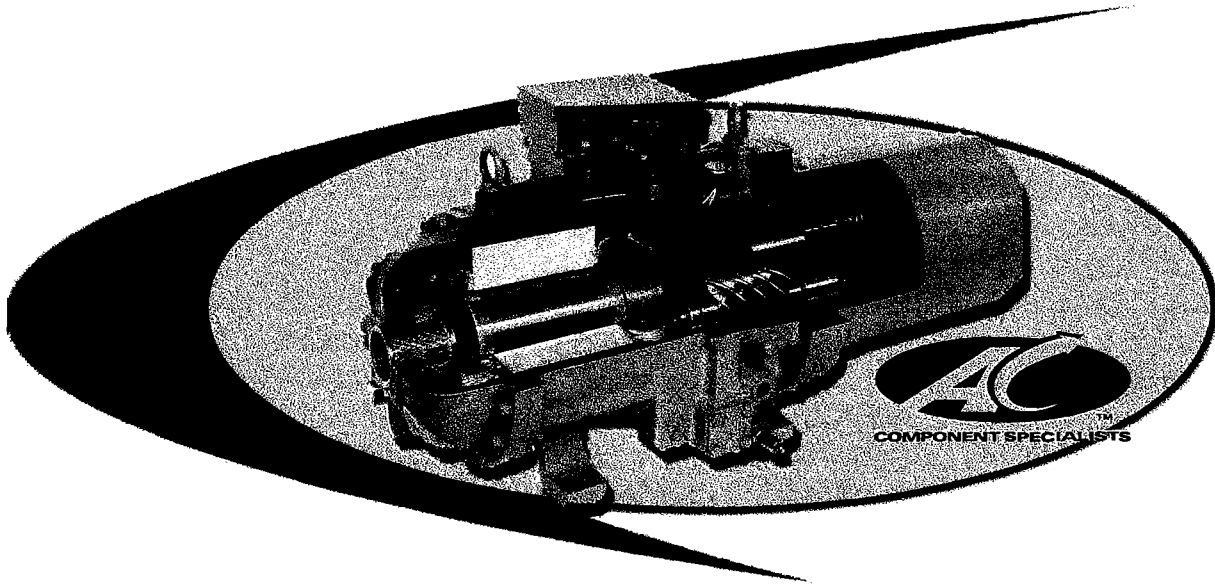


# HITACHI

## SRM SEMI-HERMETIC HORIZONTAL SCREW COMPRESSOR



## SERVICE and OPERATION INFORMATION

***AC Component Specialists, Inc.***

**Remanufactured Models:  
4002SC-H, 5002SC-H and 6002SC-H**

***Nationwide Sales and Service Center***

**899 South Prairie Lane  
P.O. Box 500**

**Marshfield, Missouri 65706**

**Phone: (417) 859-6067 Fax: (417) 859-2109**

# NOTICE

## SAFETY PRECAUTIONS

In performing any work on the compressor or the associated refrigeration equipment, proper safety procedures must ALWAYS be observed. Procedures include, but may not be limited to, the following:

- 1) Only qualified refrigeration mechanics familiar with the HITACHI compressor maintenance procedures should attempt any service to the HITACHI compressor.
- 2) The compressor may be hot from operation and the oil contained therein will also be hot, allow the compressor and the oil to cool to room temperature before beginning any service to prevent burns.
- 3) Remove and lockout all sources of power from the compressor to prevent accidental restart.
- 4) Isolate the compressor from the refrigeration system.
- 5) Recover the refrigerant from the compressor.
- 6) Check to confirm that the pressure within the compressor is at no more than 2 or 3 psig above atmospheric pressure before any service is begun.
- 7) Adherence to all national environmental requirements and local codes and ordinances is vital. It is not the intent of this bulletin to supercede any governing codes or safety practices while performing the service outlined herein.

# NOTICE

# HITACHI Screw Compressor Models 4002SC-H, 5002SC-H and 6002SC-H

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# HITACHI—HORIZONTAL SCREW COMPRESSOR

## Models 4002SC-H, 5002SC-H and 6002SC-H

### General Product Features and Specifications

#### 1.0 Product Introduction

AC Component Specialists Service & Operations Information Guide describes the general features and specifications of the HITACHI 4002 SC-H, 5002 SC-H and 6002 SC-H screw compressor models. HITACHI has been manufacturing the rotary screw compressor since the late 1960s. Worldwide market introduction was in 1973. The compressor has an overall failure rate for all shipments worldwide of less than 00.5%.

The HITACHI screw compressor was introduced to the North American market in 1982. To date, shipments to the United States have exceeded 14,000 units. The HITACHI screw compressor has provided excellent service with long lasting performance to a wide range of customers and applications.

#### 1.1 Product Features

The HITACHI—SRM semi-hermetic screw compressor has been developed by HITACHI'S own technology, including research and development activities, production engineering and system engineering. It is backed with quality HITACHI manufacturing experience in hermetic and semi-hermetic reciprocating compressors, centrifugal compressors and open screw compressors.

The years invested in research, development, and production have established HITACHI as the world leader in the HVAC/R industry in rotary screw compressor technology. Technological innovations, such as the hermetic two-pole motor in the large capacity range, an internal oil separator and unique roller type bearings for axial and radial loads, are designed to deliver reliable service to the owner.

#### 2.0 Production Features

The HITACHI screw compressor is a positive displacement compressor allowing high compression ratios to be achieved.

#### Compression Principle

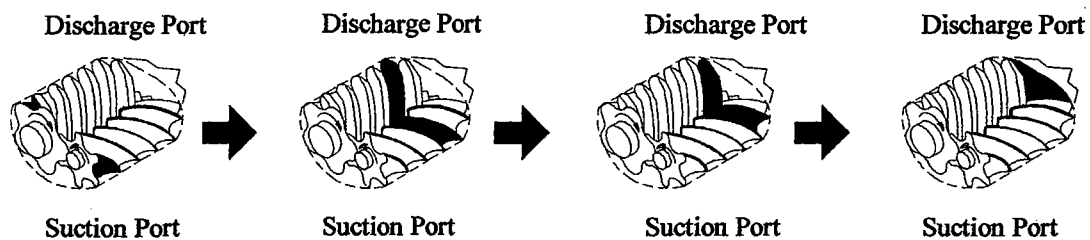


Figure 2-1  
Principle of Screw Compressor

## 2.1 Screw Compressor vs. Reciprocating Compressor

### (1) Fewer Moving Parts

The total number of parts in the screw compressor is approximately one tenth the number of parts in the reciprocating compressor. Screw compressors feature a simplicity of construction by eliminating such components as pistons, connecting rods, valve plates, oil pumps and mechanical linkages for capacity control, most commonly found in reciprocating compressors. The absence of these features in a screw compressor provides lower noise levels, minimized vibration, and higher reliability.

### (2) Energy Savings

By infinitely modulating the capacity control, the screw compressor can offer a substantial energy savings to the owner. A  $+2 \frac{1}{2}^{\circ}\text{F}$  control, typical of reciprocating compressors, causes the equipment to continually short cycle between stages, which results in a poor attempt to match the load.

### (3) Resistance to Slugging

Screw compressors have greater resistance to liquid floodback than reciprocating compressors, due to the relative size and strength of the compression mechanism (rotors vs. connecting rods).

### (4) Improved Lubrication System

Internal lubrication in a screw compressor is supplied by the pressure difference between the discharge and suction sides instead of a mechanically pumped lubrication system found in reciprocating compressors. Rapid oil foaming does not occur in HITACHI screw compressors because the lubrication oil is stored in the high pressure side.

## 2.2 HITACHI Screw Compressor Advantage

HITACHI-SRM semi-hermetic screw compressors are provided with the following innovations:

(1) A pair of patented new profile screw rotors, developed by HITACHI'S own technology, have improved the efficiency of operation with a high compression ratio.

(2) A built-in oil separator that eliminates the need for an oil pump, oil cooler and oil piping have increased the reliability and durability of the compressor.

(3) The patented double casing construction of the HITACHI screw compressor, decreases the transmission of operational sounds. This unique casing design makes the compressor one of the quietest in its class.

(4) The type and number of roller bearings used to position the screw rotors, and to support axial loads, extends the life of the compressor and increases its reliability.

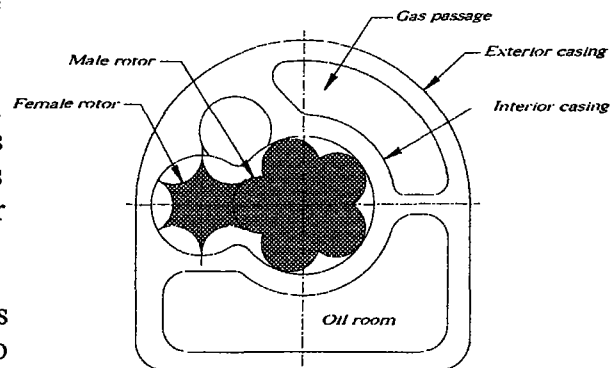


Figure 2-2

Double Casing Construction

(5) The use of a highly reliable two-pole large capacity hermetic motor, developed by HITACHI'S own technology, has resulted in a highly-efficient and durable screw compressor.

