Add oil.	
	2. Oil level gradually drops.	a. Improper pipe size or design.	a. Resize lines, provide oil lift traps.	
		b. Liquid flood-back. (Excessively cold section).	b. Readjust superheat setting; check remote bulb contact with suction line.	5
	3. Oil around compressor base and low crankcase.	Crankcase fittings leak oil.	Repair oil leaks and add proper compressor oil.	

TROUBLE SHOOTING GUIDE FOR UNITS WITH DX COOLING

Complaint	Symptoms	Probable Cause	Recommended Action	Ref. Note
D. Compressor runs continuously.	1. High temperature in conditioned area.	Excessive load.	Check for excessive infiltration or ventilation load. Check for inadequate insulation of space.	
	2. Low temperature in conditioned area.	Thermostat controlling at too low a temperature.	Reset or repair thermostat.	
	3. Bubbles in sight glass.	Lack of refrigerant.	Repair leak and charge.	1
	4. Compressor noisy or operating at abnormally low discharge pressure or abnormally high suction pressure.	Leaky valves in compressor.	Overhaul compressor.	4
	5. Compressor fully or partially unloaded, but will not stop.	Solenoid stop valve leaks.	Repair valve.	3
E. Compressor is noisy.	1. Compressor cuts out on oil failure protection control.	Lack of oil.	Add oil.	
	2. Compressor knocks.	Internal parts of compressor broken.	Overhaul compressor.	
	3. Abnormally cold suction line. Compressor knocks.	a. Liquid "flood back."	a. Check and adjust superheat. Check for loose remote bulb on section line.	5
		b. Expansion valve stuck in open position.	b. Repair or replace expansion valve.	
	4. Compressor jumps on base.	Compressor loose on base.	Tighten compressor hold down bolts.	

TROUBLE SHOOTING GUIDE FOR UNITS WITH DX COOLING

Complaint	Symptoms	Probable Cause	Recommended Action	Ref. Note
F. System short of capacity.	1. Expansion valve hisses.	Flash gas in liquid line.	Add refrigerant.	1
	2. Temperature change in refrigerant line through filter-drier or solenoid stops valve.	Clogged filter-drier or solenoid stops valve.	Replace filter core, clean valve.	2
	3. Short-cycling or continuous running.	Expansion valve stuck or obstructed.	a. Repair or replace expansion valve.	6
		b. Improper superheat adjustment.	b. Check superheat and reset.	5
	4. Superheat too high.	Excessive pressure drops in evaporator.	Check superheat and reset thermostatic expansion valve.	5
	5. Short-cycling.	Reduced airflow. a) Dirty coil. b) Dirty air filters. c) Faulty fan drives.	Clean coil, filters and check fan drive.	
G. Discharge pressure too high.	1. Excessively warm water-leaving condenser.	Too little or too warm condenser water.	Provide adequately cool water. Lower setting of cooling tower thermostat.	
	2. Excessively cool water leaving condenser.	Fouled tubes in shell-and-tube condenser.	Clean tubes.	
	3. Exceptionally hot condenser.	a. Air or non-compressible gas in system.	a. Remove charges, evacuate and recharge.	
		b. Overcharge of refrigerant.	b. Remove excess or purge.	7
		c. Coil of air-cooled condenser obstructed.	c. Remove obstruction.	
	4. Cooling tower (if used) appears to be operating satisfactorily yet excessive discharge pressure exists.	Cooling tower too small.	Recheck coiling tower rating table for correct size selection.	

Complaint	Symptoms	Probable Cause	Recommended Action	Ref. Note
H. Discharge pressure too low.	1. Excessively cold water leaving condenser.	Too much or too cool condenser water.	Adjust water regulating valve or cooling tower thermostat setting.	
	2. Cooling tower (if used) appears to be operating satisfactorily yet excessively low discharge pressure exists.	Cooling tower too large.	Recheck cooling tower rating table for correct size selection. Adjust cooling water flow rate.	
	3. Compressor short cycles.	Air-cooled condenser operating with low temperature outdoor air.	Consider controlling condensing temperature with condenser discharge air dampers or fan control.	
	4. Suction pressure rises faster than 5psi per minute after compressor shutdown.	Leaky or broken compressor discharge valves.	Remove head, examine valves and replace, as necessary.	
J. Suction pressures too high.	1. Compressor runs continuously.	Excessive load on evaporator.	Check outdoor air dampers for excessive intake of high temperature ventilation air.	
	2. Abnormally cold suction line. Liquid flooding back to compressor.	a. Expansion valve overfeeding.	a. Regulate superheat setting of expansion valve and check to see that remote bulb is properly attached to suction line.	5
		b. Expansion valve stuck in open Position.	b. Repair or replace valve.	
	3. Noisy compressor.	Broken suction valves in compressor.	Remove head; examine valves and replace, as necessary.	4

Complaint	Symptoms	Probable Cause	Recommended Action	Ref. Note
K. Suction pressures too low.	1. Bubbles in sight glass.	Lack of refrigerant.	Repair leak and charge.	1
	2. Temperature change in refrigerant line through filter-drier or solenoid stops valve.	Clogged liquid line filter-drier or solenoid valve.	Charge filter-core or clean valve.	2
	3. No flow or refrigerant through expansion valve.	Expansion valve power assembly has lost charge.	Replace expansion valve power assembly.	6
	4. Loss of capacity.	Obstructed expansion valve.	Clean valve or replace, if necessary.	
	5. Conditioned pace too cold.	Contacts on control thermostat stuck in closed position.	Repair thermostat or replace, if necessary.	
	6. Compressor short-cycles.	a. Compressor capacity control range set too low.	a. Reset compressor capacity control range.	
		b. Air-cooled condenser operating with low temperature outdoor air.	b. Consider controlling condensing temperature with condenser discharge air dampers or fan control.	

