

HITACHI

Semi-Hermetic Horizontal Screw Compressor

For High Temperature Application
With R-22, R-134a, and R407C Refrigerants

Models: 4005SC-Z

5005SC-Z

6005SC-Z

ACCS SERVICE MANUAL AND OPERATION GUIDE

AC
TM
COMPONENT SPECIALISTS

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HITACHI Screw Compressor

4005SC-Z, 5005SC-Z, & 6005SC-Z

SERVICE AND OPERATION MANUAL

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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 the bulletin to supersede any governing code or safety practices while performing the service outlined herein.

GENERAL PRODUCT FEATURES & SPECIFICATIONS

4005SC-Z, 5005SC-Z, 6005SC-Z & 10001SC-Z

- 1.0 Product Introduction** - AC Component Specialists Service and Operations Information Guide describes general features and specifications of the HITACHI 4005SC-Z, 5005SC-Z, & 6005SC-Z screw compressor models. **HITACHI** has been manufacturing the rotary screw compressor design since the late sixties. Worldwide market introduction was 1973. The **HITACHI** screw compressors have an overall failure rate for all shipments worldwide of less than zero-point five percent (00.5%).

Since 1982 these compressors have been distributed in North America exceeding twenty thousand (20,000) units to date. 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** semi-hermetic screw compressor has been developed by HITACHI's own technology, including research and development activities, production engineering and system engineering. It's backed with a long manufacturing experience with hermetic and semi-hermetic reciprocating compressors, centrifugal compressors, and open screw compressors.

The years invested in research, development, and production has established **HITACHI** as the world leader in the HVAC/R industry in rotary screw compressor technology. Technological innovations such as the semi-hermetic two-pole motor in the large capacity range, an internal oil separator, and unique ball type and roller type bearings for axial and radial loads, assure a product 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

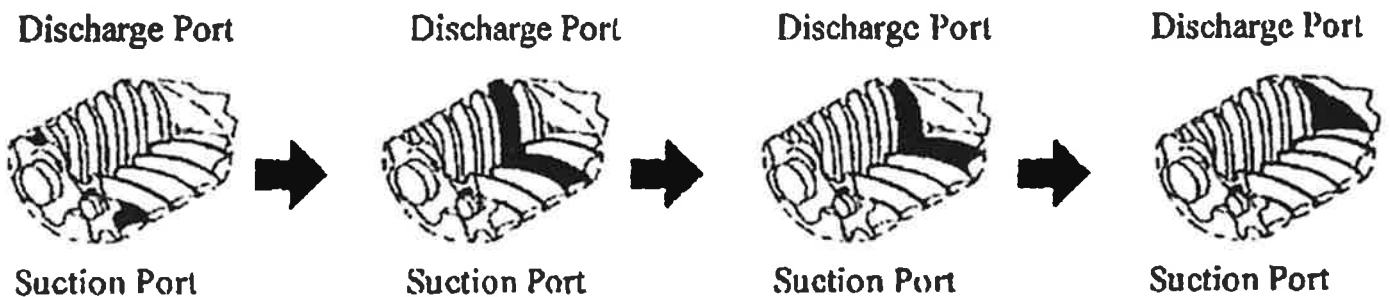


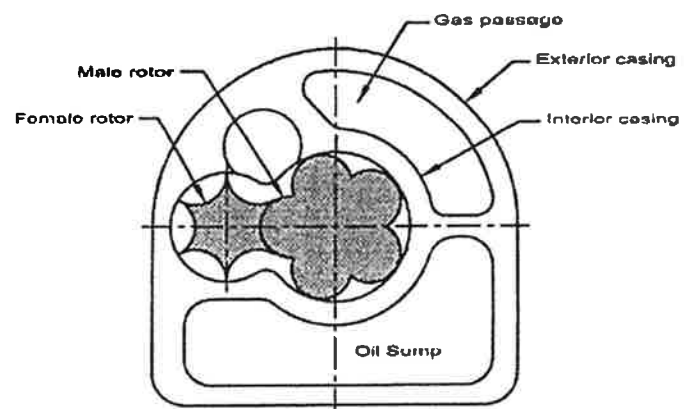
Figure 2-1. Principle of Screw Compressor

2.1 Screw Compressor vs. Reciprocating Compressor

- (1) Fewer Moving Parts - The number of parts in the screw compressor is approximately one tenth the number in reciprocating compressor. A screw compressor features the 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, higher reliability, and longer lasting performance.
- (2) Energy Savings – By infinitely modulating capacity control, the screw compressor can offer a substantial energy savings to the owner. A control range of $\pm 2\frac{1}{2}^{\circ}\text{F}$, typical of reciprocating compressors, causes the equipment to continually short cycle between stages resulting in a poor attempt to match load.
- (3) Resistance to Slugging - Screw compressors have greater resistance to liquid flood-back 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 the **HITACHI** screw compressor is supplied by a pressure difference between 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 is stored in the high-pressure side.

2.2 HITACHI Screw Compressor Advantage – HITACHI Semi-hermetic screw compressors are provided with the following innovations:

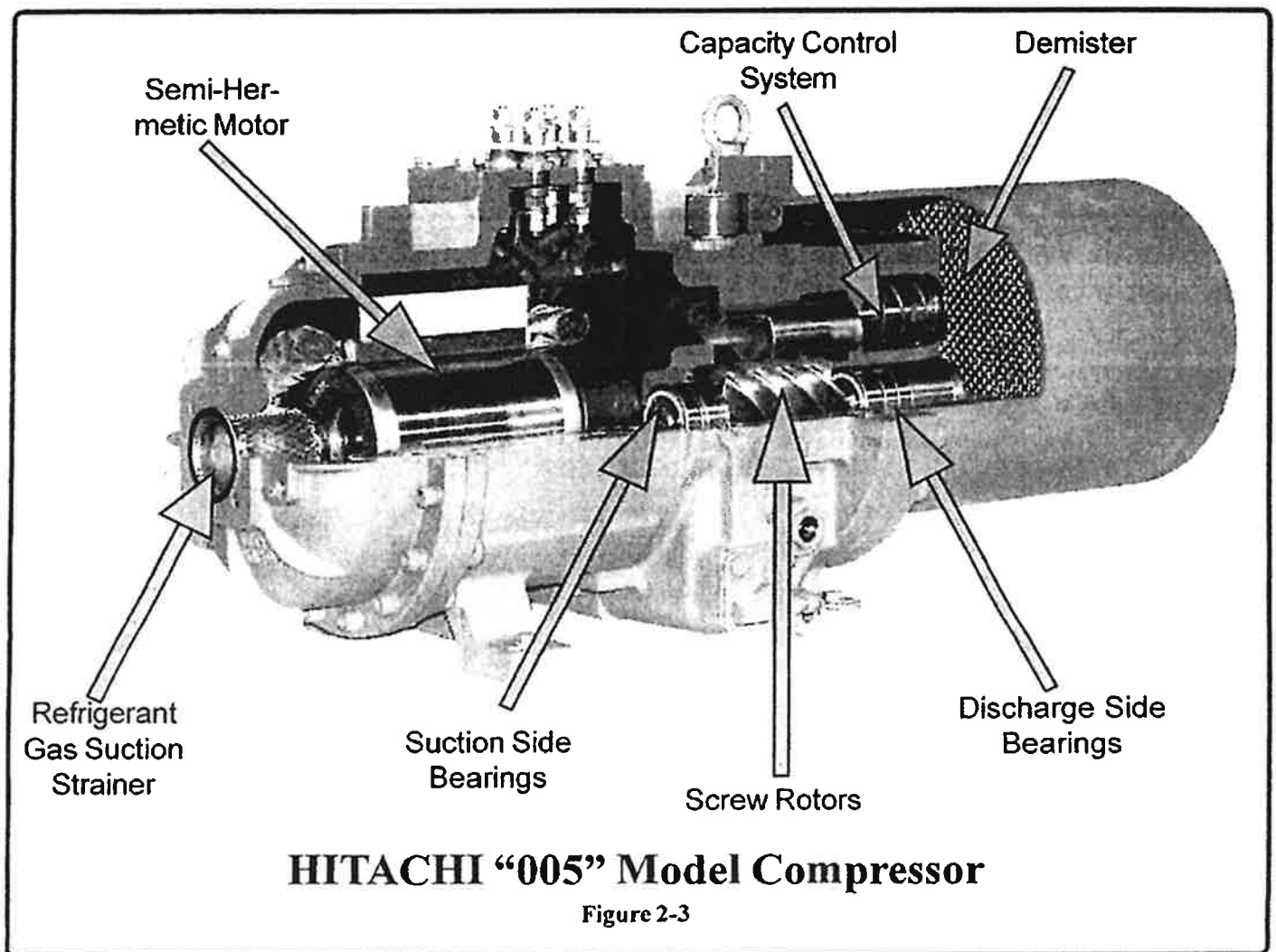
- (1) A pair of patented new profile screw rotors, developed by **HITACHI**'s own technology, have improved the efficiency in the operation with a high compression ratio.
- (2) A built-in oil separator and the elimination of the oil pump, oil cooler and oil piping have increased reliability and durability in the compressors.
- (3) The patented double casing construction of the **HITACHI** screw compressor decreases the transmission of sound. 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 axial loads, extends the life of the compressor and increases its reliability.
- (5) The use of highly reliable two-pole large capacity semi-hermetic motors, developed by **HITACHI**'s own technology, has resulted in a highly durable screw compressor



2.3 Construction

HITACHI semi-hermetic screw compressors have three major compartments:

- (1) The semi-hermetic motor Compartment – Includes the motor rotor and stator, six terminal lugs for the electric power connections, internal thermistors inserted into the stator coils to protect the motor from over temperature, four terminal connectors for the thermistors, and a suction gas strainer. The motor 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 or 60 Hz rated voltage.
- (2) The Screw Compressor Compartment – Includes a pair of screw rotors, bearings, and the components for the capacity control system.
- (3) The oil separator compartment - Includes a demister that serves as an oil separator and an oil sump reservoir with an oil strainer.



2.4 Refrigerant Flow

The 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 from the compressor compartment enters the oil separator compartment. The oil is separated from the refrigerant gas as the mixture flows through 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 in the oil sump reservoir and is mounted with a removable flange that includes an oil drain valve.

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 range for the 4005SC-Z from 33% to 100%, on the 5005SC-Z and 6005SC-Z ranging from 25% to 100%. Control is provided 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 the volume of oil contained in the capacity control cylinder. Three solenoid valves, which are installed in the oil passages, are used in combination to provide accurate infinitive capacity control.