## 2.3 Construction Details

HITACHI—SRM semi-hermetic screw compressors have three major compartments:

(1) Hermetic Motor Compartment

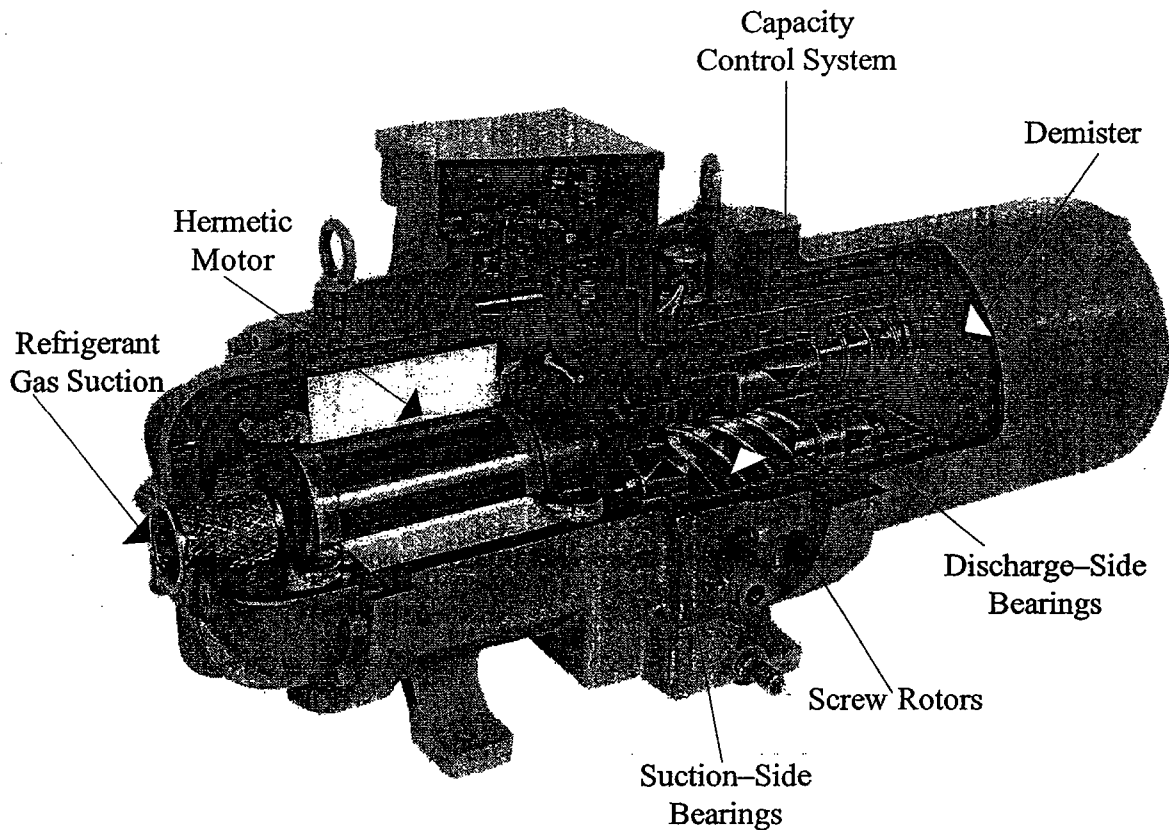
The hermetic motor compartment includes one set of a stator and a rotor, six terminal plugs for electric power connections, internal thermistors inserted into the stator coil to protect the motor from burnout, four terminal connectors for the thermistors and a suction gas strainer. The rotor of the hermetic motor is directly mounted on the suction end of the male screw rotor and drives it with a rotation of 2,880 rpm at 50 Hz or 3,470 rpm at 60 Hz on the rated voltage of an electric source.

(2) Screw Compressor Compartment

The compressor compartment includes a pair of screw rotors, bearings, and the components for the capacity control system.

(3) Oil Separator Compartment

The oil separator compartment includes a demister, chambers that serve as an oil separator and an oil sump reservoir with an oil strainer.



## 2.4 Refrigerant Flow

Suction gas enters the HITACHI screw compressor through the suction gas strainer, then through the motor compartment allowing the motor to be cooled. The refrigerant gas passes from the motor compartment into the compressor compartment. Here the gas is compressed by flowing from the suction side to the discharge side through a pair of screw rotors. The discharged refrigerant gas then enters into the oil separator compartment. The oil is separated from the refrigerant gas when the mixture hits the demister. The separated oil is stored in the oil separator, and the refrigerant gas is discharged from the discharge port.

## 2.5 Oil Flow

Oil passages from the oil reservoir are constructed internally in the compressor casing, aiding in the reduction of oil leakage. An oil strainer is inserted into the oil sump reservoir and is mounted with a removable flange. The oil strainer is constructed with a 150 mesh reinforced steel filter with a wide screen area.

Oil that is stored in the oil separator is fed through the oil strainer to the bearings and capacity control system. The oil lubricates the bearings, then enters into the suction area of the screw rotors. The oil which is fed into the capacity control system also flows back through the suction side of the screw rotors after it has been utilized as hydraulic power. Finally, the oil is discharged into the oil separator as a mixture of refrigerant and oil.

## 2.6 Capacity Control System

The HITACHI screw compressor has capacity control ranging from 100% to 25% (100% to 33% for model 4002SC-H). The control is performed by the movement of a slide valve located on the upper side of the screw rotors. Movement of the slide valve along the screw rotors controls the amount of refrigerant gas that is bypassed to the suction side. Connected to the slide valve is a piston that is located in the discharge casing. (See Fig. 2-4)

The piston moves in response to a pressure difference between both ends of the piston. Three solenoid valves, which are installed in the oil passages, are used in combination to provide accurate infinite capacity control.

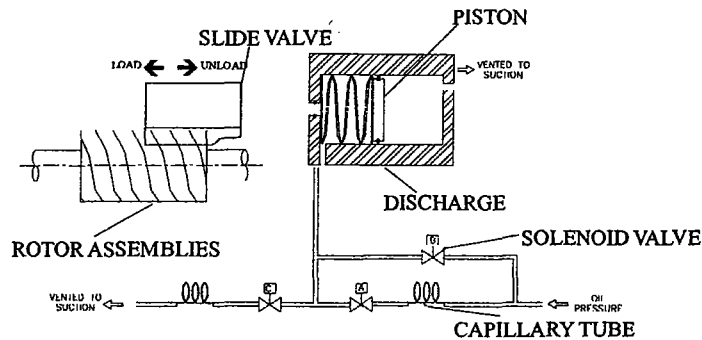


Figure 2-4: Capacity Control System

**HITACHI SCREW COMPRESSOR  
CAPACITY CONTROL SYSTEM  
INFINITE MODELS 4002SC-H, 5002SC-H, AND 6002SC-H**

<b>Condition</b>	<b>Solenoid A</b>	<b>Solenoid B</b>	<b>Solenoid C</b>
Start/Stop	Off	On	Off
Loading Up	Off	Off	On
Unloading	On	Off	Off
Load Constant	Off	Off	Off

Table 1: Solenoid Sequence of Operation

**Location of Solenoid Valves**

The location of the three solenoid valves are shown in Figure 2-5.

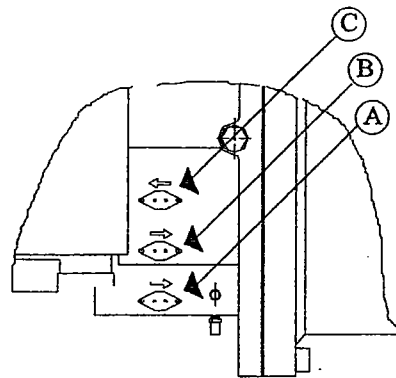


Figure 2-5 Compressor Casing  
Viewed from the Top

**Note:**

1. Minimum Load:  
33% for 4002SC-H  
25% for 5002SC-H and 6002SC-H
2. A controller for the capacity control system is not included with the compressor.



