

HITACHI HORIZONTAL SCREW COMPRESSOR SUGGESTED PREVENTATIVE MAINTENANCE SCHEDULE

The HITACHI Horizontal Screw Compressor is used industry-wide in many different refrigeration applications. The compressor is also applied in many different types of equipment design. In providing maintenance to a refrigeration system, one must keep in mind that the HITACHI Screw Compressor is only one component of a system. The combinations of design and application prevent the publication of an all-inclusive preventative maintenance schedule that would address preventative maintenance activities outside those associated with the HITACHI Screw Compressor. It is for this reason that this bulletin is not designed to supercede the maintenance activities required by the equipment manufacturer who originally applied the HITACHI Screw Compressor to an equipment design.

Dangerous voltages and currents, as well as high temperatures and high pressures are present with the service of refrigeration equipment. For this reason, only qualified refrigeration personnel should attempt any repair, maintenance or troubleshooting activities to refrigeration equipment. Do not supercede any codes or safety practices while performing work on the refrigeration system.

** Times are provided for reference purposes only, actual times may vary.*

<u>SCHEDULE</u>	<u>ESTIMATED TIME REQUIRED *</u>
<u>DAILY</u>	
1. Check alarms.	5 Minutes/Unit
2. Observe refrigeration unit for any abnormal sounds, vibrations or other operating conditions.	5 Minutes/Unit
<u>WEEKLY</u>	
1. Visually inspect oil level and oil condition (color or agitation) in the compressor sight glass.	2 Minutes/Unit
2. Insure that the compressor is not being forced to run in an abnormal operating envelope:	5 Minutes/Unit
a. High discharge pressures.	
b. Low suction pressure.	
c. High ampere draw.	
<u>MONTHLY</u>	
1. Inspect for any condenser operational conditions which may ultimately affect compressor head pressure control, such as scaling, coil cleanliness, fan operation, etc.	15 Minutes/Unit
2. Observe the operation of the compressor staging control mechanism. Insure that the compressor operates a minimum of 30 seconds fully unloaded when restarted. Also insure that the staging control does not start the compressor more than six times per hour and operates the compressor for a minimum of 5 minutes when started.	20 Minutes/Unit
3. Observe the compressor capacity control functions. Insure that the compressor loads and unloads normally when the signal is applied.	10 Minutes/Unit
4. Inspect all compressor "manual-reset" safety controls for operational temperatures and pressures. Insure that the set-points are correct and the controls have not been manually jumped.	10 Minutes/Unit
5. Inspect the refrigerant sight glass for the refrigerant charge levels and the moisture indication for the refrigerant.	5 Minutes/Unit
6. Record the operational hours of each compressor.	5 Minutes/Unit
<u>SEMI-ANNUALLY</u>	
1. Inspect the operation of the discharge check valve. Insure that it seals tightly upon shutdown of the compressor.	10 Minutes/Unit
2. Refrigerant leak-check the system, carefully inspecting service areas of the compressor (check joint, terminal plate seal bushing areas, piping flange gasket areas, etc.).	30 Minutes/Unit
<u>YEARLY</u>	
1. Sample compressor oil.	30 Minutes/Unit
2. Inspect complete refrigeration system for signs of abnormal wear. This activity would include items such as loose or broken piping clamps, fan blade slippage, refrigerant equalization tubing and other capillary control tubing that may be rubbing, unusual noises from other refrigeration system components, etc.	30 Minutes/Unit