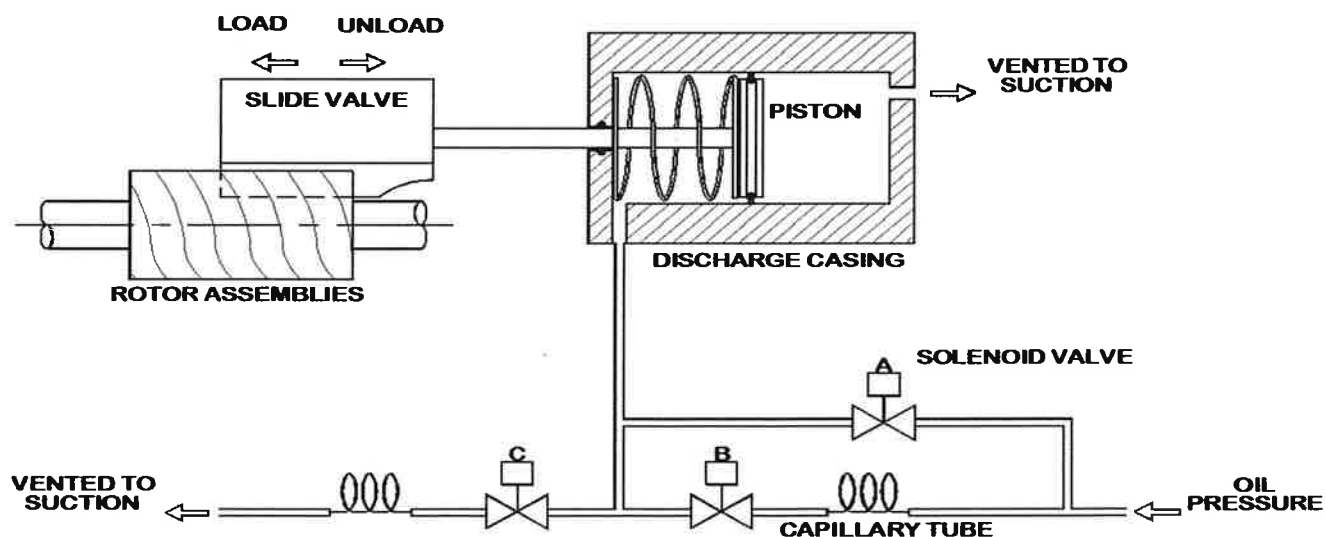


Figure 2-4: Capacity Control System

HITACHI Screw Compressor

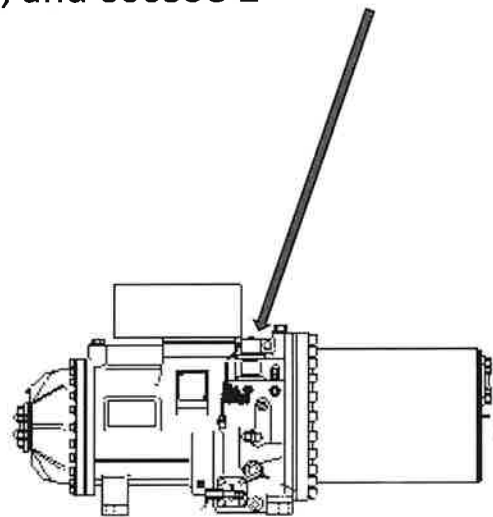
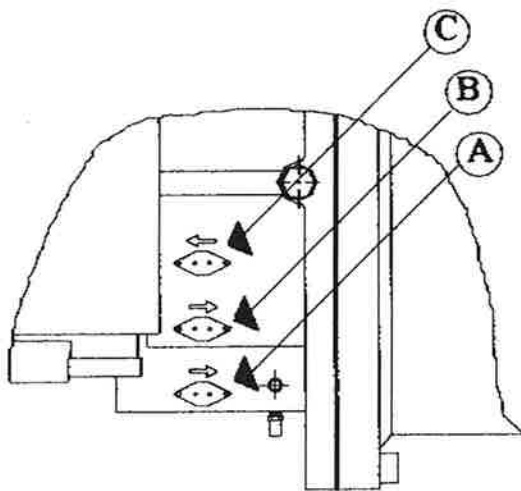
Models 4005SC-Z, 5005SC-Z, and 6005SC-Z
Infinite Capacity Control System

Condition	Solenoid A	Solenoid B	Solenoid C
Start/Stop	ON	OFF	OFF
Loading Up	OFF	OFF	ON
Unloading	OFF	ON	OFF
Load Constant	OFF	OFF	OFF

Table 1: Solenoid Sequence of Operation
For Models: 4005SC-Z, 5005SC-Z, and 6005SC-Z

Location of Solenoid Valves

For Models: 4005SC-Z, 5005SC-Z, and 6005SC-Z



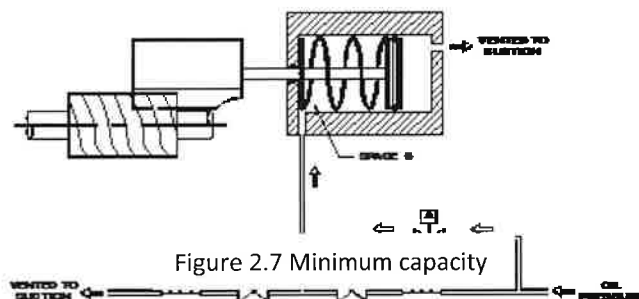
NOTE:

1. Minimum Load:
 - a. 33% for 4005SC-Z
 - b. 25% for 5005SC-Z and 6005SC-Z
2. A controller for the capacity control system is not included with the compressor.

Minimum Capacity for Starting

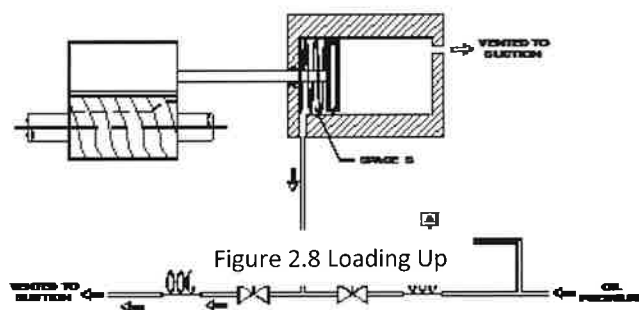
Models 4005SC-Z, 5005SC-Z, & 6005SC-Z

Solenoid valve A is opened, and the other valves are closed. The oil pressure existing in space S, moves the piston towards the right-hand direction. The piston can move to the end of its stroke so that the capacity can minimize. With the elimination of the capillary tube in-between solenoid valve A and the space S, the actuating speed of the piston may be rapid. (See Fig. 2-7)



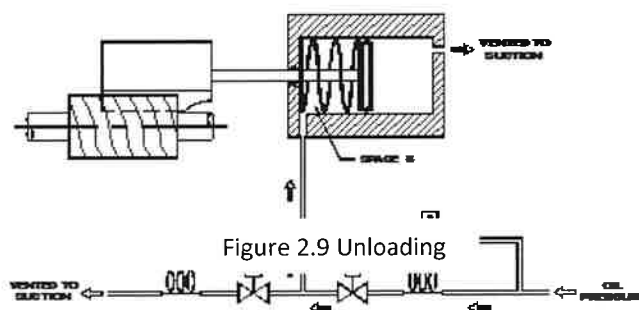
Load Up

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 load up. (See Fig. 2-8)



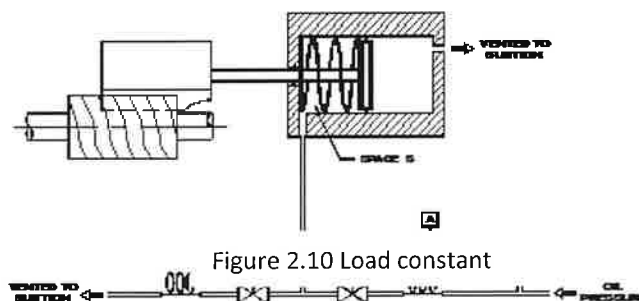
Load Down

Solenoid valve B 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 because there is a capillary tube in between the oil source and space S. (See Fig. 2-9)



Load Constant

The three solenoid valves are closed. Because all the solenoid valves are closed, the oil that exists in space S will be held and the piston will not move. (See Fig. 2-10)



Location of Solenoid Valves

The location of the three solenoid valves are shown On Page 9.

Note:

1. Minimum Load:
 - 33% for 4005SC-Z
 - 25% for 5005SC-Z and 6005SC-Z
2. A controller for the capacity control system is not included with the compressor.

2-7. Details of Components

(1) **Screw Rotors**

New asymmetrical profile screw rotors, composed of a five-lobe male screw rotor and a six-interlobe female screw rotor. These screw rotors are machined by a special hobbing and honing machine, with excellent precision, based on strict quality control.

(2) **Casing**

Double structure construction has been applied to the compressor casings and high-strength inner ribs have been provided to minimize noises and to ensure rigidity. The main casing, the discharge casing and the various covers are machined by a computer-aided machining center, to enhance reliability.

(3) **Bearings**

Radial roller bearings have been installed at both ends of the screw rotors, to support the radial loads. 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 the oil which is fed from the oil separator.

(4) **Suction Strainer**

A reinforced strainer is provided at the suction port of the screw compressor.

(5) **Semi-Hermetic Motor**

The two-pole hermetic motors have been specially developed for these screw compressors by **HITACHI**. The motors are squirrel cage, three phase, two pole, induction type. The motor range is composed of three models 40 HP, 50 HP, and 60 HP. The coils of these motors are impregnated with varnish to ensure rigidity against the heavy vibration when the motors are started.

Six terminal plugs on the 4005SC-Z, 5005SC-Z, & 6005SC-Z compressor, for electric power connections, which can be configured for either across-the-line or 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 coils, 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 with the discharge end of the screw compressor, to form one unit. The vessel is installed at the high-pressure side of the screw compressor.

3.0 **HITACHI - Compressor Cores**

When a **HITACHI** Core is being used as a replacement compressor, it is possible that the core would be of some value. Please contact AC Component Specialists, Inc. to determine if there is any residual core value and to obtain authorization for shipment of the core to ACCS.

OPERATING CONDITIONS

The following conditions must be observed in order to avoid damage to the compressor. Failure to do so will 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 Control Circuits

Magnetic contactor minimum sizing should be selected as follows:

Air Cooled Units: $I_{mg} = I_r \times 1.5$

Water Cooled Units: $I_{mg} = I_r \times 1.25$

I_{mg} : Rated Capacity of Magnetic Conductor (A)

I_r : Unit Running Current (A)

Any local or national codes that require higher rated contactor selection should be followed.

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

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 shall not exceed 370 psig.

Return Liquid Sludging

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

OPERATIONAL SAFETIES

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 – 506 V)
- 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 of installation.

5. Low Pressure Protection

- ≥ 7 PSIG Safety Cutout

For operation limits refer to the Hitachi Published capacity curves.

6. High Pressure Protection

- ≈ 370 PSIG Safety Cutout

For operation 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.

