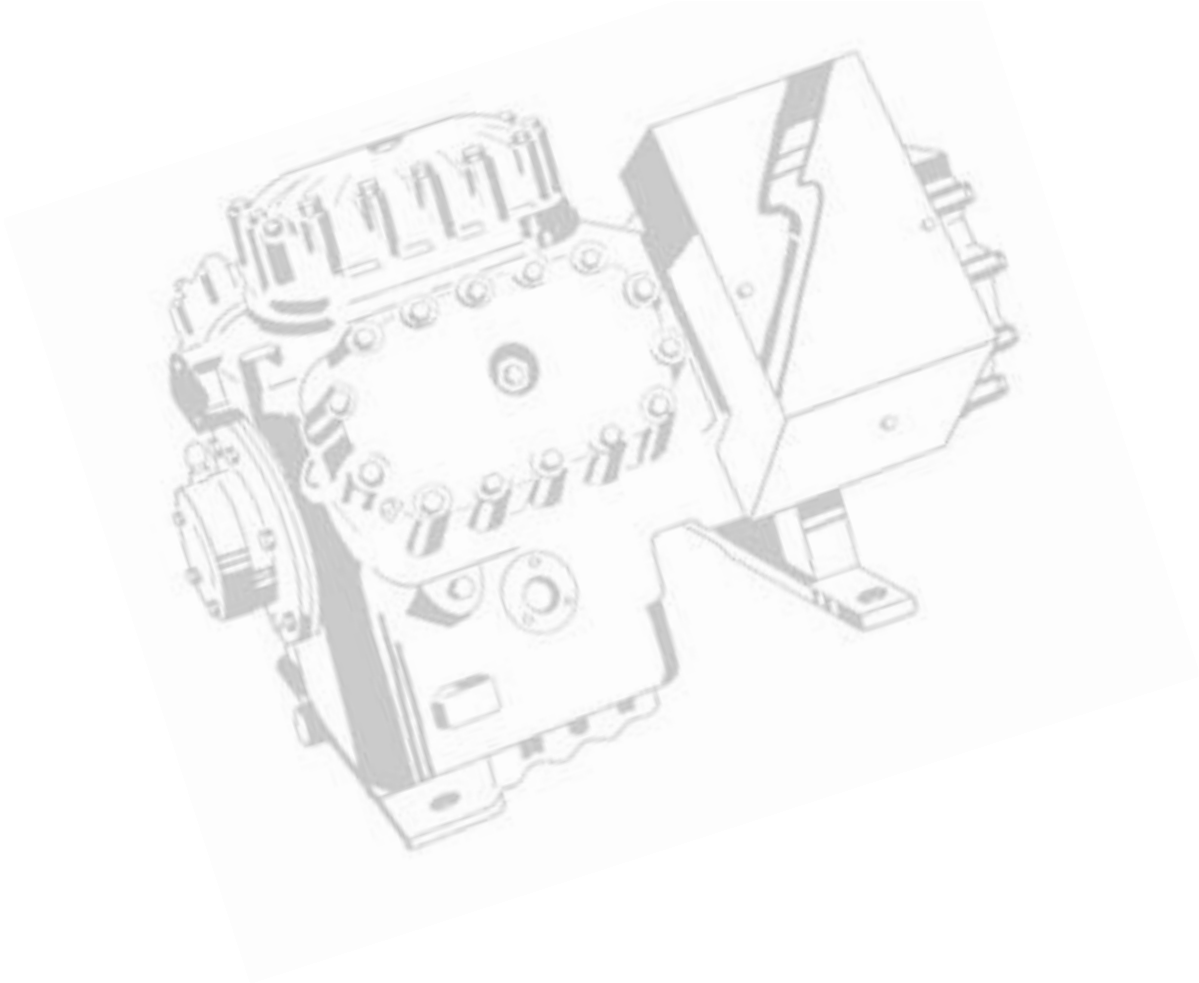




SEMI-HERMETIC COMPRESSOR TROUBLESHOOTING INFORMATION



A1 COMPRESSOR, Inc.
140 MENDEL DRIVE
ATLANTA, GA 30036
800 743-6009
www.orrbilt.com
sales@orrbilt.com





IDENTIFYING COMPRESSOR MECHANICAL FAILURES

INDICATORS, SYMPTOMS & CORRECTIONS

Most compressors fail due to system malfunction which must be corrected to prevent repeat failures. After a compressor fails, field examination of the failed compressor often will reveal symptoms of system problems. Proper corrections will help eliminate future failures.