HITACHI Screw Compressor Trouble-Shooting Guide

Models "002" SC-H

I. PROBLEM: COMPRESSOR WILL NOT OPERATE

POSSIBLE CAUSES	SERVICE CHECKS	POSSIBLE CORRECTIVE STEPS
A. Main Voltage Power Failure	1. Verify 3-phase supply voltage present at fuses.	a. Disconnect switch open. Close Disconnect. b. Broken or bad wiring connection upstream of fuses. Repair or replace wiring.
	2. Verify 3-phase incoming supply voltage is present at "line" side of the motor magnetic contactor.	a. Blown fuses. Lock out power and check for shorted condition of wiring prior to replacing fuses. Isolate compressor from wiring and check for motor winding short to ground. If shorted, replace compressor. Follow good practices for the cleanup of the refrigeration system after a hermetic motor failure. b. Broken or bad wiring connection at "load" side of fuses. Repair or replace wiring.
	3. Verify 3-phase voltage present on "load" side of magnetic contactor, when energized.	a. Contact points burned; replace contacts or complete contactor. b. Broken or bad wiring connection on "load" side of contactor. Repair or replace wiring.
	4. Verify three-phase power present on main terminal plate of the compressor.	a. If not, broken or bad wiring between "load" side of magnetic contactor and the compressor terminal plate. Replace or repair wiring. b. If power is present and compressor does not operate, compressor motor windings are open. Lock out power and remove wiring from the compressor terminal plate. Read motor winding resistance between terminal plate studs. If open, replace compressor. Follow good practices for cleanup of refrigeration system after a hermetic motor failure.
B. Control (Pilot) Voltage Loss	1. Verify control voltage at transformer.	a. Blown fuse on transformer primary side. b. Blown fuse on transformer secondary side. c. Open winding in transformer. d. Loose or broken connection at terminal strips.
	2. Verify that compressor has a "run" demand normal.	a. Cooling demand satisfied.

HITACHI Screw Compressor Trouble-Shooting Guide

Models "002" SC-H

POSSIBLE CAUSES	SERVICE CHECKS	POSSIBLE CORRECTIVE STEPS
B. Control (Pilot) Voltage Loss (Continued)	2. Verify that compressor has a "run" demand normal. (Continued)	b. Lead/lag compressor rotation changed. c. Loss of air/fluid flow through evaporator.
	3. Verify that compressor "manual-reset" safeties are in the run mode. If not, determine fault and correct condition prior to reset.	a. Over-current safety (overload setting). b. High discharge temperature safety (<248°F). c. Electrical phase monitor safety (L1, L2, L3 – clockwise rotation). d. Low suction pressure safety (>14 PSIG). e. Motor temperature safety (<239°F).
	4. Verify that compressor magnetic contactor has pilot voltage present at the coil.	a. If voltage present and contactor is not energized, replace coil and/or contactor.
II. PROBLEM: COMPRESSOR OPERATES, HOWEVER HAS FUNCTIONAL PROBLEMS		
A. Pressure and temperature operational problems.	1. High discharge pressure.	a. Too little heat rejection in condenser, condenser fouled or fans operation not adequate. Correct the condenser problem and restart. b. The pressure of return gas is too high, too much load on compressor. Reduce load on evaporator. c. Head pressure control setting not correct. Adjust setting.
	2. Motor overheats and trips "manual-reset" safety protection.	a. Superheat too high on return gas, possibly from high load condition. Reduce load on evaporator. b. Superheat too high on return gas from TXV valve adjustment too high. Adjust valve to provide superheat at compressor of 12° to 15°F. c. Discharge pressure too high from inadequate condenser heat rejection. Correct the condenser problem and restart.

HITACHI Screw Compressor Trouble-Shooting Guide

Models "002" SC-H

POSSIBLE CAUSES	SERVICE CHECKS	POSSIBLE CORRECTIVE STEPS
<p>A. Pressure and temperature operational problems. (Continued)</p>	<p>2. Motor overheats and trips "manual-reset" safety protection. (Continued)</p>	<p>d. Too frequent motor restarts (more than 6 starts/hour). Limit compressor restarts. e. Motor coil insulation failure. Send compressor in for analysis. f. Starting the compressor in the loaded mode. Correct electrical control problem and restart.</p>
	<p>3. Discharge temperature too high, trips "manual-reset" safety protection.</p>	<p>a. Operation of the compressor without adequate lubrication. Insure adequate level of approved refrigerant oil. Insure > 70 PSIG difference between suction and discharge pressure while operational. b. Restriction in the internal oil strainer, inhibiting lubrication. Clean or replace oil strainer. c. Return gas superheat too high. Adjust TXV. d. Inadequate heat rejection in the condenser. Correct the condenser problem and restart.</p>
	<p>4. Suction pressure too low.</p>	<p>a. Lack of refrigerant. System sight glass indicates a low charge. b. Too little load on the evaporator. c. No flow of refrigerant through TXV valve. TXV head has lost its charge. d. Loss of air/fluid flow through evaporator. e. Clogged liquid refrigerant line filter. f. Hot gas "bypass" valve (if applicable) setting is too low. Adjust setting.</p>
<p>B. Compressor capacity control system is not functioning properly.</p>	<p>1. Compressor will not load up.</p>	<p>a. Solenoid "C" is not receiving signal to open. Check electrical control function. b. Solenoid "C" electrical coil is open. Replace coil. c. Solenoid "C" valve does not open when signal is applied. Replace solenoid valve. d. Solenoid valve "B" or "A" is energized. Correct the electrical control function.</p>