OPERATIONAL SAFETIES

Mechanical Safeties and Operational Requirements

1. Discharge Gas Check Valve Required
 - Required to limit 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 sight glass under all stable operating conditions.
 - Minimum of 70 PSIG differential between suction and discharge pressures.
 - Crankcase heater to maintain the compressor crankcase at a minimum of 11°F higher than other components in the system.

PROTECTIVE DEVICES

The **HITACHI** Semi-Hermetic Horizontal Screw Compressor, as supplied to the United States, does not have the following protective devices. They must be supplied by others to ensure proper use of the compressor. ACCS part numbers are included for your reference. All protective safety devices shall be manual reset type.

1. **Motor Protector**

AC Component Specialists, Inc. has two protector offerings that are UL approved and comply with **HITACHI** manual reset requirements.

- Electronic motor protection module Part Number **MOD1Z04A**, is a dual voltage 120/208-240 VAC module that responds to PTC thermistors embedded in the motor windings to provide motor over-temperature protection.
- Retrofit kit for 2 ACE electronic motor protection module Part Number **KIT1A45A**, to replace **MOD1Z02A** that is obsolete and no longer in production.

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

A crankcase heater must be applied. The hole provided for the crankcase heater 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 12-volt crankcase heater part number **CCH1Z01A** or a 200-watt 230-volt crankcase heater part number **CCH1Z02A**.

3. **Continuous Capacity Control**

The capacity control is performed by the exchange of oil pressure to the unloader piston. Three oil control solenoid valves, 120-volt, are supplied with the compressor. A solenoid valve controller must be employed to adjust capacity. Please call for details.

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 start-up and to monitor 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°F. The discharge gas temperature should be sensed on the discharge gas piping at a distance of 9 7/8 inches from the compressor housing.

PILOT DUTY ELECTRIC MOTOR PROTECTION MODULE

ACCS Part Number MOD1Z04A

The **HITACHI** Horizontal Screw Compressors, as supplied to the US market (4005SC-Z, 5005SC-Z, & 6005SC-Z), are 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 electric motor module, to provide protection against the operation of the compressor above factory allowable temperature limits for the motor.

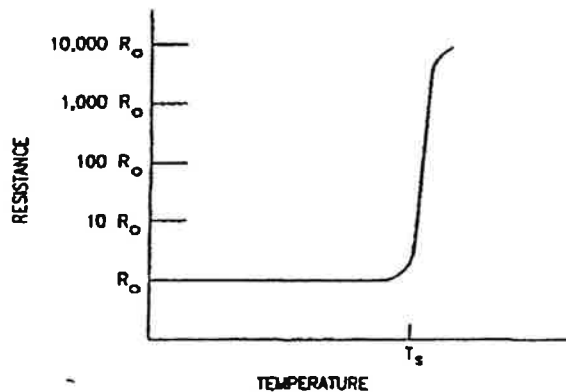


Figure 1

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 (Fig. 2), for detailed hookup information.

Service and Replacement

High voltage input 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.*

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. The Electronic motor protection module, ACCS part number **MOD1Z04A**, available through AC Component Specialists, Inc., is a dual supply voltage (120/208-240 VAC) module.

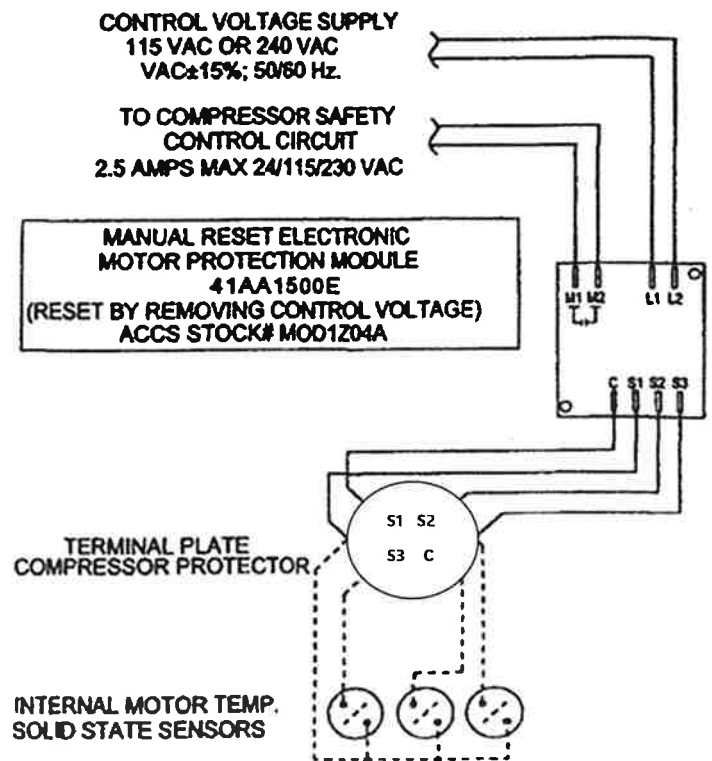


Figure 2

OBSOLETE

2ACE ELECTRICAL MOTOR PROTECTION ACCS PART NUMBER MOD1Z02A

The solid state 2ACE module is an economical and reliable protection platform which combines current and thermal overload protection for large three phase motors.

These UL recognized motor protection modules are used with positive temperature coefficient (PTC) thermistors installed in the motor windings. These thermistors exhibit low resistance until their temperature increases to a predetermined trip point. A unique feature of the steep slop PTC is an increased resistance of several orders of magnitude at the trip point. This exponential raise in resistance results in the opening of the 2 ACE control relay which can be wired in series with a starter/contacter coil.

Where locked rotor conditions can cause rapid current overload, the response time of thermal protection may not be adequate. The 2ACE module employs a proprietary design with one current sensor per phase that responds to changes in current. By utilizing the control relay, the module can be calibrated for individual applications with a "must hold" current range from 25-225 Amps.

The current transducers allow the module to offer added features of phase protection, unbalance, and improper phase sequence conditions.

The current transducer can also be used as an accurate, stable device to measure AC current. The 2ACE output is linear over its full-scale range of 0-225 Amps and is independent of load. This low ripple output is achieved by full scale signal conditioning of the transducer and can be directly connected to a control microprocessor without filter conditioning.

General Specification

	Units	Minimum	Typical	Maximum
Operating Temperature Range	°C	-40		+70
Supply Voltage (Rated 24 VAC at 0.240A Load)	VAC	18	24	30
Rated Line Frequency Utility Regulation		45 56	50 60	55 64
Rated Line Frequency	Hz	45	50/60	62
Low Voltage Cut-Out Trip	V ac	15	16	17
Low Voltage Cut-In Reset	V ac			18
Low Voltage Response Time (Supply 100% to 50%)	SEC	0.150	0.200	0.250

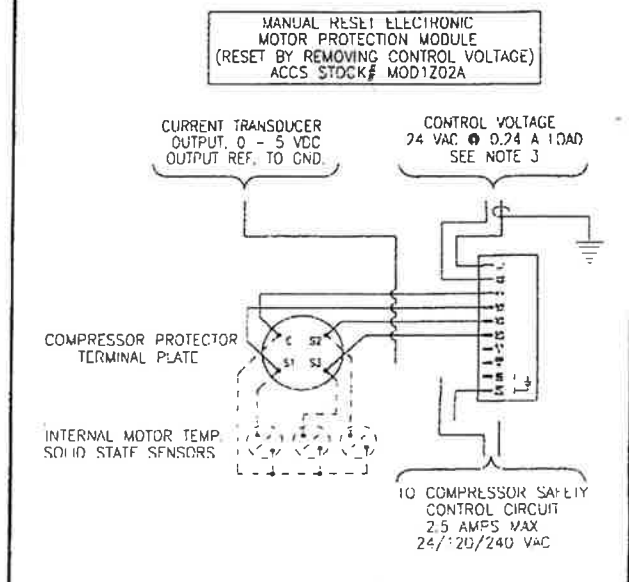
Thermal Motor Specification

Units		
Sensor Trip Resistance	K Ω	13 $\pm$ 3
Sensor Reset Resistance	K Ω	3.25 $\pm$ 0.5
Sensor Response Time	SEC	0.50 Typical

Current Transducer and Protection Specification

Units		
Sensed Output at B & G Terminal	Vdc mA	0 to 5 Full Scale 4 - 20 Full Scale
Accuracy		$\pm$ 3% Full Scale
Response (10 to 90%)	Sec	0.150 Typical
Shorted Current Sensor Protection	Ω	<10 Typical
Repeatability		$\pm$ 1% Full Scale
Current Phase / Unbalance Detection	Load 17% Partial 25% Unload 50%	
Must Hold Calibration Range	A ac	25 to 225
Overload Current Trip Time		MH x 400%: 1.5 Sec.
Phase Miswire Response Time (Improper Sequence)	SEC	1.1 Max
Phase Loss Response Time	SEC	1.0 Max

Detailed Hookup Information for 2ACE Electronic Motor Protection Module ACCS part number MOD1Z02A



2ACE ELECTRONIC MOTOR PROTECTION

FAULT DIAGNOSTIC DISPLAY CODES

DISPLAY VALUE	DEFINITION
0	Normal – no fault detected. Sweeping zero display – consists of turning on & off one led segment sequentially to provide active operation mode.
HA XXX	Normal – Motor Off – Current <5 A AC. Must Hold calibration setting displayed. Acceptable range for XXX is 025 – 225.
1	Current Overload
2	Loaded Unbalance / Phase Loss ($\geq 17\%$)
3	Unloaded Unbalance / Phase Loss ($\geq 25\%$)
4	Improper Phase Sequence
5	Over – Temperature
6	Out of Range of Must Hold calibration
7	Unload Unbalance
8	Phase Loss ($> 60\%$)
All Other Alpha Symbols	Internal Errors – Contact ACCS

ACCS Sales Office Phone: 417-859-6067
Submit an online request at: www.accscompressor.com

Retrofit Kit - KIT1A45A

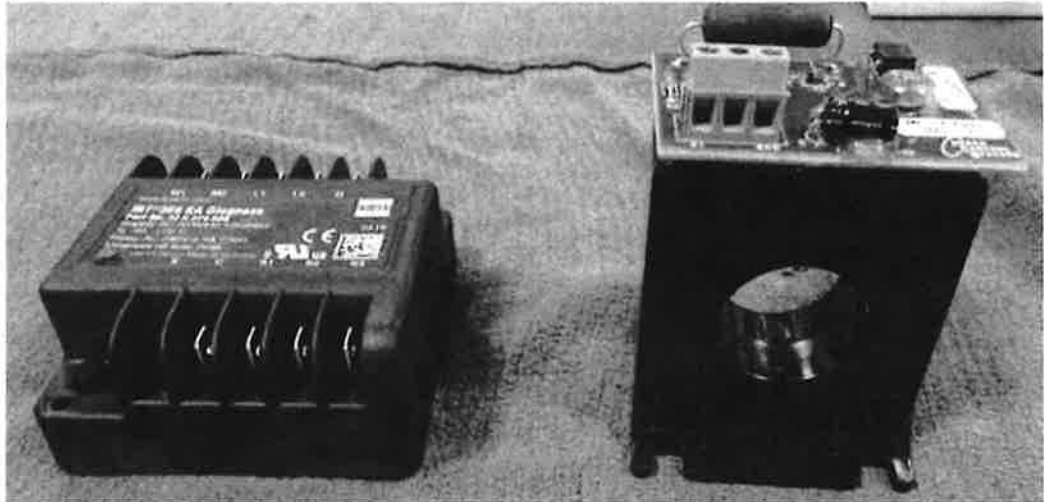
To Replace 2ACE Module (MOD1Z02A)

KIT1A45A - Retrofit of obsolete (MOD1Z02A) 2ACE Module

Due to the 2ACE Module being discontinued by the manufacturer, ACCS is providing the following components in a kit to replace this part.