<p><u>REFRIGERANT FLOODBACK</u> This is a result of liquid returning to the compressor during the RUNNING CYCLE. The oil is diluted with refrigerant to the point it cannot properly lubricate the load bearing surfaces.</p>	
<p><u>Open Drive Compressor</u> Worn pistons and cylinders. No evidence of overheating.</p>	<p>The liquid washed the oil off the pistons and cylinder walls during the suction stroke causing them to wear during the compression stroke.</p>
<p><u>Refrigerant Cooled Compressors</u> Center & Rear bearing worn / seized Dragging rotor, shorted stator Progressively worn crankshaft Worn or broken rods Possible worn piston rings</p>	<p>The liquid dilutes the oil in the crankcase and the refrigerant rich oil will be pumped to the rods and bearings through the crankshaft. As the refrigerant boils off, there will not be enough oil for proper lubrication at the bearing farthest from the oil pump. The center and rear bearings may seize or may wear enough to allow the rotor to drop and drag on the stator causing it to short or spot burn.</p>
<p><u>CORRECTION:</u></p> <ol style="list-style-type: none"> 1. Maintain proper evaporator and compressor superheat. 2. Correct abnormally low load condition. 3. Install suction accumulator to stop uncontrolled liquid return 	

<p><u>FLOODED STARTS</u> Worn or scored rods or bearings Rods broken from seizure Erratic Wear pattern or crankshaft</p>	<p>This is the result of refrigerant migration to the crankcase oil during the OFF CYCLE. When the compressor starts, the diluted oil cannot properly lubricate the crankshaft load bearing surfaces causing erratic wear or seizure pattern.</p>
<p><u>CORRECTION:</u></p> <ol style="list-style-type: none"> 1. Locate the compressor in a warm ambient or install continuous pumpdown. 2. Check crankcase heater operation (Should be energized during off cycle). 3. Operate with minimum refrigerant charge. 	



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<p><u>LIQUID SLUGGING</u> Broken reeds, rods or bearings. Loose or broken backer rods Blown Gaskets</p>	<p>This is the result of trying to compress liquid in the cylinders. Slugging is an extreme floodback in the first stage of compound or in open drive compressors and a severe flooded start in the second stage of compound or in refrigerant cooled compressors.</p>
<p><u>CORRECTION:</u></p> <ol style="list-style-type: none"> 1. Maintain proper evaporator and compressor superheat. 2. Correct abnormally low load conditions 3. Locate the compressor in a warm ambient or install continuous pumpdown 4. Proper oil management piping sized properly. 	
<p><u>HIGH DISCHARGE TEMPERATURE</u> Discolored valve plate Burned reed valves Worn pistons, rings and cylinders Stator spot burn from metal fragments</p>	<p>This is the result of temperatures in the compressor head and cylinders becoming so hot that the oil loses its ability to lubricate properly. That causes pistons, rings and cylinder walls to wear resulting in blow by, leaking valves and metal fragments in the oil.</p>
<p><u>CORRECTION:</u></p> <ol style="list-style-type: none"> 1. Correct high compressor ration from low load conditions, high discharge pressure conditions. 2. Check low pressure switch setting. 3. Insulate suction lines. 4. Provide proper compressor cooling motor cooling. Excessive motor heat can overheat refrigeration. 	
<p><u>LOSS OF OIL</u> All rods and bearings worn or scored Crankshaft uniformly scored. Rods broken from seizure Little or no oil in crankcase</p>	<p>This is the result of insufficient oil in the crankcase to properly lubricate the bearing surfaces. When the flow of refrigerant is too low to return oil as fast as it is being pumped out, a uniform wearing of all load bearings will result.</p>
<p><u>CORRECTION:</u></p> <ol style="list-style-type: none"> 1. Check Oil failure control operation, if applicable. 2. Check system refrigerant charge. 3. Correct abnormally low load situations or short cycling. 4. Check for improper line sizing and improper traps. 5. Check for inadequate defrosts. 	