### Minimum Capacity for Starting

Solenoid valve B is opened and the other valves are closed. The oil pressure existing in space S actuates the piston towards the right-hand direction. The piston will move to the end of its stroke, minimizing capacity. With no capillary tube between solenoid valve B and the space S, the actuating speed of the piston will be maximized. (See Fig. 2-6)

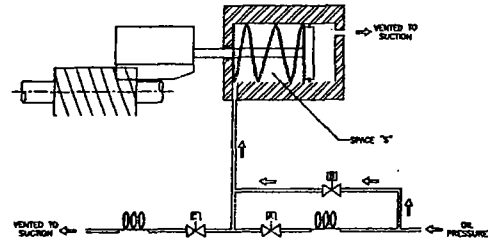


FIGURE 2-6: MINIMUM CAPACITY

### Load Up

Solenoid valve C is opened and the other valves are closed. The oil pressure, which exists in space S will be released through the capillary tube by opening solenoid valve C. The piston will move slowly in the left-hand direction so that the capacity will increase. (See Fig. 2-7)

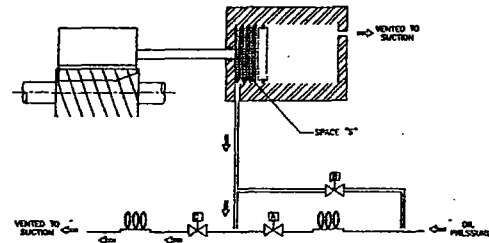


FIGURE 2-7: LOADING UP

### Unloading

Solenoid valve A is opened and the other valves are closed. The oil pressure, which exists in the space S, actuates the piston towards the right-hand direction. The actuating speed of the piston will be slow due to the capillary tube in this circuit. (See Fig. 2-8)

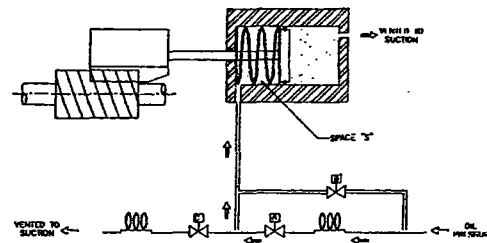


FIGURE 2-8: UNLOADING

### Load Constant

The three solenoid valves are closed. With all of the solenoid valves closed, the oil existing in space S will be held and the piston will not move. (See Fig. 2-9)

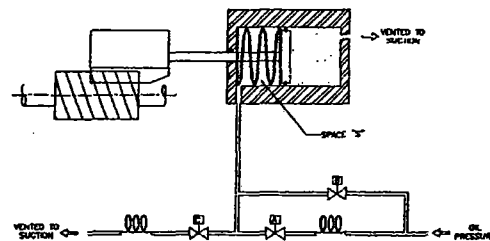


FIGURE 2-9: LOAD CONSTANT

## 2.7 Details of Components

### (1) Screw Rotors

New asymmetrical profile screw rotors, comprised of a five-lobe male screw rotor and a six-innerlobe female screw rotor, are made of ductile cast iron, or spheroidal graphite cast iron, FCD 60, in accordance with JIS G5502. These screw rotors are machined by a special hobbing and honing machine, with excellent precision, based on strict quality control.

### (2) Casing

A double structure construction has been applied to the compressor casings and high-strength inner ribs have been provided in order to minimize noises and to ensure rigidity. The main casing, the discharge casing and the various covers are made of high-strength gray cast iron, FC 25, in accordance with JIS G5501. These casings and covers are machined by a computer-aided machining center, to enhance reliability and productivity.

### (3) Bearings

Radial roller bearings have been installed in the screw compressors to support the radial loads from the screw rotors. At the discharge end of the screw compressor, triple angular contact ball bearings for the male screw rotor and double ball bearings for the female screw rotor are installed, to support axial thrust loads and to position the screw rotors. Each bearing is lubricated by oil fed from the oil separator.

### (4) Suction Strainer

An 80 mesh reinforced strainer is provided at the suction port of the screw compressor.

### (5) Hermetic Motor

The two-pole hermetic motors have been specially developed for these screw compressors made by HITACHI. The motors are squirrel cage, three-phase, two-pole, induction type. The motor range is composed of three models, normal 50HP, 60HP, and 75HP. The coils of these motors are impregnated with varnish to ensure rigidity against heavy vibration when the motors are started.

Six terminal plugs for electric power connections, which can comply with star-delta starting, are provided in a dust-proof terminal box located at the top of the screw compressor. The four terminals for the motor protectors, which are inserted into the motor stator coil, are provided in a dust-proof cover located at the front side of the motor casing.

### (6) Oil Separator

A vessel with a demister is directly connected on the discharge end of the screw compressor, to form one unit. The vessel is installed at the high pressure side of the screw compressor. The material of the vessel is in accordance with JIS G3454, "Carbon Steel Pipes for Pressure Service STPG 38." The vessel has been designed, welded and tested in accordance with JIS B8240-1979, "Construction of Pressure Vessel for Refrigeration."

# HITACHI SCREW COMPRESSOR

## Operating Conditions

The following conditions must be observed in order to avoid damage to the compressor. Failure to do so may void the manufacturer's warranty.

### **Reverse Rotation**

Reverse rotation is not permitted under any circumstance. This will damage the screw rotors and void the warranty.

### **Power and Control Circuits**

The capacity of the magnetic contactors shall be equal to or greater than the maximum continuous current. Also, overcurrent relays must be installed for motor protection. All control circuits shall be designed to reset manually when the motor protector trips. Do not use an automatic reset system.

### **Suction and Discharge Pressure**

The suction pressure must be higher than 7 psig (0.5kg/cm<sup>2</sup>G). A pump down cycle (when the liquid line is closed to remove refrigerant from the evaporator to the condenser) is not permitted where pump down would allow suction pressure to drop below 7 psig. The discharge pressure must be higher than 140 psig (9.5kg/cm<sup>2</sup>G) and shall not exceed 360 psig (25kg/cm<sup>2</sup>G).

### **Return Liquid Slugging**

No direct return of liquid refrigerant to the compressor is permitted under any conditions.

# SCREW COMPRESSOR PROTECTIVE DEVICES

The HITACHI horizontal screw compressor, as supplied to the United States, does not have the following protective devices. They must be supplied by others in order to ensure proper use of the compressor. ACCS part numbers are included for your reference.

## **1. Motor Protector**

Solid state thermistors have been embedded in the windings of the motor. These thermistors are Texas Instrument's model 3BA115-40. An electronic motor protection module, Texas Instrument (31AA1500E) is of the manual resetting type under the U.L. listed file. ACCS part number MOD1Z01A is a dual control voltage (120 volt-208/240volt) and can be installed before compressor shipment.

## **2. Oil Heater (Crankcase Heater)**

A crankcase heater should be applied. The diameter of the hole provided is 12.7mm and 140mm in length. It is located in the oil sump at the bottom of the compressor casing. The output of the heater is 200 watts. ACCS can supply a 200 watt/120 volt crankcase heater, part number CCH1Z01A.

## **3. Continuous Capacity Control**

The Capacity control is performed by the exchange of oil pressure to the unloader piston. Three oil pressure solenoid valves (120 volt) are supplied with the compressor. A solenoid valve controller must be employed to adjust capacity. A capacity control micro processor is available from ACCS. Please call for information & pricing.

## **4. Reverse Rotation**

A check valve must be installed on the discharge piping to prevent reverse rotation during shutdown of the compressor. Electrical phase protection is required to prevent reverse rotation at startup and monitoring for lost phase.

## **5. Discharge Temperature Protection**

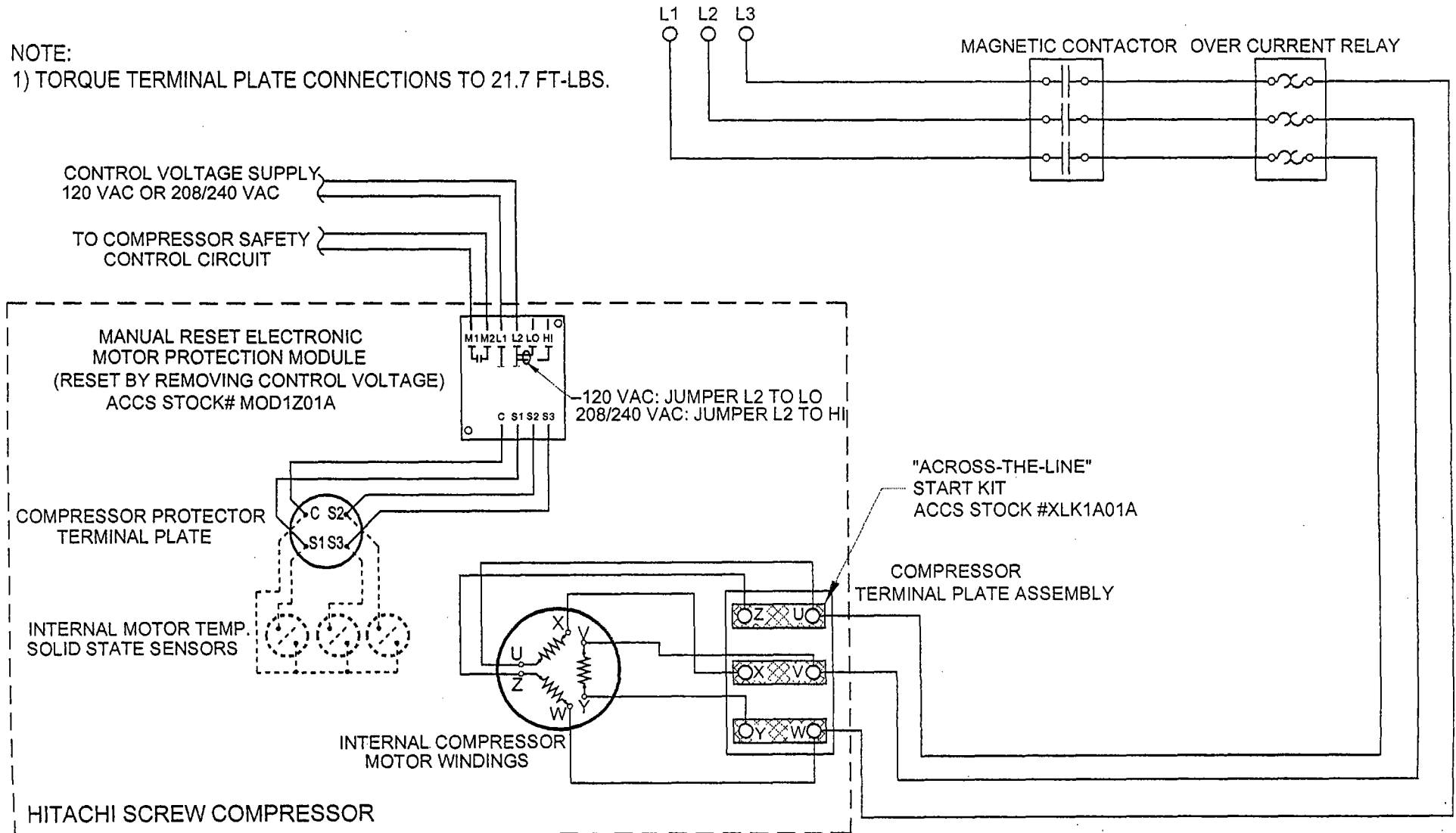
A manual resettable discharge temperature safety switch must be provided in order to limit operation of the compressor when discharge temperatures exceed 248 degrees Fahrenheit. This temperature should be sensed as close to the discharge piping connector on the compressor as possible.