Images shown to the right are for the contents in this kit, a Thermal Motor Protection Module, and a Current Transducer.

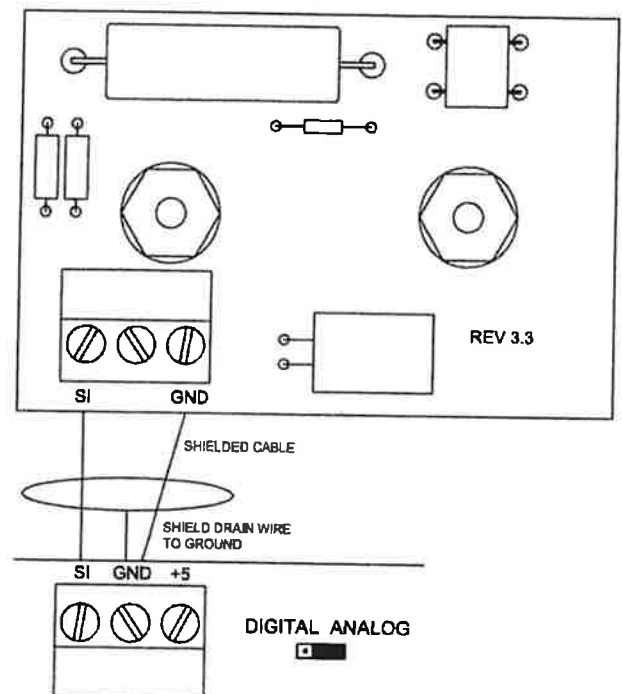
The function of these two components is only to provide thermal motor protection for the compressor and an amp current input reading.



Installation

1. In Installing the amp sensor, you must use shielded cable and shield must not be broken. Shield must be connected only at the sensor Input terminal block.
2. The amp Sensor is 0-5vdc.
3. The amp sensor generates its own voltage and requires no 5vdc power from a controller. This is a digital input.
4. The Thermal Protection Module is a stand-alone sensor and is not required to be connected to a controller.
5. The power supply for the motor protection module is a dual voltage power Supply (120 or 220acv)
6. M1 & M2 is the dry contact for the control voltage to the contactor.
7. C, S1, S2, & S3 are to be connected to the same labeled terminals on the **HITACHI** screw compressor.

CURRENT TRANSFORMER WIRING DIAGRAM



ELECTRICAL PHASING FOR PROPER COMPRESSOR ROTATION

The **HITACHI** Horizontal Screw Compressors, as supplied to the US market (Models 4005SC-Z, 5005SC-Z, & 6005SC-Z), are factory nameplated for operation at the following voltages:

208-230 Volt - 3 PH - 60 Hz
460 Volt - 3 PH - 60 Hz

All models are provided with 6 terminals for line voltage connections, to allow STAR-DELTA starting. ACROSS-THE-LINE starting is also applicable to the compressor. Please refer to 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 supersede 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. Ensure 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 6 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

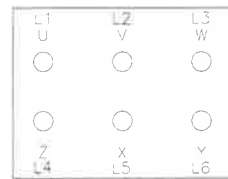


Fig 106.1

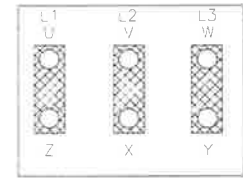


Fig. 106.2

1. Turn off the main disconnect and lock out. Ensure 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 L1, L2, & L3 designated power.
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 3 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 to achieve a CLOCKWISE rotary. **NEVER CONNECT TEST LEADS TO OR DISCONNECT TEST LEADS FROM A LIVE CIRCUIT.**
7. Where 6 power leads are used connect the test leads of the phase rotation indicator to the L4, L5, & L6 designated power leads and repeat steps 4 through 6.
8. When testing is complete, disconnect the power to the circuit and lockout. Disconnect the testing device from the circuit.
9. 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)
10. 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.

Across The Line Starting Kit XLK1A01A

HITACHI TERMINAL PLATE ASSEMBLIES

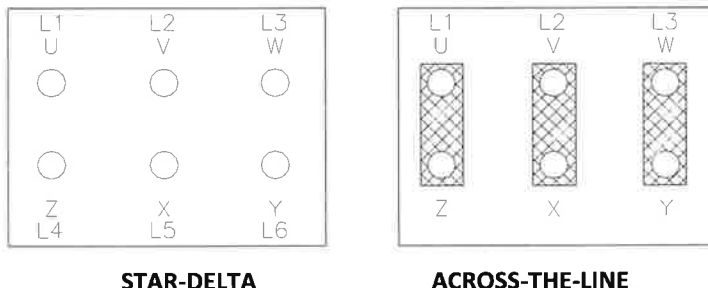


FIGURE 1

The **HITACHI** Horizontal Screw Compressor supplied to the North American market is provided with six main electrical terminals, to allow for Star-Delta starting of the compressor.

However, across-the-line starting is also applicable to the compressor. To wire the compressor to accept across-the-line starting, terminals “U” to “Z”, “V” to “X”, and “W” to “Y” must be connected. This information can be seen in **Figure 1**, above.



FIGURE 2

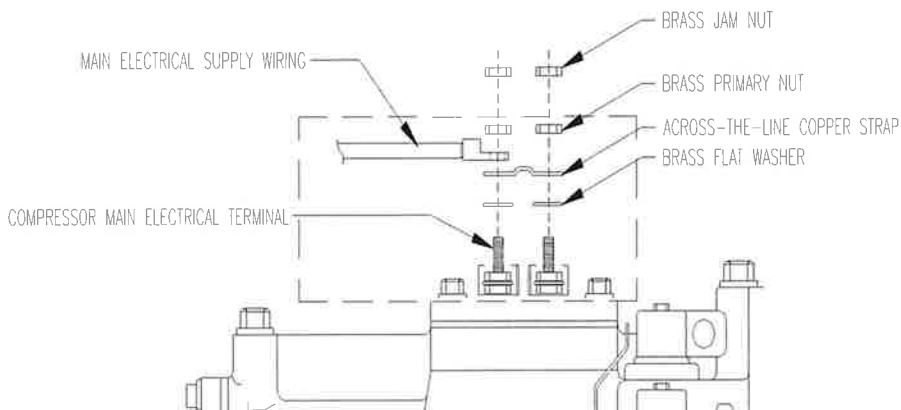


FIGURE 3

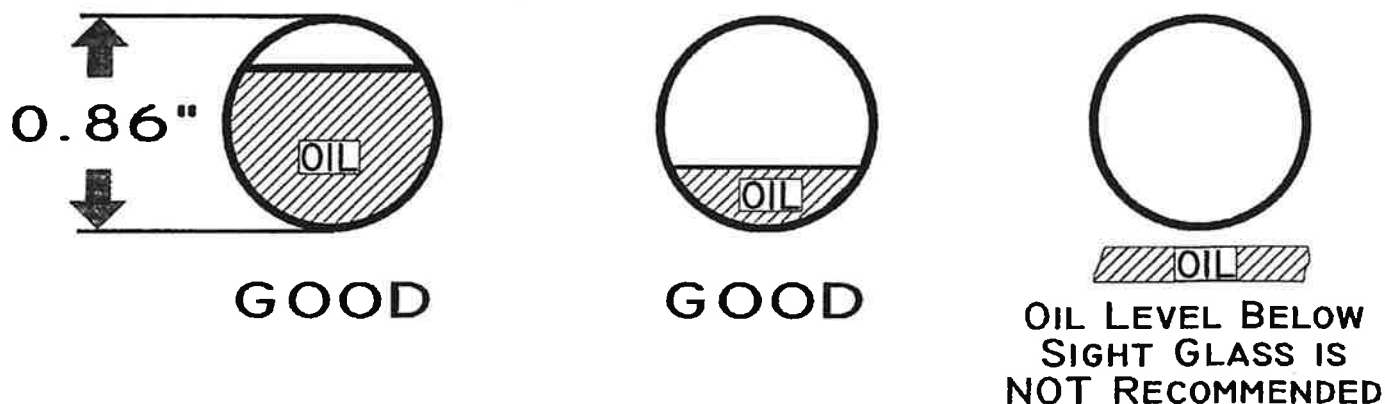
AC Component Specialists offers as a purchase option, an Across-The-Line Starting Kit (**XLK1A01A**) to assist in the hookup as described above. **Figure 2** above, shows one of the copper straps included in this kit. There are three straps provided in the kit to accommodate the hookup pattern shown in **Figure 1** at the top of this page. **Figure 3** details the recommended installation location for this strap, with relation to the nuts and washers on the main electrical terminal stud. The torque value for both the primary nut and jam nut is 21.7 ft/lbs. When tightening the primary and jam nuts, be sure to hold the nut below the strap to prevent the main terminal stud from turning. Please follow this installation guide to insure tight electrical connections for incoming power to the **HITACHI** screw compressor.

HITACHI SCERW COMPRESSOR OIL MANAGEMENT

1. The oil level should be maintained within the oil sight glass range under steady-state operating conditions. The period with no visible oil 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 an operating condition and an 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:

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

No Action Needed.

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

- a. **Operate at minimum load.**

If the oil level returns within one minute, this indicates the possibility of oil trapped in the system (accumulator, piping, etc.). Changes should be made to the system design to ensure the return of oil to the compressor.

- a. If the oil level does not return within one minute:

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

Oil Specification and Maintenance

HITACHI - SRM REFRIGERATING SCREW COMPRESSORS

1. Oil Level

Oil level should be maintained within the oil sight glass range under steady-state 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 drops at the suction strainer, or the oil strainer, exceeds 0.3 kg/cm²G (4.3 psi), the amount of foreign particles is considered to be excessive. The refrigeration system design and manufacturing conditions must be reviewed - For newly designed systems, the lubrication oil must be sampled from the oil chamber with **OTK1A01A** after 72 hours and analyzed for impurities.