IDENTIFYING COMPRESSOR MECHANICAL FAILURES

INDICATORS, SYMPTOMS & CORRECTIONS

ELECTRICAL FAILURES

Motors are generally damaged as a result of mechanical failures but some are true electrical failures.

<p><u>GENERAL OR UNIFORM BURN</u> Entire motor winding is uniformly overheated or burned</p>	<p><u>CORRECTION:</u></p> <ol style="list-style-type: none"> 1. Check for high or low voltage. 2. Check for unbalanced voltage 3. Check for rapid compressor cycling
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<p><u>SINGLE PHASE BURN</u> A result of not having current through the un burned and overloading of the other two.</p>	<p>Two phases of a three phase motor are overheated or burned.</p>
<p><u>CORRECTION:</u></p> <ol style="list-style-type: none"> 1. Check For proper motor protection. 2. Check contactor contacts and mechanical condition. 3. Check terminal and wiring condition. 4. Check for unbalanced voltage. 5. Check for blown fuses. 	

<p><u>HALF WINDING SINGLE PHASE BURN</u> This occurs when one half of a PART WINDING START motor has a single phasing condition. Two contactors are used in the PART WINDING START and a problem exists with one.</p>
<p><u>CORRECTION:</u></p> <ol style="list-style-type: none"> 1. Check both contactors, one will be defective. 2. Check sequence timer for one second or less total time.

<p><u>HALF WINDING BURN</u> Half of all phases are PART WINDING START motor is overheated or burned.</p>
<p><u>CORRECTION:</u></p> <ol style="list-style-type: none"> 1. Check for electrical feed back circuit energizing a contactor holding coil. 2. Replace contactors with ones properly sized.



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ELECTRICAL FAILURES

PRIMARY SINGLE PHASE BURN

Only one phase of a three phase motor is overheated or burned as the result of the loss of a phase of the primary of a Δ to Y or Y to Δ transformer configuration.

CORRECTION:

1. Check transformer for proper voltage incoming and outgoing.

START WINDING BURN

Only the start winding is burned in a single phase motor due to excessive current in the start winding.

CORRECTION:

1. Check C, S and R wiring of the compressor.
2. Check start capacitor and start relay.
3. Check for overloaded compressor.

RUN WINDING BURN:

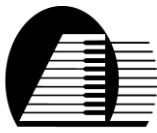
Only the run winding is burned in a single phase compressor.

CORRECTION:

1. Check start relay.
2. Check run capacitor.
3. Check supply voltage.

SPOT BURN

A localized burn within the winding, between the winding, or from winding to ground. Can be electrical failure or possible mechanical failure resulting from foreign materials in motor winding.



A-1 COMPRESSOR

TROUBLESHOOTING CHECK LIST

<u>COMPRESSOR CONDITION</u>	<u>POSSIBLE CAUSE</u>
COMPRESSOR HUMS BUT WON'T START	<ol style="list-style-type: none">1. Improperly wired.2. Low line voltage.3. Defective start relay.4. Defective run or start capacitor.5. Un-equalized pressures on PSC motor.6. Shorted or grounded motor windings.7. Internal compressor mechanical damage.
COMPRESSOR WILL NOT RUN, DOES NOT TRY TO START	<ol style="list-style-type: none">1. Power circuit open due to blown fuse, tripped circuit breaker, or open disconnect switch.2. Compressor motor protector open.3. Open thermostat or control.4. Burned motor windings – open circuit.
COMPRESSOR STARTS BUT TRIPS ON OVERLOAD PROTECTOR	<ol style="list-style-type: none">1. Low line voltage.2. Improperly wired.3. Defective run or start capacitor.4. Defective start relay.5. Excessive suction or discharge pressure.6. Tight bearings or mechanical damage in compressor.7. Defective overload protector.8. Shorted or grounded motor windings.
UNIT SHORT CYCLES	<ol style="list-style-type: none">1. Control differential too small.2. Shortage of refrigerant.3. Discharge pressure too high.4. Discharge valve leaking.
STARTING RELAY BURNS OUT	<ol style="list-style-type: none">1. Low or high line voltage.2. Short cycling.3. Improper mounting of relay.4. Incorrect running capacitor.5. Incorrect relay.
CONTACTORS STICK ON STARTING RELAY	<ol style="list-style-type: none">1. Short running cycle.2. No bleed resistor on start capacitor.
STARTING CAPACITORS BURN OUT	<ol style="list-style-type: none">1. Compressor short cycling.2. Relay contacts sticking.3. Incorrect capacitor.4. Start winding remaining in circuit for prolonged period.