HITACHI Screw Compressor Trouble-Shooting Guide

Models "002" SC-H

POSSIBLE CAUSES	SERVICE CHECKS	POSSIBLE CORRECTIVE STEPS
B. Compressor capacity control system is not functioning properly. (Continued)	1. Compressor will not load up. (Continued)	e. Solenoid valve "B" or "A" is not closed when de-energized. Replace solenoid valve. f. The oil capillary tubing, coming from the rear of the compressor to the front, is plugged. Clean or replace tubing. g. Capacity control piston rod seal, internal to the compressor, is leaking. <i>Slipper Ring Replacement Kit Required.</i>
	2. Compressor will not unload.	a. Solenoid "A" is not energized. Check electrical control function. b. Solenoid "A" electrical coil is open. Replace coil. c. Solenoid "A" does not open when signal is applied. Replace solenoid valve. d. Solenoid "C" is energized. Correct the electrical control function. e. The oil capillary tubing coiled on the front of the compressor is plugged. Clean or replace. f. Internal compressor oil level too low. Add approved refrigerant oil. g. The capacity control piston seal, internal to the compressor, is damaged. <i>Slipper Ring Replacement Kit Required.</i>
	3. Compressor will not rapidly unload.	a. Solenoid "B" is not energized. Check electrical control function. b. Solenoid "B" electrical coil is open. Replace coil. c. Solenoid "B" does not open when signal is applied. Replace solenoid valve. d. Capacity control piston internal to compressor is stuck. <i>Slipper Ring Replacement Kit Required.</i>

HITACHI Screw Compressor Trouble-Shooting Guide

Models "002" SC-H

POSSIBLE CAUSES	SERVICE CHECKS	POSSIBLE CORRECTIVE
<p>C. Compressor operates, however is noisy.</p>	<p>1. Verify that noise is coming from the internals of compressor, not from a loose terminal box or piping hangers, etc.</p>	<ul style="list-style-type: none"> a. Return gas superheat too low, allowing liquid refrigerant flood-back and washing of internal lubrication. Adjust TXV superheat. b. Inadequate internal compressor lubrication due to plugged oil strainer. Clean and/or replace strainer. c. Inadequate internal compressor lubrication resulting from operating the compressor with less than 70 PSI differential between the high side (discharge) and low side (suction). Correct operating condition to assure a minimum of 70 PSI differential. d. Operation of the compressor with low levels of lubrication. Oil trapped in system and/or leakage of oil out of system. Repair the unusual operating conditions and recharge with approved refrigeration oil. e. Bearing failure. Send compressor in for analysis and determination of the extent of internal damage. f. Contact of screw rotors with themselves or with the main casing or slide valve assembly. Send compressor in for analysis. g. Inside components loose. Send compressor in for analysis. h. Magnetic flux noise of hermetic motor, due to deteriorated motor insulation. Send compressor in for analysis. i. Debris caught inside of suction strainer basket. Clean or replace suction strainer basket.

This bulletin is designed as a trouble-shooting guide for checking the operation of the HITACHI screw compressor. Dangerous voltages and currents, as well as high temperatures and high pressures are associated with the service of any refrigeration compressor. For that reason, only qualified refrigeration technicians should be attempting any repairs or trouble-shooting activities on refrigeration systems and the associated components of those systems. Proper safety precautions and procedures should always be observed. Protective clothing and safety gear should be worn when servicing this equipment. Make sure that the pressure in affected lines is no more than 2 or 3 PSI above atmospheric pressure before any components are removed that could cause injuries. Electrically locking out the equipment before performing any service will prevent accidental restart. Adherence to national environmental requirements and local codes and ordinances should be paramount. It is not the intent of this bulletin to supercede any codes or safety practices while performing troubleshooting or maintenance activities to the HITACHI screw compressor.