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 ensure that they do not enter the refrigeration system. Acid test strips are not a reliable testing procedure for the above. ACCS oil sample testing kits provide accurate levels, **OTK1A01A**.

c. **Moisture** - Moisture content in the refrigeration system must be less than 200 ppm, as determined by the gas chromatograph method or the Carl Fisher method. Contact ACCS for oil sampling and analysis information, **OTK1A01A**.

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** "005" semi-hermetic screw compressor is charged with a specially developed oil, **HITACHI** Oil SW220HT (**OIL1A21A**), at the time of shipment. The SW220HT is an ester type synthetic oil that features a high kinematic viscosity under mixed conditions with refrigerant. Table 1 provides detail on the refrigeration oil.

Table 1

Characteristics of Refrigeration Type Oil

	Test Method	
Name of Oil	-	SW220HT
Kinematic Viscosity At 40°C (104°F) At 100°C (212°F)	ASTM D445	220mm ² /s(220cSt) 19.2mm ² /s(19.2cSt)
Pour Point	ASTM D97	-24°C
Flash Point	ASTM D93	260°C
Total Acid Number	ASTM D664	Less than 0.15
Color	ASTM D1209	300
Density at 15.6°C	IP 365	980 kg/m ³

b. Oil Charging Quantity

The required oil charge for the screw compressor will vary depending on the design of the refrigeration system (including a 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)
4005SC-Z	6
5005SC-Z	6
6005SC-Z	6

Oil Charge shown above is 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 at the time of shipment. Confirm that the oil is viewed from the oil sight glass under any operating conditions.

HITACHI SW220HT Oil

ACCS Part Number OIL1A21A (1 gallon size)

With the introduction of the new “005” series Horizontal screw compressors for use with refrigerants R-22, R-407C, and R-134a, **HITACHI** decided to make available a universal lubricant that would be compatible with all three refrigerants.

This oil was developed to enhance the previous oils and provide superior protection benefits for the new compressors. SW220HT developed oil is solely for use in HITACHI screw compressors. This is an ISO220 grade synthetic lubricant with select polyester (POE) base stocks with an added acid scavenger that acts to bind moisture and neutralize acid and thereby minimize copper plating within the compressor.

System acid is often the by-product of moisture that has entered the system. Our oil is supplied dry with a moisture content of typically less than 50ppm. It is important to follow proper POE oil handling procedures and to minimize the time that the system is open to the atmosphere. POE oil products are hygroscopic and can absorb up to 1500ppm of moisture if left open for a short time.

High moisture content can affect the refrigeration system in the following ways:

- ◆ Reduced capacity, affecting performance.
- ◆ Potential for corrosion, limiting compressor life.
- ◆ Potential to cause copper plating, leading to elevated compressor wear.
- ◆ Reduced internal clearances, resulting in elevated operating temperatures.
- ◆ Acid production associated with moisture content may result in motor insulation degradation

The incorporation of an acid scavenger, for increased compressor life, is but one of many benefits that SW220HT oil provides. Additional benefits include:

- ◆ Universal compatibility with refrigerants R-22, R-407C, and R-134a.
- ◆ Outstanding product cleanliness and purity.
- ◆ Long lubricant life, with proper maintenance.
- ◆ Superior lubricity and wear protection.
- ◆ Excellent miscibility and fluidity within compressor operating ranges.
- ◆ Excellent high-temperature stability.
- ◆ No adverse health and safety effects when properly handled.

SW220HT is the proper oil for use in the new **HITACHI** ‘005’ Series Horizontal screw compressors. Substituting another type or brand of oil would cancel out many exceptional benefits of the oil, thus compromising the life and reliability of the compressor. The UL listing of these compressors is based on the use of SW220HT lubricant. Using any other oil in the **HITACHI** “005” series Horizontal Screw Compressors will void the factory warranty.



HITACHI Refrigeration and A/C Screw Compressors

Oil Change Kit- SW220HT

ACCS Stock/Part #: **KIT1A08A**

Oil Changes should occur after 40 hours of run time, then yearly. This will ensure your compressor is running at the best level and there are no contaminants that will cause loading problems, diminished run hours, failure, and costly down time. When replacing earlier models, retrofitting, cleaning up the system from a burnout, or contaminants due to high levels in the oil, careful handling of an oil change to the refrigeration system must be accomplished. As much old lubricant as possible should be removed from the system prior to the installation of the replacement / retrofit compressor or removed from the compressor for an annual oil change. The supplied SW220HT oil (**OIL1A21A**) in the new or remanufactured compressor should be used during the initial startup on the old system.



← Ensure the appropriate box for the refrigerant is marked on the nameplate for the refrigerant in use if plate is on your model compressor. Operate the compressor with new oil, for a minimum of 40

run hours, ensuring that the oil remains visible in the compressor sight glass under all stable operational conditions. Remove the oil charge from the compressor, check cleanliness of strainer, change out the oil strainer plate gasket and strainer O-ring, wipe out the sump, and recharge with fresh SW220HT Refrigeration Lubricant. Operate the compressor for a minimum of 40 operational hours and sample the lubricant with an ACCS Oil Test Kit (**OTK1A01A**) (included in the oil change kit or can be purchased separately). Follow the instructions included with the kit for proper oil analysis. When results are received for the oil analysis perform another oil change, if recommended, to clean up the entire system. Water can be detrimental to the system affecting in the following ways: Reduced Capacity, Corrosion, Copper Plating, loading issues, and/or Compressor Wear. To preserve the dryness of the lubricants and protect the system, careful handling of the lubricant product is required. This minimizes exposure to atmospheric moisture. Recommended shelf life is 2 years. Samples should be taken by the 2 year date to ensure that the compressor oil still complies with relevant specifications. Several oil changes may need to be performed to clear up units that are severely contaminated. Evaporating solvent can be used to clean the oil strainer and the oil sump. First, wipe out the compressor sump, with proper gloves, then spray or pour about a quart of cleaning solvent into the sump.



↑ HITACHI - KIT1A08A

Included:

- Oil Strainer Gasket • O-Ring Strainer
- 2 – 1 Gal Container of Oil SW220HT • Oil Test Kit • MSDS Sheet

NEVER: Leave containers or compressors open, expose lubricant to humidity continually.

ALWAYS: Use entire contents of the lubricant container, once opened.

****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/FUSHENG compressor maintenance procedures should attempt any service to the screw 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 supersede any governing codes or safety practices while performing the service outlined herein.

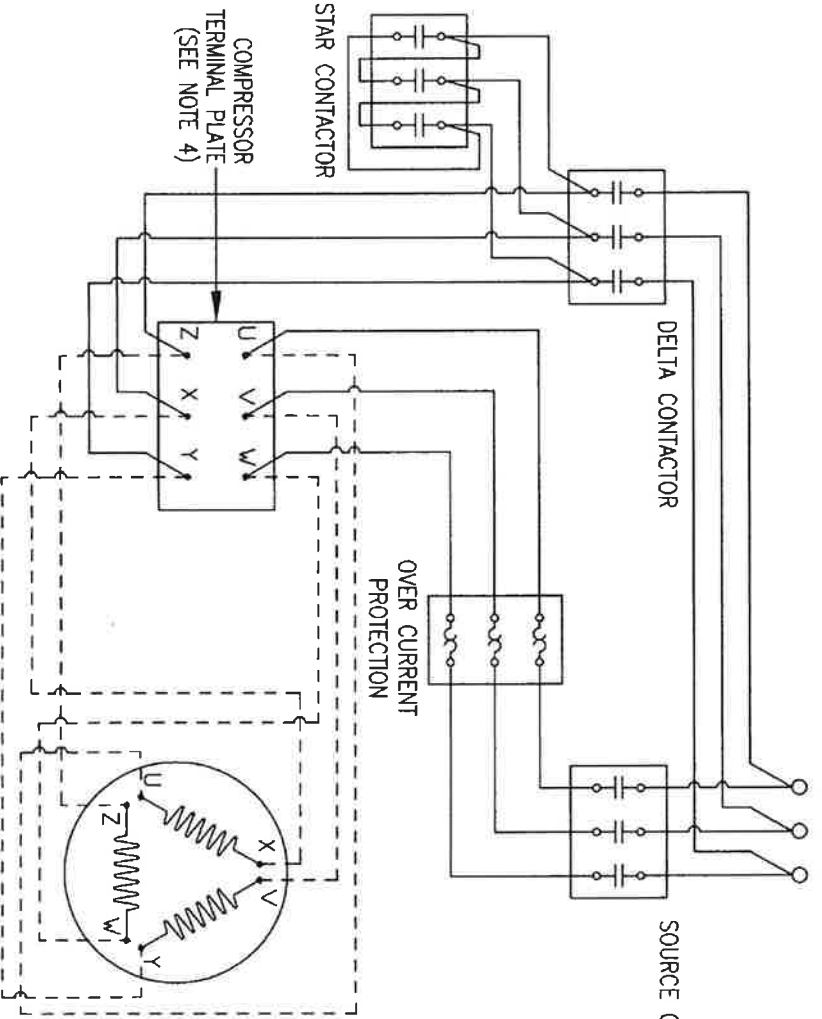


↑ OTK1A01A

MAIN SUPPLY VOLTAGE (SPECIFY WHEN ORDERING COMPRESSOR)

230V, 60 HZ., 3 PH
460V, 60 HZ., 3 PH

L1 L2 L3



NOTES:

1. STAR OPERATION = 5 SECONDS; CONTACTOR PICKUP & RELEASE <0.035 SEC.
2. PHASE ROTATION, L2 MUST FOLLOW L1.
3. OVER CURRENT PROTECTION SELECTION BASED ON THE FOLLOWING CHART:

MODEL NO.	460-3-60	230-3-60
4005SC-Z	50 AMP	94 AMP
5005SC-Z	55 AMP	118 AMP
6005SC-Z	66 AMP	127 AMP

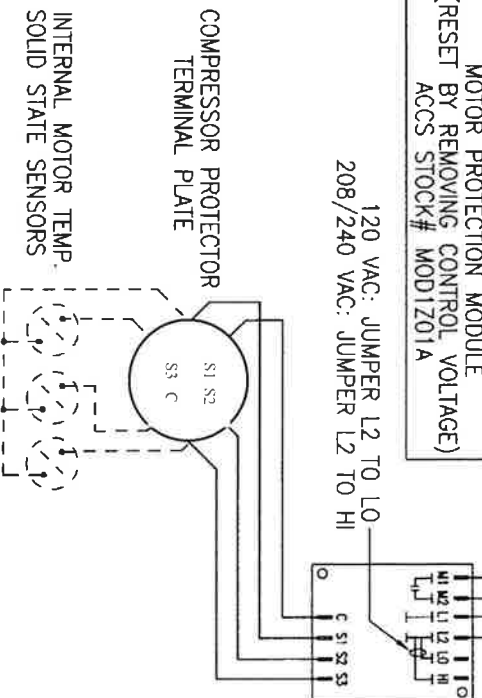
4. TORQUE ALL TERMINAL PLATE CONNECTIONS TO 21.7 FT-LBS.