Trouble Analysis Notes

1. ***Refrigerant Shortage*** - The system must contain sufficient refrigerant charge to flood the sub-cooling tubes of the condenser. If the system is short of charge, refrigerant gas enters the sub-cooling tubes, causing them to become part of the condensing surface. This robs the condenser of its ability to sub-cool the liquid. Without sub-cooling, the liquid leaves the condenser at saturation temperature and pressure. Therefore, any pressure drop within the liquid line causes some of the liquid to flash; reducing the temperature of the remaining liquid to the saturation temperature that corresponds to the lower pressure. Flash gas displaces liquid within the port of the expansion valve, reducing the valve's capacity. This results in reduced evaporator capacity and a corresponding reduction in suction pressure.

2. ***Restricted Filter-Drier*** - The liquid line filter-drier may become clogged with dirt and other foreign matter left in the system during erection. This will most likely occur during the first few weeks of system operation. A temperature drop between the inlet and outlet connections evidences a clogged filter-drier. If it is badly clogged, frost may appear on the outlet piping. The restriction is causing a pressure drop, which, in turn, is causing the liquid to flash. Flash gas reduces the capacity of the expansion valve, resulting in a reduction in evaporator capacity and suction pressure.

3. ***Leaking Liquid Line Solenoid Valve*** - If the liquid line solenoid valve leaks badly, the compressor may be unable to reduce the suction pressure sufficiently to terminate the pump-down cycle. This will cause the compressor to run continuously on its minimum stage of loading. A temperature drop evidences a leaking valve across the valve body and the appearance of flash gas in the liquid line sight glass.

4. ***Broken Compressor Valves*** - Broken compressor valves are generally indicated by a rapid rise in suction pressure immediately after the machine is stopped. If the suction pressure rises faster than 4 psig per minute, the compressor valves are not holding. However, before any action is taken, make certain that the pressure rise is not caused by a pressure leak on the low side of the system, such as a leaking liquid line solenoid valve.

5. ***Superheat Adjustment*** - If the thermostatic expansion valve is adjusted to produce too little superheat, liquid refrigerant may pass from the evaporator into the suction line. An abnormally cold suction line and possible liquid flood-back to the compressor evidence this. On the other hand, too much superheat results in the feeding of too little refrigerant to the evaporator. This will cause a shortage of evaporator capacity, which is particularly noticeable at system full load conditions. Adjust the superheat carefully, taking as accurate suction pressure and temperature readings as possible. Normally, 12 to 15 F of superheat are satisfactory for most air conditioning applications.

6. ***Inoperative Expansion Valve*** - If an expansion valve is protected from dirt and other foreign matter by a liquid line filter-drier, the most likely cause for malfunction is loss of charge from the valve power element. When this occurs, the valve remains closed or nearly closed. An inoperative expansion valve is indicated by low evaporator capacity, low suction pressure, high superheat and frosting at the evaporator inlet. To test for an inoperative power element:

a. Stop compressor.
b. Remove remote bulb from suction line.
c. Place bulb in container of ice water.
d. Start compressor.
e. Remove bulb from ice water and warm in hand. At the same time check the temperature of the suction line at the evaporator. If a rapid reduction in temperature is noted, the element is working properly.

Warning, Do not allow liquid to flood-through the coil for any longer than is necessary to complete the test. Flood-back to the compressor should be avoided at all cost.

7. ***Refrigerant Overcharge*** - An overcharge of refrigerant causes a portion of the condenser tubes to become flooded with liquid, or submerged in liquid in the case of the water-cooled condenser, reducing the effective condensing surface. This increases the condensing temperature and pressure, resulting in possible trip-out on the high-pressure control or compressor overloads. The refrigerant overcharge is removed by connecting a refrigerant cylinder to the liquid line-charging valve; starting the system and opening the charging valve. Since the pressure within the liquid line is greater than that in the cylinder, refrigerant will flow into the cylinder. Icing the cylinder will further reduce the pressure, speeding the removal of refrigerant. Remove enough refrigerant to return the condensing pressure to normal.

8. ***Improperly Sized Expansion Valve*** - An oversized expansion valve will generally overfeed the evaporator at part load, however at full load, it will perform satisfactorily. The reason being, at part load the valve attempts to control at its superheat setting but its oversize port allows liquid to pass too rapidly. This over-feeds the evaporator, causing a reduction in the superheat of the leaving gas. In response, the valve closes until normal superheat is re-established. At this point, the valve again opens to pass another slug of refrigerant. This "hunting" condition causes the suction pressure to vary and may not allow liquid to pass into the suction line. An undersize valve, on the other hand, controls well at part load demand. Under conditions of rising system demand, the evaporator capacity falls behind the load, and the superheat rises.