# HITACHI SRM SEMI-HERMETIC SCREW COMPRESSOR - SERIES 4002SC-H, 5002SC-H & 6002SC-H

## WIRING DIAGRAM FOR ACROSS-THE-LINE STARTING

MAIN SUPPLY VOLTAGE  
 (SPECIFY WHEN ORDERING THE COMPRESSOR)  
 230 VOLTS, 60 HZ, 3 PH  
 460 VOLTS, 60 HZ, 3 PH

NOTE:  
 1) TORQUE TERMINAL PLATE CONNECTIONS TO 21.7 FT-LBS.



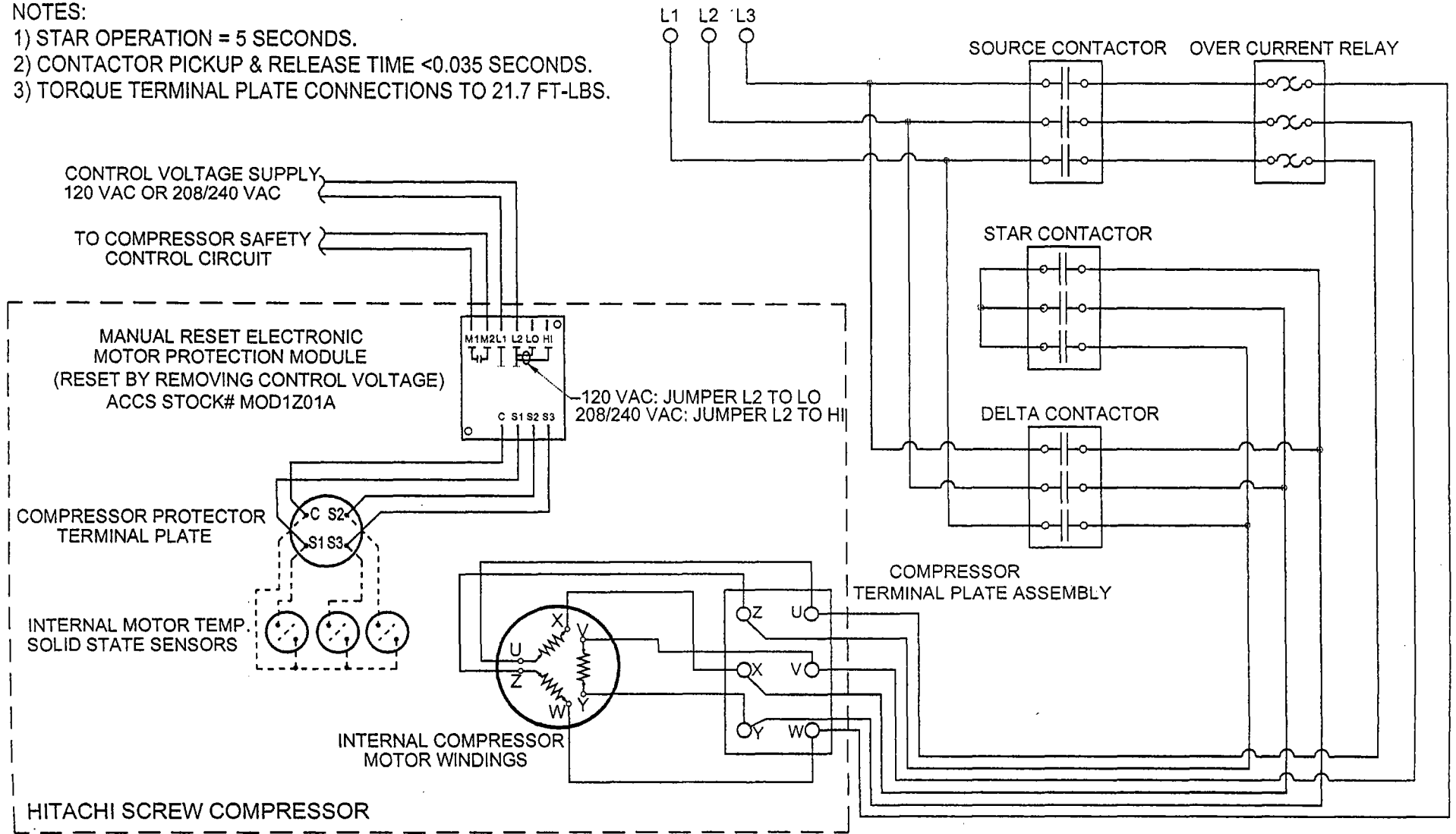
# HITACHI SRM SEMI-HERMETIC SCREW COMPRESSOR - SERIES 4002SC-H, 5002SC-H & 6002SC-H

## WIRING DIAGRAM FOR REDUCED VOLTAGE (STAR-DELTA) STARTING

MAIN SUPPLY VOLTAGE  
(SPECIFY WHEN ORDERING THE COMPRESSOR)  
230 VOLTS, 60 HZ, 3 PH  
460 VOLTS, 60 HZ, 3 PH

**NOTES:**

- 1) STAR OPERATION = 5 SECONDS.
- 2) CONTACTOR PICKUP & RELEASE TIME < 0.035 SECONDS.
- 3) TORQUE TERMINAL PLATE CONNECTIONS TO 21.7 FT-LBS.



# HITACHI—SRM REFRIGERATING SCREW COMPRESSORS

## Pilot Duty Electronic Motor Protection Modules

The HITACHI Horizontal Screw Compressor, as supplied to the U.S. market (Models 4002SC-H, 5002SC-H, and 6002SC-H), is equipped with external electrical connections for the three Positive Temperature Coefficient (PTC) thermistor sensors, which are internally installed in the hermetic motor windings. The following guide is designed to be an aid for the application of an electronic motor protection module, to provide protection against the operation of the compressor above factory allowable temperature limits for the motor.

PTC thermistor sensors contain a conductive ceramic material, whose most useful property is the ability to remain at a low base resistance over a wide temperature band, and to increase abruptly at its trip or switch temperature (Fig. 1). When this abrupt resistance increase occurs, the sensor acts as a solid state thermal switch and provides an input signal to the electronic motor protection module which, in turn, can interrupt power to the starter or contactor coil.

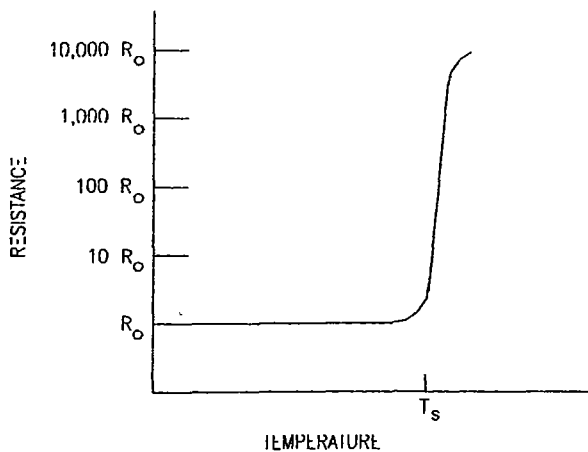


Figure 1

The electronic motor protection module, ACCS stock #MOD1Z01A, available through AC Component Specialists, is a dual supply voltage (120/208-240 VAC) module. It provides a 2.5 amp maximum, at 24/120/240 VAC, dry contact for the safety circuit. Three channels are provided to sense the temperature from each motor winding PTC thermistor. To comply with HITACHI factory requirements, this module is a manual reset type, requiring the removal of supply voltage for a minimum of five seconds, in order to reset the circuit. Refer to the following wiring diagram, Figure 2, for detailed hookup information.