REVISIONS			
REV	DESCRIPTION	BY	DATE
1	REMOVED NOTES # 1 & 4	RSI	26 OCT 00
2	REMOVED T-PLATE TO REFLECT ACTUAL LAYOUT	RSI	12 FEB 01

CONTROL VOLTAGE SUPPLY
120 VAC OR 208/240 VAC
TO COMPRESSOR SAFETY
CONTROL CIRCUIT
2.5 AMPS MAX 24/120/240 VAC

MANUAL RESET ELECTRONIC
MOTOR PROTECTION MODULE
(RESET BY REMOVING CONTROL VOLTAGE)
ACCS STOCK# MOD1Z01A

120 VAC: JUMPER L2 TO L0
208/240 VAC: JUMPER L2 TO HI



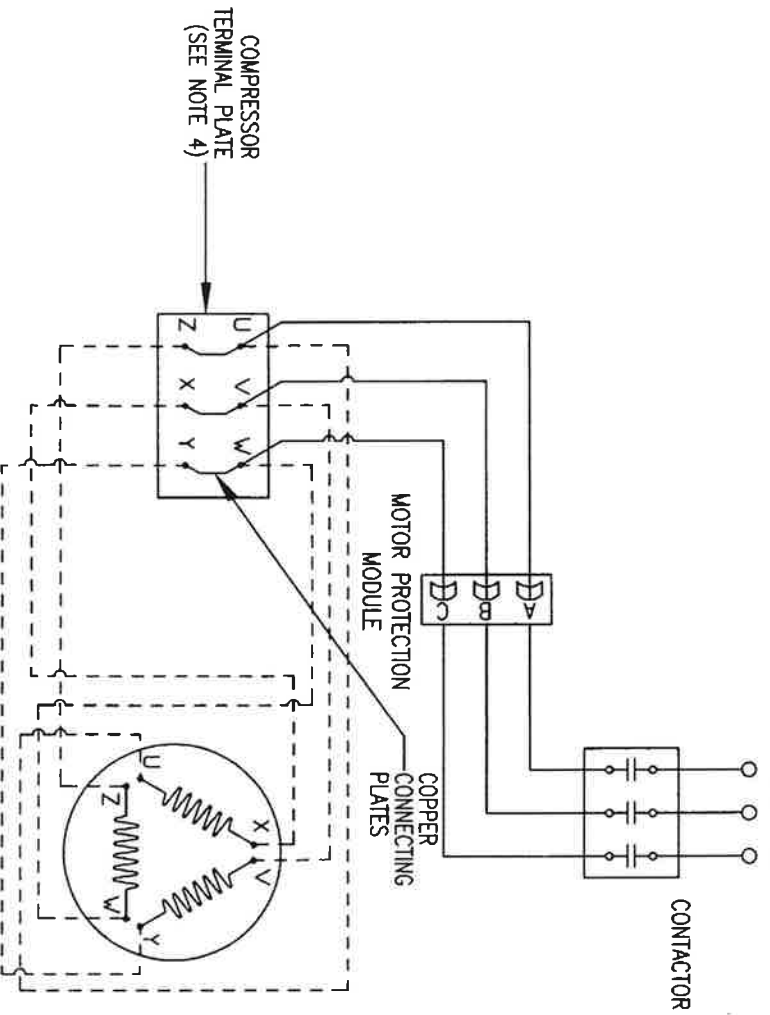
COMPONENT SPECIALISTS			
P. D. Box 300 899 S. Prairie Ave. Meriden, CT 06450 Phone: (417) 693-6067 Fax: (417) 693-2109			
DATE	SCALE	CHECKED BY	REV.
01/01/0168	RSI	RSI	B
11 APR 2000	NONE	PMC	1 OF 1

HITACHI 4005, 5005 & 6005SC-Z
COMPRESSOR STAR-DELTA WIRING
WITH ACCS P/N MOD1Z01A MOTOR
PROTECTION MODULE AND OVER
CURRENT PROTECTION SETTINGS

MAIN SUPPLY VOLTAGE (SPECIFY WHEN ORDERING COMPRESSOR)

230V, 60 HZ., 3 PH
460V, 60 HZ., 3 PH

L1 L2 L3



NOTES:

1. PHASE ROTATION, L2 MUST FOLLOW L1.
2. OVER CURRENT PROTECTION SELECTION BASED ON THE FOLLOWING CHART:

MODEL NO.	460-3-60	230-3-60
4005SC-Z	87 AMP	163 AMP
5005SC-Z	95 AMP	205 AMP
6005SC-Z	115 AMP	220 AMP

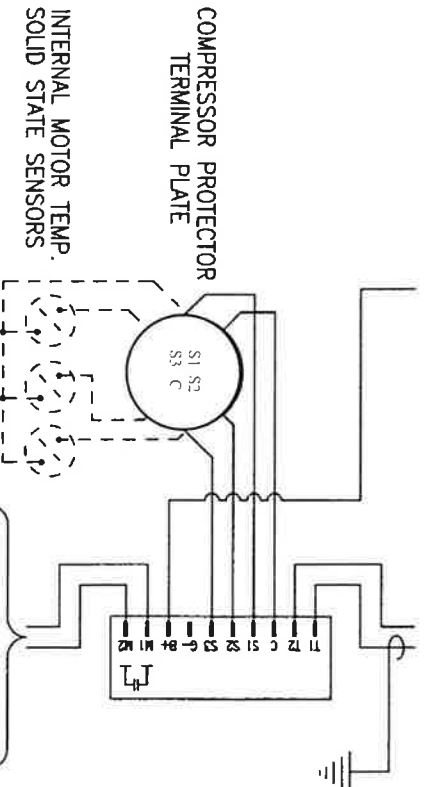
3. T1 MUST BE REFERENCED TO GROUND @ 24 VAC TRANSFORMER
4. TORQUE ALL TERMINAL PLATE CONNECTIONS TO 21.7 FT-LBS.

REVISIONS			
REV	DESCRIPTION	BY	DATE
A	REVISED NOTE #4	RS	24 OCT 00
B	ELIMINATED "C" CONNECTION	RS	27 NOV 00
C	REVISED T-PLATE TO REFLECT ACTUAL LAYOUT	RS	12 FEB 01

MANUAL RESET ELECTRONIC
MOTOR PROTECTION MODULE
(RESET BY REMOVING CONTROL VOLTAGE)
ACCS STOCK# MOD1202A

CURRENT TRANSDUCER
OUTPUT, 0 - 5 VDC
OUTPUT REF. TO GND

CONTROL VOLTAGE
24 VAC @ 0.24 A LOAD
SEE NOTE 3



COMPONENT SPECIALISTS			
			
P. D. Box 500 899 S. Prairie Lane Northfield, NJ 08706 Phone (417) 899-6067 Fax (417) 899-2109			
TITLE	DATE	SCALE	REV
HITACHI 4005, 5005 & 6005SC-Z COMPRESSOR, ACROSS THE LINE START, ACCS P/N MOD1202A MOTOR PROTECTION MODULE AND OVER CURRENT PROTECTION SETTINGS	11 APR 2000	NONE	1 OF 1
CHK NO. 01010170	DATE	CHECKED BY: RSI	REV C
DRWN BY	SCALE	CHKD BY: PAK	SHEET

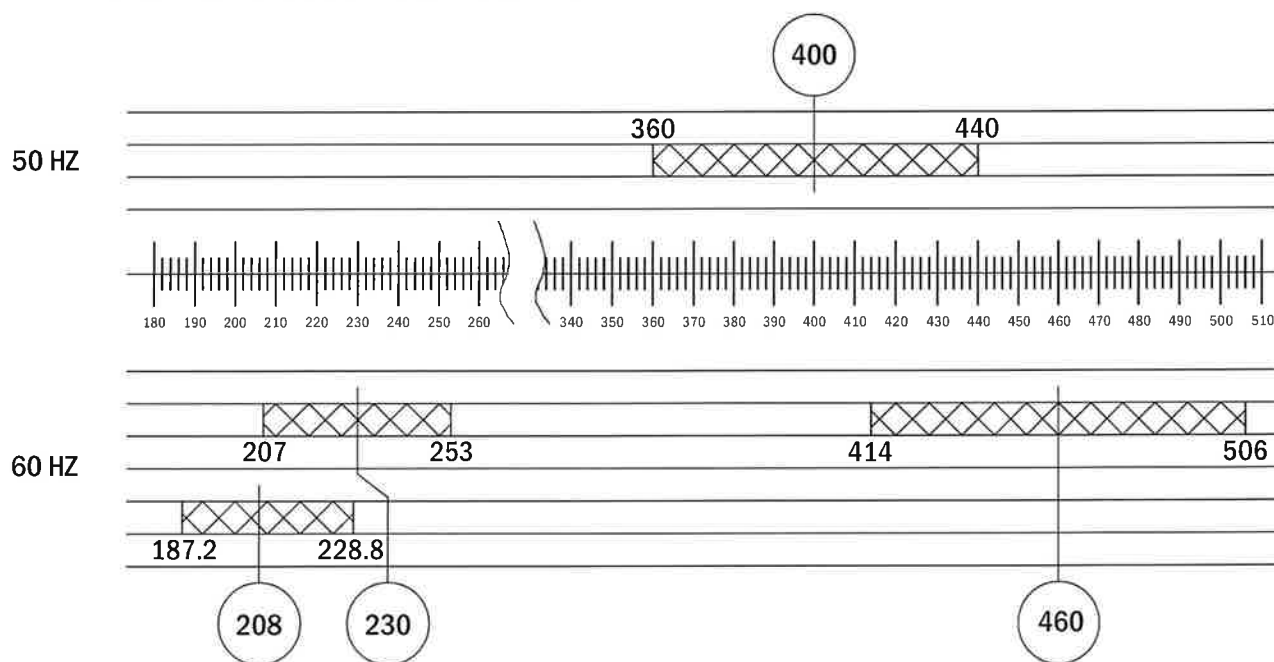
HITACHI REFRIGERATING SCREW COMPRESSORS PERMISSIBLE VOLTAGE RANGE FOR THE SCREW COMPRESSOR

The **HITACHI** Horizontal Screw Compressors, as supplied to the US market, are factory nameplated for operation at the following voltages:

Compressor Model Number						
Voltage	4002	5002	6002	4005	5005	6005
208-3-60	N/A	N/A	N/A	✓	✓	✓
230-3-60	✓	✓	✓	✓	✓	✓
460-3-60	✓	✓	✓	✓	✓	✓

The following guide is designed as an application aid for determining the permissible voltage ranges for the **HITACHI** Screw Compressor.

The permissible voltage range for the compressor includes a safety factor of $\pm 10\%$. The following chart will illustrate the application voltage ranges as approved by **HITACHI** for the US Horizontal Screw Compressor. Since the 460 VOLT 3 PH 60 HZ nameplated compressor utilizes the same motor as the 400 VOLT 3 PH 50 HZ compressor, supplied other than to the US market, its permissible operating voltage range in the 50 HZ market is shown in the upper section of the chart.