TROUBLESHOOTING CHART

OBSERVATION	POSSIBLE CAUSE	REMEDY
1. COMPRESSOR WILL NOT START	Power Off	Check main switch, fuses and wiring.
	Current overload	Reset manually
	Oil safety switch open	Reset manually
	Loose electrical connections or faulty wiring.	Tighten connections. Check wiring and rewire if necessary.
	Compressor motor burned out.	Check and replace compressor, if necessary.
2. LOW COMPRESOR CAPACITY OR INABILITY TO PULL DOWN SYSTEM	Blown valve plate or cylinder head gasket.	See No. 3
	Leaky valve plate or worn valve seats.	Replace valve plate assembly
	Leaky suction valves	Pump down, remove cylinder head, examine valves and valve seats. Replace, if necessary.
	Broken connecting rods or pistons	Replace Compressor
3. BLOWN VALVE PLATE	Cylinder head bolts not properly torque	a. Replace gaskets. b. Re-torque cylinder head bolts to manufacturers specs.
	Excessive oil in compressor systems causes hydraulic cylinder pressures.	a. Remove excessive oil until oil level is maintained between 1/8 – 3/8 up the sight glass.
	Liquid refrigerant floodback or flooded start	See No. 7 (Flooding)

TROUBLESHOOTING CHART

OBSERVATION	POSSIBLE CAUSE	REMEDY
4. COMPRESSOR CYCLES INTERMITTENTLY	Low pressure switch erratic in operation	a. Check tubing to switch to see if clogged or crimped. b. Check setting of switch.
	Insufficient refrigerant in system. Suction service valve closed.	Add refrigerant.
	Suction service valve closed.	Open Valve.
	Insufficient water flowing through condenser or clogged condenser.	Adjust water regulating valve to condenser, Clean condenser.
	Discharge service valve not fully open.	Open Valve
	Air in system	Purge
5. COMPRESSOR CONTINUOUSLY CYCLES	Condenser capacity reduced by refrigerant over-charge accompanied by high discharge pressure.	Repair or Replace Check and clean tubing Remove excess refrigerant
	Plugged filter-drier.	Replace filter
	Excessive water flow through condenser	Adjust water regulating valve
6. LOW DISCHARGE PRESSURE	Suction service valve partially closed.	Open valve
	Leaky compressor suction valves.	Pump down, remove the cylinder head, examine valves and valve seats; replace if necessary.
	Worn piston rings	Replace compressor

TROUBLESHOOTING CHART

OBSERVATION	POSSIBLE CAUSE	REMEDY
7. FLOODING	Improper system piping slows liquid to compressor	Correct piping.
	Defrost cycle improperly set or not operating correctly	Do not allow more than 1/3 of system on defrost at any given time. Check operation of defrost system.
	Defective or improperly set expansion valve	Increase superheat or replace valve
	Evaporator fan failure	Correct problem or replace fan
8. LOW PRESSURE SUCTION	Insufficient refrigerant	Add refrigerant
	Evaporator fan failure	Correct problem or replace fan.
	Plugged filter-drier	Replace filter
9. COMPRESSOR NOISY	Slugging due to floodback of refrigerant.	See No. 7 (Flooding)
	Hydraulic knock due to excess oil in circulation	a. Remove excess oil b. Recheck oil return system.
	Bearings wiped because of loss of oil.	a. Add oil b. Check oil return system. c. See No. 15 (Oil Return) & No. 11 (Oil Pressure) d. Check for defective oil failure control.
	Improper support or isolation of piping	Provide sufficient right angle bends in piping to absorb vibration and support firmly with suitable hangers.
	Compressor not firmly mounted	Check for loose mounts.
	Unit not properly isolated or vibration pad defective,	Add vibration isolation or check for defective isolation pads.
Broken connecting rods, valves or other running gear.	Replace compressor.	