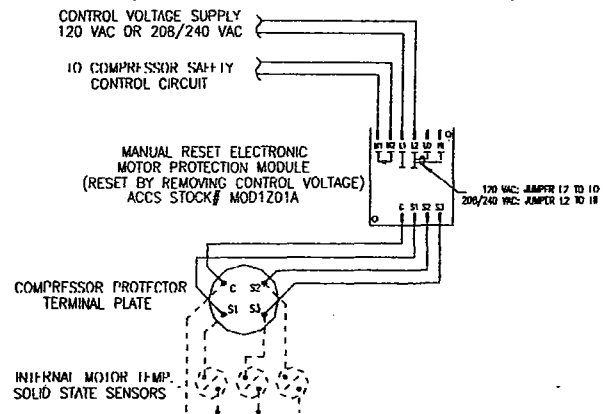


Figure 2

### AFTERMARKET SERVICE & REPLACEMENT

High voltage input to one of the three channels of the module, may damage the sensitivity of the module and thus inhibit its ability to protect the compressor motor. Compressors requiring service due to an electrical problem with the motor, should have the electronic motor protection module replaced. If the compressor is replaced, **ACCS highly recommends that the electronic motor protection module be concurrently replaced.**

# HITACHI—SRM REFRIGERATING SCREW COMPRESSORS

## Electrical Phasing for Proper Compressor Rotation

The HITACHI Horizontal Screw Compressor, as supplied to the U.S. market (Models 4002SC-H, 5002SC-H, and 6002SC-H), is factory nameplated for operation at the following voltages:

230 Volt - 3 PH - 60 Hz

460 Volt - 3 PH - 60 Hz

All models are provided with six terminals for line voltage connections, to allow STAR-DELTA starting. ACROSS-THE-LINE starting is also applicable to the compressor. Please refer to page 10 and 11 for wiring diagrams.

The following guide is designed as an application aid for phasing line voltage connections, which will achieve proper rotation of the HITACHI Horizontal Screw Compressor. Improper phasing and reverse operation of this compressor will void the warranty and damage the compressor.

It is not the intent of this service bulletin to supercede any safety requirements, local codes, or provide an unsafe working environment for the operator while performing these tasks. In many instances, dangerous levels of voltage and current are present, therefore it is important that the operator avoid direct contact with any uninsulated, current-carrying surfaces. Appropriate insulating gloves and clothing should be worn. Before using any electrical instrument or accessory for actual testing, the unit should be checked on a known live line to make certain it is operating correctly.

For discussion purposes, the text refers to the use of a phase rotation indication meter. Specific instructions, contained herein, apply to a GREENLEE Model 5700 (ACCS Stock # MTR1Z01A). Read and understand all instructions for the indicator of choice before attempting to use it. Insure that the indicator chosen is suitable for use at the supply voltage being tested.

Figure 106.1 represents the HITACHI screw compressor electrical terminal plate assembly, showing the six terminals as provided for STAR-DELTA Starting.

Figure 106.2 represents the HITACHI screw compressor electrical terminal plate assembly, showing the positions of the "Across the Line" Start Kit (ACCS Stock #XLK1A01A) For ACROSS THE LINE Starting.

### HITACHI TERMINAL PLATE ASSEMBLIES

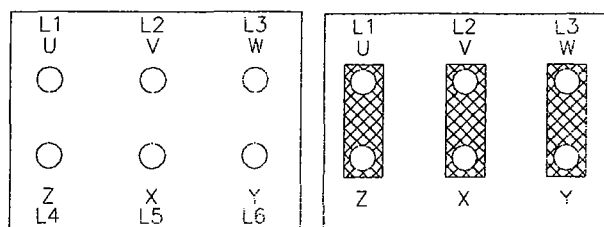


FIG. 106.1

FIG. 106.2

- 1) Turn off the main disconnect and lock out. Insure that the voltage is turned off.
- 2) Remove the lead wires from the compressor terminal plate studs. Position the wires so that they are not in contact with the enclosure or with each other.
- 3) Connect the test leads of the Phase Rotation Indicator to the three phase power leads to be tested.
  - L1, L2, L3 Figure 106.1 & 106.2
  - L4, L5, L6 Figure 106.1 (ONLY)
- 4) Unlock and turn on the main disconnect.
- 5) Energize the compressor contactor being phased.
- 6) With all three phase indicator lights lit, the phase sequence must indicate a CLOCKWISE rotary field. If it does not indicate a CLOCKWISE rotary field, or if the three phase light indicators are not lit, turn off the incoming power and correct the fault (fuses, breakers, loose connections, etc.) If the indication is a COUNTER CLOCKWISE rotary field, repositioning of the power leads is required in order to achieve a CLOCKWISE rotary. **NEVER CONNECT TEST LEADS TO OR DISCONNECT TEST LEADS FROM A LIVE CIRCUIT.**
- 7) When testing is complete, disconnect the power to the circuit and lockout. Disconnect the testing device from the circuit.
- 8) Reconnect the leads wires to the compressor terminal plate assembly so that:
  - L1(U), L2(V), L3(W)= Clockwise Rotary Field
  - L4(Z), L5(X), L6(Y)= Clockwise Rotary Field (if applicable)
- 9) When the compressor is ready to energize, monitor the suction and discharge pressures, at the compressor ports, with a service manifold. When the compressor is idle, the suction and discharge pressure should be equalized. When the compressor is energized, the suction pressure should decrease and the discharge pressure should increase rapidly. If not, disconnect the power immediately and recheck phasing sequence.



# HITACHI—SRM REFRIGERATING SCREW COMPRESSORS

## Compressor Oil Replacement Procedures

When the refrigeration oil in a system is determined to be in an unacceptable range (foreign particles, impurities, acidity/moisture content, etc. [referencing p.15 section 2]), consideration should be given to its replacement. The following guide applies directly to the HITACHI Horizontal Screw Compressor, Models 4002SC-H, 5002SC-H and 6002SC-H for use with R-22. However, it will serve as a useful tool when servicing earlier models of the horizontal screw compressor.

In performing any work on mechanical refrigeration equipment, proper safety procedures should ALWAYS be observed. Make sure that the pressure in the affected lines is no more than two or three PSI above atmospheric pressure before any components are removed that could cause injuries. Electrically locking out the equipment while performing this 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 supersede any codes or safety practices while performing the replacement of a refrigeration oil charge.

### The following steps are suggested:

1. Appropriate shut-off valves should be tightly closed to isolate the compressor from the rest of the system.
2. Recover the refrigerant trapped in the compressor and line sets.
3. By the use of dry nitrogen, pressurize the compressor chamber to approximately 10 PSI.
4. Connect one end of a hose to the oil drain valve located on the four bolt plate to the left of the oil sight glass. Place the other end of the hose in a collection container of adequate capacity to hold the old oil charge.
5. Slowly open the oil valve, allowing the nitrogen pressure to aid in the draining process. As the oil level lowers, some pockets of nitrogen pressure will be released. Close the oil drain valve and allow the oil to accumulate at the drain valve.
6. Repeat the process, as described in Step 5, until as much oil as possible is retrieved. Reduce the nitrogen pressure to a safe working level (two or three PSI).
7. Using a 17 mm wrench, remove the four bolt plate, which has the oil valve attached. Remove the oil strainer screen assembly by pulling it straight out.
8. Clean all gasket material from the surfaces of both the four bolt plate and its mounting flange. Clean the oil strainer assembly, insuring that the screen is not blocked by foreign material. Discard the old oil strainer O-ring.
9. Using a genuine HITACHI gasket and O-ring (ACCS parts GSK1A03A and ORG1A01A), reassemble the oil strainer and four bolt plate. The tightening torque for the four M10 bolts is 500 cm-kg (36.1 ft/lbs).
10. Pressurize the system with nitrogen and by the use of a bubble solution, check all fittings for leak integrity.
11. Install an adequate approved oil charge for the system (referencing p.15 section 3). Oil may be pumped into the compressor through the check fitting located to the right of the lowest solenoid valve
12. Evacuated the system to 29" of vacuum. Isolate the vacuum pump from the system, allowing the system to remain at 29" of vacuum. Hold for 1 hour to verify that the system will "maintain" the level. Add enough R-22 to bring the system back to zero pounds. Let the system maintain for 1 hour. Recover this R-22 for recycling
13. Repeat Step 12.
14. Evacuate the system to a "deep" level of 500 or less microns. Once this level is obtained, isolate the vacuum pump from the system. **THE MAXIMUM RISE OF MICRON LEVEL OVER A 15 MINUTE PERIOD IS 200 MICRONS.** If the rise is greater than this, excessive moisture is present in the system. A continued repeat of this step is required until the rise in micron level falls within this parameter.
15. Reopen the isolation valves and turn on the crankcase heater. Allowing adequate time for the oil chamber temperature to increase, restart the compressor and observe its operation and oil level with the capacity control solenoid valves in "auto" operation.