Operation of the **HITACHI** Screw Compressor below the permissible voltage range may lead to the following malfunctions:

- * Lack of motor output torque - motor does not rotate.
- * Motor coil temperature rise
- * Motor burnout

The **HITACHI** Screw Compressors are UL approved. The UL approved motor, internal to these compressors, have 3 thermistors buried in the motor windings to monitor the winding temperature. The output of the thermistors is monitored by a 3-channel electronic motor protection module (**MOD1A02A, KIT1A45A, or MOD1A04A**) to provide protection against motor over-temperature. **HITACHI** Screw Compressors supplied other than to the US market, may not carry the UL approval and may be protected by other types of winding temperature sensors.



HITACHI

SRM Semi-Hermetic Screw Compressor

General Product Information

Model		4005SC-Z	5005SC-Z	6005SC-Z
Cooling Capacity (R22)	<i>kW</i> <i>(kcal/h)</i> <i>Bty/h</i>	159.6 (137,200) 544,200	196.9 (169,300) 671,700	242.6 (208,600) 827,700
Motor Input	<i>kW</i>	39.0	48.0	59.5
Net Weight	<i>Kg</i>	360	420	440
Shipping Weight	<i>Lbs</i>	795#	925#	970#
Overall Dimension				
Height	<i>mm</i> <i>in</i>	566 22 1/4	591 23 1/4	591 23 1/4
Width	<i>mm</i> <i>in</i>	413 16 1/4	455 17 7/8	455 17 7/8
Length	<i>mm</i> <i>in</i>	1123 45	1209 47 1/4	1239 48 3/8
Displacement	<i>m3/h</i> <i>cfm</i>	165.6 97.5	204.2 120.2	251.5 148.0
Piping Connections				
Suction Piping O.D.	<i>mm</i> <i>in</i>	53.98 2 1/8	53.98 2 1/8	53.98 2 1/8
Discharge Piping O.D.	<i>mm</i> <i>in</i>	34.92 1 3/8	41.28 1 5/8	41.28 1 5/8

NOTES:

- The compressors are driven by two pole motors directly mounted on the compressor shaft, and with a rotation of 3,470 rpm for 60 hz, at the rated voltage
- Refrigerants R22, R407C., and R134a are applicable to these compressors. Continue to use with only one refrigerant that is chosen at the installation.
- SW220HT Oil is charged in these compressors at the time of shipment.
- Capacity control is applicable down to 25% (33% for model 4005SC-Z) of the rated capacity.
- The standard color is light green (Munsell Code 10G5/2).
- The cooling capacity and the motor input are based on the following conditions:
 - Condensing Temperature: 40.6° C (105° F)
 - Leaving Liquid Temperature: 40.6° C (105° F)
 - Evaporating Temperature: 4.4° C (40° F)
 - Suction Gas Temperature to Compressor: 12.8° C (55° F)
- The US dimensions shown here are converted from metric.
- These compressors should be installed indoors or in a location equivalent to an indoor environment.

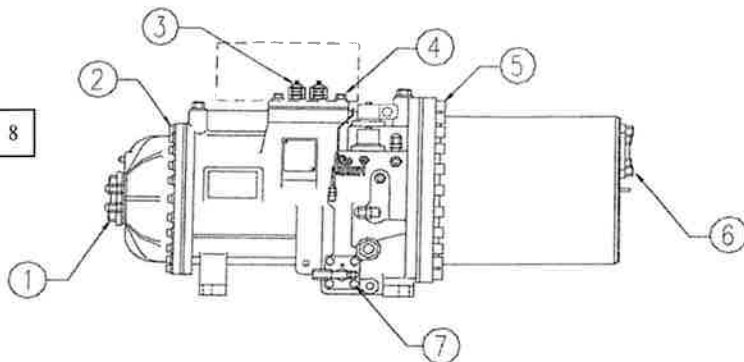
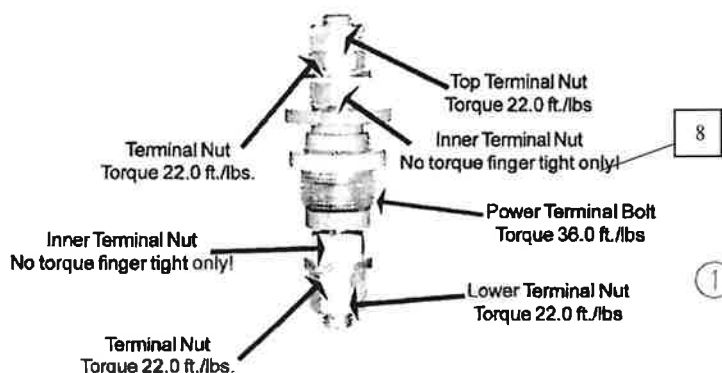
HITACHI – STANDARD TORQUE

Model: 4005SC-Z, 5005SC-Z, and 6005SC-Z Standard Torque Values

Bolt #	Description	Model: 4005SC-Z, 5005SC-Z, & 6005SC-Z
1	Suction Flange	37.0 ft/lbs
2	Motor Cover Bolts	57.8 ft/lbs
3	Electrical Terminal Nuts	21.7 ft/lbs
4	Terminal Plate Bolts	57.8 ft/lbs
5	Oil Separator	144.6 ft/lbs
6	Discharge Flange Bolts	74.0 ft/lbs
7	Oil Strainer Cover Bolts	36.1 ft/lbs
8	Power terminal Bolt	36.1 ft/lbs

Electrical Terminal Posts

Compressor Diagram



HITACHI – Kits Available Through ACCS

Slipper Ring Replacement Kit



ITEM	DESCRIPTION
1	Refrigerant Oil, SW220HT
2	Piston Rod
3	Piston Slipper Ring
4	Piston Rod Slipper Ring
5	Piston Rod Gasket
6	Lock Washer, Piston Rod
7	Gasket, Oil Separator
8	Gasket, Discharge Casing End
9	Gasket, Oil Strainer Cover
10	O-Ring, Oil Strainer
11	Gasket, Discharge Flange
12	Gasket, Suction Flange
13	Gasket, Suction Strainer
14	Oil Test Kit

ACCS slipper ring replacement kit has been assembled to assist in in field repairs. This Kit comes complete with necessary replacement parts as well as a procedure manual with pictures. This preventative maintenance procedure will help extend the life of the compressor and ensure maximum capacity with continued efficient compressor performance.



The ACCS Oil Analysis Test Kit is an invaluable tool for preventative compressor maintenance. Using this Kit on an annual basis will help

< OTK1A01A Kit Contains:

- 1 Oil Sample Bottle and label sticker
- 1 Sample Sealant Bag
- 1 Addressed Return Container
- 1 Oil Sample Data Sheet
- 1 Instruction Sheet
- Oil Sample Test Results

maintain High performance levels from your HITACHI compressor. Test results will include amount and type of contaminants in the system as well as moisture and acid contents. Results of this test will help you make an informed decision as to what type of maintenance is needed for optimal system and compressor performance.

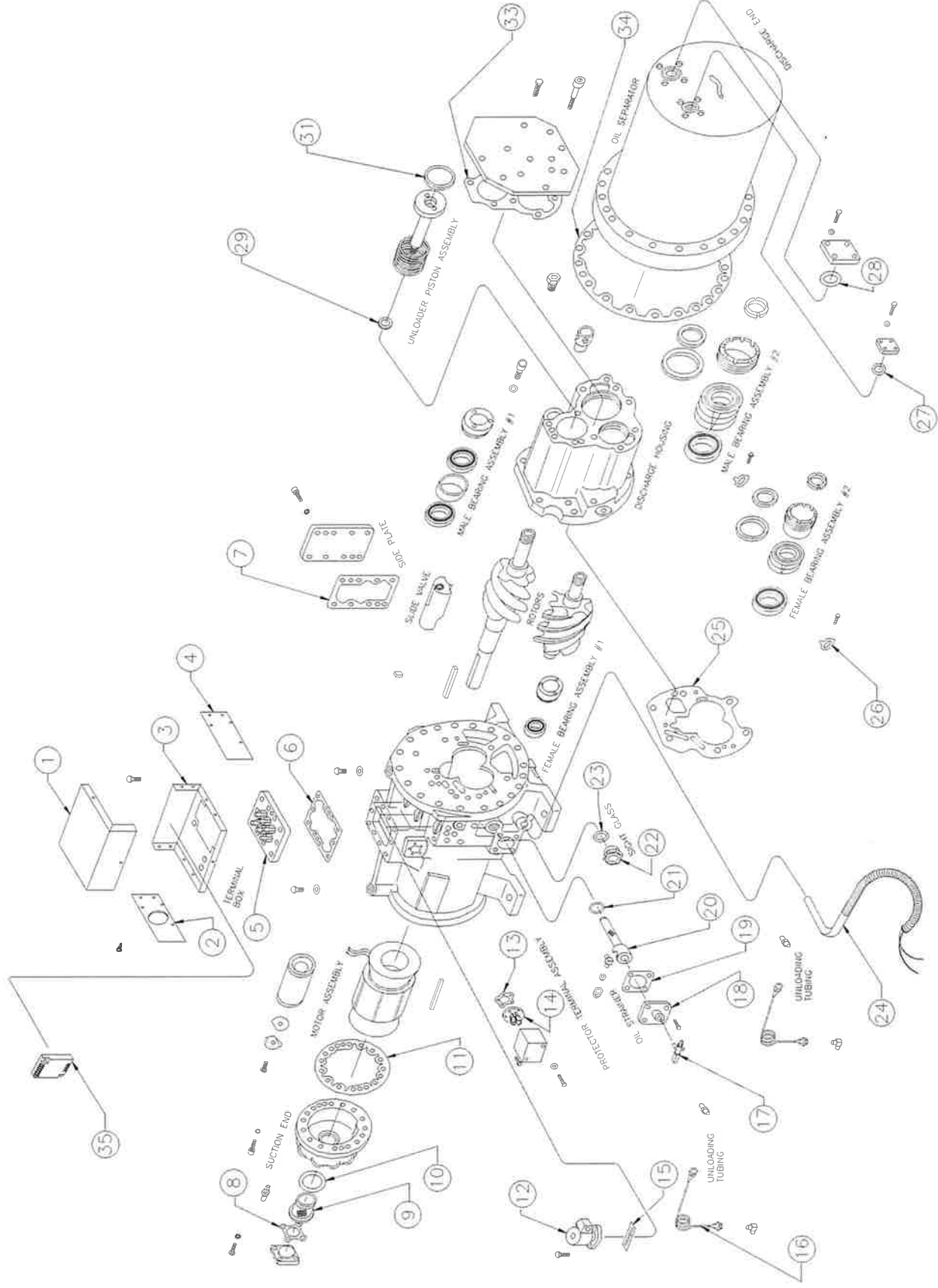
HITACHI - Specialty Tool Kit

KIT1A46A

This kit contains all the tools needed for field repairs on HITACHI screw compressors. An ACCS custom wrench is included to assist with terminal plate replacements. Picks and hooks are in this kit to ease the slipper ring repair process. Also, there are sockets, a ratchet, torque wrench, and so many other tools for service on the **HITACHI** compressors.