TROUBLESHOOTING CHART

OBSERVATION	POSSIBLE CAUSE	REMEDY
10. PIPE RATTLE	Inadequate supported piping or other running gear	Support pipes or check pipe connections.
11. OIL PRESSURE LOWER THAN NORMAL OR NO OIL PRESSURE	Low oil charge	Check oil level requirements
	Faulty oil pump drive segment	Replace segment
	Worn oil pump	Replace bearing head assembly
	Worn compressor bearings	Replace compressor
12. COMPRESSOR MOTOR PROTECTORS TRIPPING OR CYCLING	High suction pressure on low temperature compressor causes excessive amp draw	If system does not have EPR valve, throttle suction service valve until system pulls down.
	High discharge pressure	Check for loss of condenser water or blocked condenser fan or coil.
	Incorrect overload relay or must trip amp setting too low	Replace with correct overload relay.
	Defective overload relay	Replace
	High suction temperature	Reduce suction temperature by TXV adjustment or provide de-superheating.
	Loose power or control circuit wiring connection	Check all power and control circuit connections.
	Defective motor	Check for motor ground or short. Replace compressor if found.
	Faulty motor protection device	Replace module or head sensor, if necessary.



TROUBLESHOOTING CHART

OBSERVATION	POSSIBLE CAUSE	REMEDY
13. COMPRESSOR CYCLES ON LOCKED ROTOR	Low line voltage	Check line voltage and determine location of voltage drop.
	Seized compressor (remove bearing head assembly and attempt to rotate crankshaft)	Replace compressor
	Compressor motor defective	Check for motor winding short or ground.
	Single phasing	Check voltage across all 3 legs at contactor. Correct source of problem.
	Liquid refrigerant condensing in the cylinder	Check and replace valve plates
	On part-winding start compressors, the second set of windings may not be energized.	a. Faulty contactor – replace. b. Faulty time-delay relay – replace.
14. MOTOR BURNOUT	Check control box for welded starter contacts, welded overload contacts or burned out heater elements.	Replace defective components



TROUBLESHOOTING CHART

OBSERVATION	POSSIBLE CAUSE	REMEDY
15. CARRIER COMPRESSORS ON PARALLEL COMPRESSOR INSTALLATIONS, OIL LEVEL DOES NOT EQUALIZE OR REMAIN AT A CONSTANT LEVEL IN ALL COMPRESSORS	Oil equalization line not level preventing gas equalization.	Level oil equalization line.
	06E Compressors only: Pressure equalization check valve in the motor rotor lock bolt may have been left out in one or all compressors	Remove suction service valve and inspect for check valve in motor rotor lock bolt at the end of the crankshaft. Check valve is required on all 06E compressors in parallel systems using oil equalization line connected at the sight glass location.
	Excessive blow by into crankcase – worn rings, valves or blown gasket.	Replace gasket, valve plate or compressor.
	06D Compressors Only: Oil pressure regulator tube is not below sight glass opening and is discharging oil into the oil equalization line and into an off compressor. (Tube has been replaced by Valve Ass’y. on newer models)	On 06D parallel compressor systems, remove oil equalization line and insure oil regulator tube is below opening. Push down if necessary.



TROUBLESHOOTING CHART

OBSERVATION	POSSIBLE CAUSE	REMEDY
16. COMPRESSOR RUNNING HOT	Blown valve plate or cylinder gasket	See No. 3
	Broken suction or discharge valve	Replace valves and valve plate, if necessary.
	Compressor ratio too high	a. Check setting of high and low pressure switches b. Check condenser – is it plugged? c. Check that all evaporator and condenser fans are operating properly.
	High Suction Temperature	Replace suction temperature by TXV adjustment or provide de-superheating.
	Cylinder head cooling fan not operating or incorrect voltage to fan motor	Replace defective part or check that available voltage agrees with fan motor voltage.
	Non-seating internal pressure relief valve.	Inspect for signs of overheating, replace if necessary.
	High oil level	Lower oil level.
	Excessive blow-by-into crankcase – worn rings, valves or blown gasket	Replace gasket, valve plate or compressor.