# HITACHI—SRM REFRIGERATING SCREW COMPRESSORS

## Oil Specification and Maintenance Sheet

### 1. Oil Level

Oil level should be maintained within the oil sight glass range under any operating condition. The period with no oil visible in the oil sight glass, under starting and other unstable conditions, must not exceed 30 seconds.

### 2. Impurities in the Refrigeration Cycle

#### a. Foreign Particles

If the pressure drop at the suction strainer, or the oil strainer, exceeds 0.3 kg/cm 2G (4.3 psi), the amount of foreign particles is considered to be excessive. The refrigeration system design and manufacturing procedures must be reviewed.

For newly designed systems, the lubrication oil must be sampled from the oil chamber after 72 hours, tested in the factory, and checked according to the oil color photograph. (ACCS Service Exhibit 103-1 *available upon request.*)

#### b. System Impurities

Organic compounds, such as trichlene (used for washing the heat-exchangers), acids, and any dust and dirt may cause a harmful chemical reaction. Take precautions to insure that they do not enter the refrigeration system.

#### c. Moisture

Moisture content in the refrigeration system must be less than 200 p.p.m., as determined by the gas chromatograph method or the Carl Fisher method. Contact ACCS for oil sampling and analysis information.

#### d. Non-condensing Gas

Non-condensing gas, particularly air and nitrogen gas, must not exceed 2% of the total refrigerant volume in the refrigeration system.

### 3. Refrigeration Oil for Screw Compressor

#### a. Characteristics of Refrigeration Oil

The HITACHI-SRM semi-hermetic screw compressor is charged with a specially-developed oil, HITACHI Oil SR30, at the time of shipment (unless specified otherwise when ordered). HITACHI Oil SR30 is an ester type synthetic oil that features a high kinematic viscosity under mixed conditions with refrigerant.

SUNISO 4GS, a mineral oil, is approved by HITACHI for use in the screw compressor. The use of the SUNISO 4GS, versus HITACHI Oil SR30, will result in a decrease of 2% to 4% in cooling capacity of the compressor, due to lower viscosity, with motor input remaining the same.

A comparison of the characteristics between HITACHI Oil SR30 and SUNISO 4GS is shown in Table 1.

Table 1: Characteristics of Refrigeration Oil

Name of Oil Color	HITACHI Oil SR30	SUNISO 4GS
Color (ASTM)	L1.0	L1.5
Reaction	Neutral	Neutral
Flash Point	240°C (464°F)	180°C (356°F)
Viscosity at:		
100°C (212°F)	30 cst (150 SUS)	6 cst (50 SUS)
40°C (104°F)	213 cst (1000 SUS)	63 cst (300SUS)
Pour:	-30°C (-22°F)	-27°C (-17°F)
Dielectric Strength	30 kV	30 kV
Total Acid No.	0.05 mgKOH/g	0.01 mgKOH/g
Specific Gravity	1.0 g/cm <sup>3</sup>	0.93 g/cm <sup>3</sup>

### 3.2. Oil Charging Quantity

The required oil charge for the screw compressor will vary depending on the design of the refrigeration system (including condenser, cooler, reservoir, accumulator, etc.). Therefore, oil charging quantity cannot be determined from the compressor data alone. Designers of the refrigeration system should calculate, test and determine oil charging quantity, referring to the following data.

Model	Oil Charge (Liters)	
	A	B
4002SC-H	4	6
5002SC-H	5	7
6002SC-H	5	7

Oil Charge A: Minimum required quantity for the compressor alone without consideration of oil discharge to the refrigeration system.

Oil Charge B. An example of charging quantities for HITACHI water-cooled self-contained water chillers which are equipped with a shell-and-tube type condenser and a dry type cooler.

The standard compressor is charged with oil charge B at the time of shipment. Confirm that the oil is viewed from the oil sight glass under any operating condition.

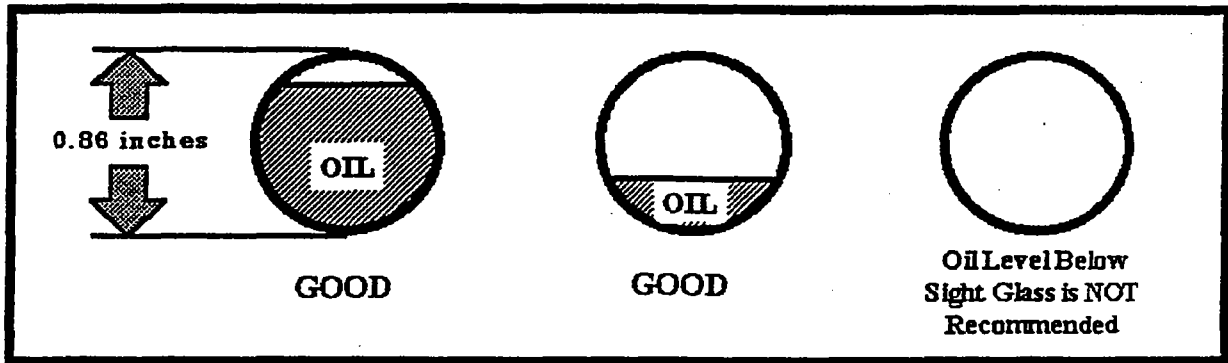
# HITACHI

## SCREW COMPRESSOR OIL MANAGEMENT

1. The oil level should be maintained within the oil sight glass range under any operating condition. The period with no oil visible in the oil sight glass, under starting and other unstable conditions, **must not exceed 30 seconds**. The oil level in the sight glass should be checked during operation.

NOTE: The oil level might be different between the operating condition and the idle condition.

2. The diameter of the sight glass is 0.86 inches. Please check the oil level in the sight glass in the following manner:



3. In the event of oil disappearance from the sight glass, proceed with these steps:

1. If the oil level returns within 30 seconds after disappearance:

**No action needed**

2. If the oil level does not return within 30 seconds:

A. **Operate at minimum load.**

If the oil level returns within one (1) minute, this indicates the possibility of oil trapped in the system (accumulator, etc.).

Changes should be made to the system design in order to improve the oil return flow.

B. If the oil level does not return within one (1) minute:

**Additional oil may be required.** Add approximately two (2) liters of additional oil. HITACHI approved oils are available through AC Component Specialists.



# AC Component Specialists HITACHI SCREW COMPRESSOR NORTH AMERICA SERVICE CENTER

## SERVICE BULLETIN

### Recommended Handling Procedures—JOMO Freol SR30

The HITACHI—SRM semi-hermetic screw compressor is charged with a specially developed HITACHI Oil SR30 at the time of shipment, (unless specified otherwise when ordered from ACCS). HITACHI Oil SR30 is an ester type synthetic oil that features a high kinematic viscosity under mixed conditions with refrigerant.

Ester products are hygroscopic and can absorb up to 1500 ppm (0.15%) water from the atmosphere after several days of exposure. Water can be detrimental to the refrigeration system, in particular, high water levels can affect the system in the following ways:

- Reduced capacity
- Potential to cause corrosion
- Potential to cause copper plating, leading to compressor wear

Compressor trials have shown that the lubricant and refrigeration system can tolerate a few hundred ppm of water. However, to preserve the dryness of the lubricants and thereby protect the refrigeration system, careful handling of the products is required to minimize exposure to atmospheric moisture. Recommended shelf life is two years under controlled storage conditions, after which it is recommended that samples be taken to ensure that the product continues to comply with relevant specifications.

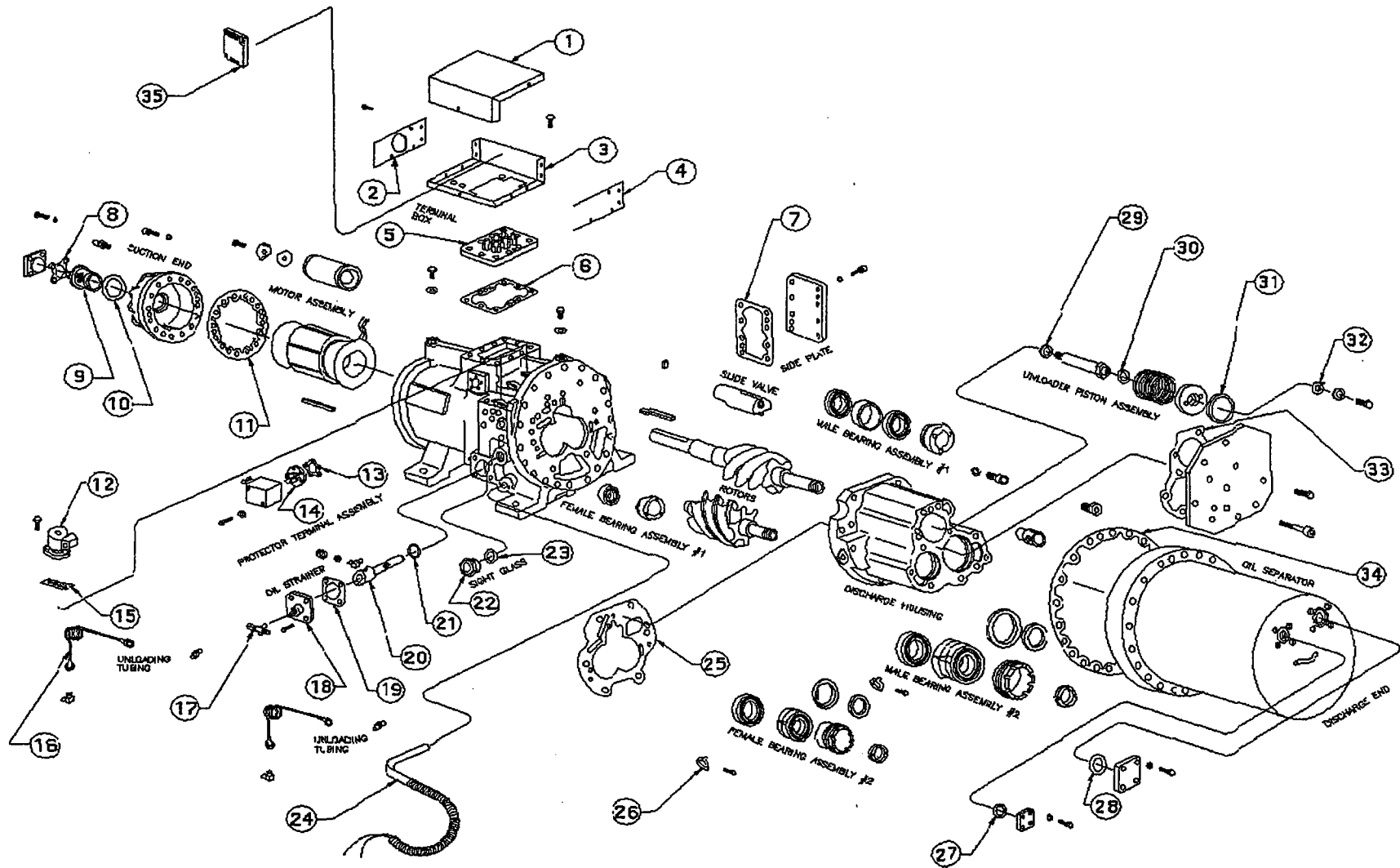
You should ***ALWAYS***:

- Use entire contents of the lubricant container, once opened, or
- “Blanket” part used containers with dry air or preferably with dry nitrogen and reseal, or
- Transfer remaining lubricant to smaller, sealed containers.

You should ***NEVER***:

- Leave containers open for long periods of time.
- Continually expose the lubricant to humidity through repeated sampling of a container.

# HITACHI SCREW COMPRESSOR EXPLODED SERVICE PARTS VIEW MODELS: 4002 SC-H, 5002 SC-H, & 6002 SC-H



# HITACHI SCREW COMPRESSOR SERVICE PARTS LIST

## MODELS: 4002 SC-H, 5002 SC-H, & 6002 SC-H

Use in conjunction with ACCS Service Exhibit Number 100

BUBBLE	DESCRIPTION	QTY.	4002	5002	6002
1	POWER TERMINAL BOX LID	1	TER1A04A	TER1A04A	TER1A04A
2	POWER TERMINAL BOX -SIDE PLATE - LEFT	1	TER1A06A	TER1A06A	TER1A06A
3	POWER TERMINAL BOX	1	TER1A03A	TER1A03A	TER1A03A
4	POWER TERMINAL BOX SIDE PLATE - RIGHT	1	TER1A05A	TER1A05A	TER1A05A
5	MOTOR TERMINAL PLATE ASSEMBLY	1	TPA1A01A	TPA1A01A	TPA1A01A
6	GASKET TERMINAL PLATE ASSEMBLY	1	GSK1A04A	GSK1A04A	GSK1A04A
7	GASKET - SIDE PLATE	1	GSK1A09A	GSK1A09A	GSK1A09A
8	GASKET SUCTION FLANGE	1	GSK1A02A	GSK1A02A	GSK1A02A
9	SUCTION GAS STRAINER	1	STR1A02A	STR1A02A	STR1A02A
10	GASKET - GAS STRAINER	1	GSK1A01A	GSK1A01A	GSK1A01A
11	GASKET - MOTOR COVER	1	GSK1A05A	GSK1A05A	GSK1A05A
12	SOLENOID VALVE	3	SOL1A01A	SOL1A01A	SOL1A01A
13	GASKET - PROTECTOR TERMINAL	1	GSK1A22A	GSK1A22A	GSK1A22A
14	PROTECTOR TERMINAL PLATE ASSY.	1	TPA1A02A	TPA1A02A	TPA1A02A
15	GASKET - SOLENOID VALVE	3	GSK1A17A	GSK1A17A	GSK1A17A
16	UNLOADER PIPING	2	UNP1A01A	UNP1A01A	UNP1A01A
17	OIL VALVE	1	VLV1A04A	VLV1A04A	VLV1A04A
18	OIL STRAINER COVER W/MLV PORT	1	COV1A02A	COV1A02A	COV1A02A
19	GASKET - OIL STRAINER COVER	1	GSK1A03A	GSK1A03A	GSK1A03A
20	OIL STRAINER ASSEMBLY	1	STR1A01A	STR1A01A	STR1A01A
21	O - RING - OIL STRAINER	1	ORG1A01A	ORG1A01A	ORG1A01A
22	SIGHT GLASS ASSEMBLY	1	SGA1A01A	SGA1A01A	SGA1A01A
23	GASKET - SIGHT GLASS	1	GSK1A13A	GSK1A13A	GSK1A13A
24	CRANKCASE HEATER	1	CCH1Z01A	CCH1Z01A	CCH1Z01A
25	GASKET - DISCHARGE HOUSING	1	GSK1A19A	GSK1A20A	GSK1A20A
26	LOCK WASHER - #2 BEARING ASSY'S.	2	LKW1A01A	LKW1A01A	LKW1A01A
27	GASKET - SEALED FLANGE	1	N/A	GSK1A10A	GSK1A10A
28	GASKET - DISCHARGE FLANGE	1	GSK1A11A	GSK1A12A	GSK1A12A
29	SLIPPER RING - SHAFT	1	SLR1A01A	SLR1A01A	SLR1A01A
30	GASKET - UNLOADER PISTON ASSY.	1	GSK1A18A	GSK1A18A	GSK1A18A
31	SLIPPER RING - PISTON	1	SLR1A02A	SLR1A03A	SLR1A03A
32	LOCK WASHER - UNLOADER ASSY.	1	LKW1A02A	LKW1A02A	LKW1A02A
33	GASKET - END COVER	1	GSK1A15A	GSK1A16A	GSK1A16A
34	GASKET - OIL SEPARATOR	1	GSK1A06A	GSK1A07A	GSK1A07A
35	ELECTRONIC MOTOR PROTECTOR MOD	1	MOD1Z01A	MOD1Z01A	MOD1Z01A



# AC Component Specialists HITACHI SCREW COMPRESSOR NORTH AMERICA SERVICE CENTER

## PREVENTATIVE MAINTENANCE PROGRAM

### ACCS OIL ANALYSIS INSTRUCTION SHEET

#### General Information

The oil used in the HITACHI compressor is a polyol ester (POE) synthetic refrigeration oil. The POE synthetic oils are known to have a relatively high attraction for moisture.

To increase the compressor's life, it is necessary to establish a good oil maintenance program. ACCS has oil sample kits available which include a sample bottle, plastic bag, and a self addressed box. Oil samples should be taken anytime after the compressor has run for a minimum of 72 hours from the initial time of startup.

Please complete the enclosed oil sample identification form and sample bottle label. The form and sample bottle must be labeled with the exact unit and compressor ID number. This information is critical for proper maintenance history on each compressor. **Sample bottle label should be completed before taking the oil sample.**

#### Oil Sampling Procedure

When drawing an oil sample, allow some oil to purge off before filling the sample bottle. After an oil sample is drawn from the compressor, place the bottle into the plastic bag, then into the box, affix the proper postage, and put into the mail. A complete spectrochemical analysis of the oil's condition is sent back to you in approximately two weeks. If the oil condition is abnormal, the oil should be drained from the compressor and replaced with new HITACHI SR30 oil, also available from ACCS.

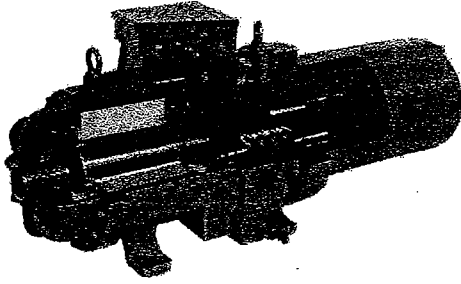
Once oil conditions have been established as good, re-sampling the oil on a yearly basis is recommended. Pre-1993 HITACHI screw compressors did not have an oil drain valve. If you are changing oil, this is a good time to install an oil valve kit. (See ACCS SB #109) If you have further questions, please do not hesitate to call ACCS at (417) 859-6067.

**Oil Test Kit - Part # OTK1A01A**

**SR30 Oil - Part # OIL1A02A (20 Liter Container) or Part # OIL1A03A (1 Gallon Container)**

**Oil Valve Kit - Part # KIT1A01A**

AC Component Specialists, Inc. • P.O. BOX 500 • MARSHFIELD, MISSOURI 65706 • (417) 859-6067  
*Authorized Nationwide HITACHI Screw Compressor and Replacement Parts Distributor*  
ACCS SALES BULLETIN NUMBER 510                      AC02003030059                      © ACCS 2000



# HITACHI

## SRM Semi-Hermetic Screw Compressor General Product Information

MODEL		4002SC - H	5002SC - H	6002SC - H
<b>COOLING CAPACITY</b>				
50 Hz Operation	kcal/h	111,500	138,000	170,000
60 Hz Operation		134,500	166,000	204,500
50 Hz Operation	Btu/h	442,500	547,500	674,500
60 Hz Operation		533,500	658,500	811,500
<b>MOTOR INPUT</b>				
50 Hz Operation	kW	32.5	40.0	49.5
60 Hz Operation		39.0	48.0	59.5
<b>OVERALL DIMENSIONS</b>				
Height	mm (ft. - in.)	572 (1-10-1/2)	597 (1-11-1/2)	597 (1-11-1/2)
Width	mm (ft. - in.)	437 (1-5-1/4)	465 (1-6-1/4)	465 (1-6-1/4)
Length	mm (ft. - in.)	1,117 (3-8)	1,203 (3-11-3/8)	1,233 (4-0-1/2)
Net Weight	kg (lbs.)	320 (710)	430 (950)	450 (995)
Shipping Weight	kg (lbs.)	427 (940)	482 (1060)	527 (1160)
<b>DISPLACEMENT</b>				
50 Hz Operation	m/h (cfm)	137.4 (80.9)	169.5 (99.8)	208.7 (122.8)
60 Hz Operation	m/h (cfm)	165.6 (97.5)	204.2 (120.2)	251.5 (148.0)
<b>PIPING CONNECTING</b>				
Suction Piping O.D.	mm	54.0	54.0	54.0
Suction Piping O.D.	(in.)	(2-1/8)	(2-1/8)	(2-1/8)
Discharge Piping O.D.	mm	35.0	41.0	41.0
Discharge Piping O.D.	(in.)	(1-3/8)	(1-5/8)	(1-5/8)

The cooling capacity and the motor input are based on the following conditions:

Condensing Temperature:	40.6° C (105° F)
Leaving Liquid Temperature from Condenser:	40.6° C (105° F)
Evaporating Temperature:	4.4° C (40° F)
Suction Gas Temperature to Compressor:	12.8° C (55° F)



# HITACHI REFRIGERATING SCREW COMPRESSORS

## COMPRESSOR STARTUP CHECK SHEET

In performing any work on mechanical refrigeration equipment, proper safety procedures should ALWAYS be observed. Electrically locking out the equipment while performing any startup or 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 supersede any codes or safety practices while performing the startup procedure.

Only qualified refrigeration mechanics familiar with the Hitachi compressor should perform this startup and any subsequent service procedures.

For each compressor circuit the following items shall be observed and recorded:

Job site name: \_\_\_\_\_ Date: \_\_\_\_\_

Compressor location: \_\_\_\_\_

Compressor model / SN / Voltage: \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

The following electrical and mechanical safeties shall be in place before placing the compressor into service. Failure to implement these safeties may void the warranty.

### Electrically Applied Safeties (All Manually Reset)

#### 1. Phase Protection

- Phase Reversal                      Must be A-B-C Clockwise
- Voltage Protection                 $\pm 10\%$  allowance [i.e. 460V = 414V – 506V]
- Phase Loss                          Single Phasing
- Phase Imbalance                  Less than 3% of average voltage present

#### 2. Overload Protection

- Based on Compressor Rated Load Amps (RLA)

#### 3. Motor Over-Temperature Protection

- Over Temperature Cutout @ 239 °F

#### 4. Discharge Gas Temperature

- Safety Cutout @ 248 °F

*Liquid injection cooling is required above 248 °F. Liquid injection cooling extends the discharge gas limit to 266 °F. Refer to the Hitachi published details on liquid injection cooling for details on installation.*

# HITACHI REFRIGERATING SCREW COMPRESSORS COMPRESSOR STARTUP CHECK SHEET

## 5. Low Pressure Protection

- $\geq 7$  PSIG Safety Cutout

*For operational limits refer to the Hitachi published capacity curves.*

## 6. High Pressure Protection

- $\leq 370$  PSIG Safety Cutout

*For operational limits refer to the Hitachi published capacity curves.*

## 7. Starting and Stopping Limits

- Must not exceed 6 starts per hour
- If started, remain "On" for a minimum of 5 minutes
- Do not restart compressor until it is fully equalized
- Compressor to be started and operated fully unloaded for 30 – 60 seconds after starting.

## Mechanical Safeties and Operational Requirements

### 1. Discharge Gas Check Valve Required

- Required to limit the time required for pressure equalization and prevents reverse flow of high-pressure gas from the condenser that would result in excessive reverse rotation of the screw rotors.

### 2. Suction Gas Superheat

- 9 F° to 27 F° at compressor

### 3. Discharge Gas Superheat

- Minimum of 54 F°

### 4. Oil Requirements

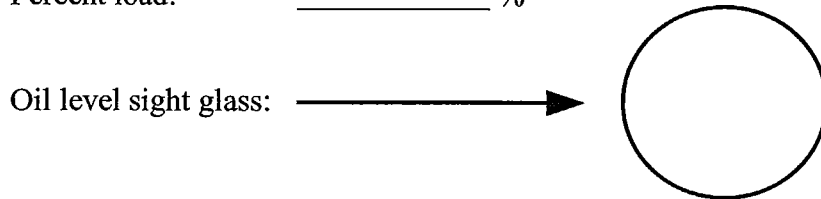
- Oil visible in the sight glass under all stable operating conditions
- Minimum of 70 PSIG differential between suction and discharge pressures
- Crankcase heater required to maintain the compressor crankcase at a minimum of 11 F° higher than other components in the system. Heater shall be energized and allowed time to heat oil prior to starting compressor.

# HITACHI REFRIGERATING SCREW COMPRESSORS COMPRESSOR STARTUP CHECK SHEET

## COMPRESSOR

- Verify that all wiring is properly secured and protected from hot surfaces and sharp edges.
- Verify proper phase rotation of compressor power supply.
- At as close to full load conditions as possible, record compressor operating conditions:

Air/water temp.: Supply \_\_\_\_\_ ° F / Return \_\_\_\_\_ ° F  
Comp. discharge: Pressure \_\_\_\_\_ PSIG / Temperature \_\_\_\_\_ ° F  
Comp. suction: Pressure \_\_\_\_\_ PSIG / Temperature \_\_\_\_\_ ° F  
Oil pressure: Pressure \_\_\_\_\_ PSIG / Strainer ΔP \_\_\_\_\_ PSIG  
Supply volts: L1-L2 \_\_\_\_\_, L2-L3 \_\_\_\_\_, L3-L1 \_\_\_\_\_  
Amps: L1 \_\_\_\_\_, L2 \_\_\_\_\_, L3 \_\_\_\_\_  
Percent load: \_\_\_\_\_ %



## LIQUID LINE SIGHT GLASS

Observe liquid line sight glass and check indicator for refrigerant moisture indication and verify that glass is clear.

Refrigerant condition: \_\_\_\_\_, Clear glass:  Yes  No

- Verify proper loading and unloading of the compressor.
- Check that the condenser stages cycle on./off as dictated by design.
- Where applicable, verify analog output ramping properly in response to discharge pressure.
- Check that the system reaches target and holds there.
- PUMP DOWN CYCLE

Observe the cut-out pressure for the compressor when pump down is initiated.

Pump down cut-out pressure: \_\_\_\_\_ PSIG [should be  $\geq 7$  PSIG]

# HITACHI REFRIGERATING SCREW COMPRESSORS COMPRESSOR STARTUP CHECK SHEET

## SUPERHEAT DETERMINATION

From the operating conditions recorded above:

- a) Convert the recorded suction pressure to saturated temperature using a refrigeration temperature/pressure chart.
  - b) Subtract the temperature obtained in the conversion from the measured suction line temperature. The difference is suction superheat.
  - c) The superheat should be within a range of 9 F ° to 27 F ° at the compressor. If the superheat is not within this range, the thermal expansion valve(s) need to be adjusted.
  - d) Record the superheat: \_\_\_\_\_ F °
- Record in the additional comment section, below, any added safety or control devices that have been added by others.

Additional comments: \_\_\_\_\_  
\_\_\_\_\_  
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Service Technician: \_\_\_\_\_

Date: \_\_\_\_\_