HITACHI SCREW COMPRESSOR EXPLODED SERVICE PARTS VIEW

MODELS: 4005SC-H, 5005SC-H, & 6005SC-H



BUBBLE #	DESCRIPTION	QTY.	4005	5005	6005
1	POWER TERMINAL BOX LID	1	TER1A04B	TER1A04B	TER1A04B
2	POWER TERMINAL BOX SIDE PLATE LFT	1	TER1A06A	TER1A06A	TER1A06A
3	POWER TERMINAL BOX	1	TER1A03B	TER1A03B	TER1A03B
4	POWER TERMINAL BOX SIDE PLATE RT	1	TER1A05A	TER1A05A	TER1A05A
5	MOTOR TERMINAL PLATE ASSEMBLY	1	TPA1A01B	TPA1A01B	TPA1A01B
6	GASKET TERMINAL PLATE ASSEMBLY	1	GSK1A04A	GSK1A04A	GSK1A04A
7	GASKET SIDE PLATE	1	GSK1A09B	GSK1A09B	GSK1A09B
8	GASKET SUCTION FLANGE	1	GSK1A02B	GSK1A02B	GSK1A02B
9	SUCTION GAS STRAINER	1	STR1A02A	STR1A02A	STR1A02A
10	GASKET GAS STRAINER	1	GSK1A01B	GSK1A01B	GSK1A01B
11	GASKET MOTOR COVER	1	GSK1A05B	GSK1A05B	GSK1A05B
12	SOLENOID VALVE	3	SOL1A01A	SOL1A01A	SOL1A01A
13	GASKET PROTECTOR TERMINAL	1	GSK1A22B	GSK1A22B	GSK1A22B
14	PROTECTOR TERMINAL PLATE ASSY. NEW PROTECTOR TERMINAL PLATE ASSY REMAN	1	TPA1Z01B TPA9A01B	TPA1Z01B TPA9A01B	TPA1Z01B TPA9A01B
15	GASKET SOLINOID VALVE	3	GSK1A17A	GSK1A17A	GSK1A17A
16	UNLOADER PIPING	2	UNP1A01A	UNP1A01A	UNP1A01A
17	OIL VALVE	1	VLV1A04A	VLV1A04A	VLV1A04A
18	OIL STRAINER COVER W/ VALVE PORT	1	COV1A02A	COV1A02A	COV1A02A
19	GASKET OIL STRAINER COVER	1	GSK1A03B	GSK1A03B	GSK1A03B
20	OIL STRAINER	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	GSK1A19B	GSK1A20B	GSK1A20B
26	LOCK WASHER BEARING ASSEMBLY	2	LKW1A01A	LKW1A01A	LKW1A01A
27	GASKET SEALED FLANGE	1	N/A	GSK1A10B	GSK1A10B
28	GASKET DISCHARGE FLANGE	1	GSK1A11B	GSK1A12B	GSK1A12B
29	SLIPPER RING SHAFT	1	***	***	***
30	GASKET UNLOADER PISTON ASSEMBLY	1	***	***	***
31	SLIPPER RING PISTON	1	***	***	***
32	LOCK WASHER UNLOADER ASSEMBLY	1	***	***	***
33	GASKET END COVER	1	***	***	***
34	GASKET OIL SEPERATOR	1	GSK1A06B	GSK1A07B	GSK1A07B
35	ELECTRONIC MOTOR PROTECTION MODULE 2ACE MODULE RETROFIT KIT	1	MOD1Z04A KIT1A45A	MOD1Z04A KIT1A45A	MOD1Z04A KIT1A45A
	ACROSS THE LINE START KIT SET OF 3	1	XLK1A01A	XLK1A01A	XLK1A01A
	VIBRATION ISOLATION PADS SET OF 4	1	PAD1Z01A	PAD1Z01A	PAD1Z01A
	Solenoid Valve Coil Only 120V - 2 & 5 Series	3	COL1A02A	COL1A02A	COL1A02A

*** AVAILABLE ONLY IN SLIPPER RING KIT

AC COMPONENT SPECIALSITS, INC. EXPLODED VIEW PARTS LIST BREAKDOWN

HITACHI – SRM REFRIGERATING SCREW COMPRESSOR

MOUNTING PADS FOR SOUND AND VIBRATION ABSORPTION ACCS STOCK # PAD1Z01A

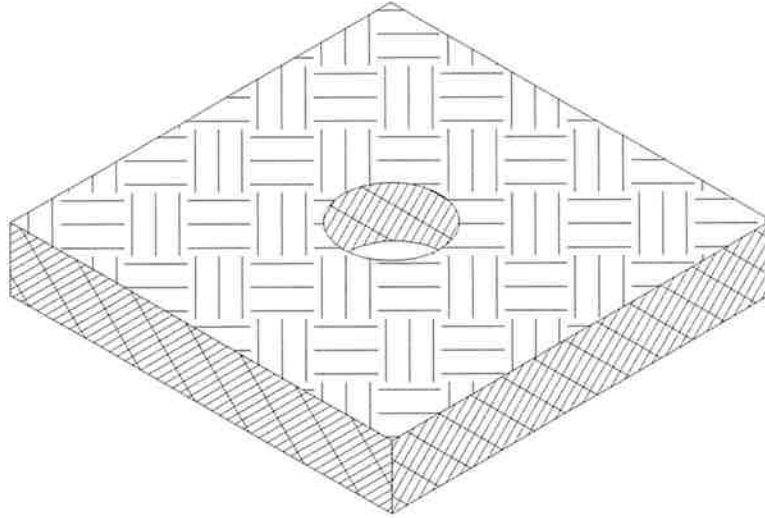


FIGURE 1

The low vibration and noise levels of the HITACHI screw compressor are achieved through simple construction features, eliminating components such as pistons, connecting rods, valve plates, oil pumps and mechanical linkages for capacity control. The patented design of the HITACHI screw compressor provides balanced forces, thus achieving lower vibration levels. The generation of higher frequency operational sounds, due to the use of a two-pole large capacity motor, allows the interception of operational sounds to be easily accomplished.

As a purchase option for the HITACHI screw compressor, AC Component Specialists offers a mounting pad kit for sound and vibration absorption (ACCS stock #PAD1Z01A). Figure 1 above, represents an individual pad in this kit. There are four pads included in the kit, one for each mounting foot of the compressor. This high capacity 3" x 3" rubber pad has a maximum load rating of 1500 PSI and a maximum deflection of 0.08". A 7/8" clearance hole is provided for installation of mounting bolts. These pads are fiber-reinforced for strength and stability and are resistant to most industrial chemicals and oils. These pads are designed for bolt down applications and stacking of these pads is not recommended.

ACCS Compressor Information Guide

Please fill in the following information about your new HITACHI compressor. This information can be used as a quick reference when calling for service or technical information

Compressor Model: _____

Compressor Voltage: _____

Compressor Serial #: _____

Date Compressor Purchased: _____

Compressor Purchased through: _____

Date of compressor installation: _____

Technician or group that installed: _____

Oil Type: _____

Refrigerant Type: _____

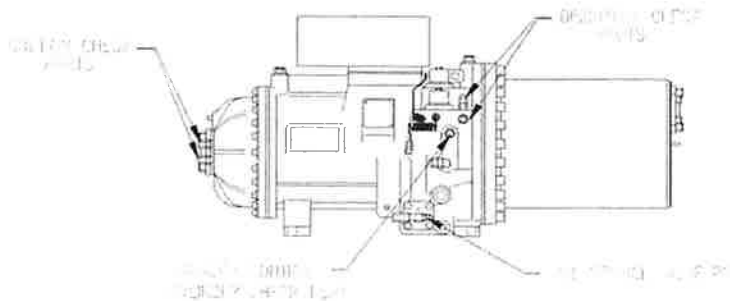
OIL HISTORY INFORMATION:

Date	Oil Type	Amount added	Oil Change Out?	Oil Analysis Test?	Date	Oil Type	Amount added	Oil Change Out?	Oil Analysis Test?
			Yes / No	Yes / No				Yes / No	Yes / No
			Yes / No	Yes / No				Yes / No	Yes / No
			Yes / No	Yes / No				Yes / No	Yes / No
			Yes / No	Yes / No				Yes / No	Yes / No
			Yes / No	Yes / No				Yes / No	Yes / No
			Yes / No	Yes / No				Yes / No	Yes / No
			Yes / No	Yes / No				Yes / No	Yes / No

HITACHI – SRM HORIZONTAL SCREW COMPRESSOR

FIELD SERVICE PRESSURE CHECKS

FIGURE 1



The HITACHI Horizontal Screw Compressor is provided with a series of service check ports. These ports have been made available for use by a qualified service technician when service or maintenance to the compressor becomes necessary. These ports are identified in **Figure 1** above. On the suction end of the compressor, adjacent to the flanged connection for the suction piping, two suction pressure service ports are found in a horizontal position. There are two discharge service ports located very close to the capacity control solenoid valves. One of these ports is oriented horizontally, the other vertically as shown. In addition, a port is also provided that senses the pressure internal to the capacity control cylinder. A final port is located on the oil service valve.

ACCS Service Bulletin AC-01-003-03-0010 has been designed as an aid in the utilization of these service ports for service trouble shooting and maintenance of the HITACHI Horizontal Screw Compressor.

When the compressor is in operation, the following pressure readings will apply:

1. If there is greater than 5 PSIG differential between a discharge pressure check port reading and the pressure reading at the oil service valve, the 150 mesh oil strainer (located behind the four bolt oil valve plate) may be obstructed. Service to the oil strainer should be scheduled.
2. If there is more than 5 PSIG differential between a suction pressure check port and the pressure at a check port upstream of the flanged suction piping connection, service to the 80 mesh suction basket (located behind the four bolt suction piping connection) should be scheduled.
3. The pressure reading at the capacity control cylinder pressure port will be as follows:
 - a. When the compressor is fully loaded, the pressure at the cylinder port will approximate suction pressure.
 - b. When the compressor is fully unloaded, the pressure at the cylinder port will approximate discharge pressure.
 - c. When operation of the compressor is in between fully loaded and fully unloaded, the pressure at the cylinder port will be at an intermediate pressure between suction and discharge pressure.
 - d. The pressure reading should remain fairly constant at the cylinder port while the compressor is in a stable operational condition and all capacity control solenoids are de-energized.

HITACHI Horizontal Screw Compressors

Suggested Preventative Maintenance Schedule

The HITACHI Horizontal Screw Compressor is used industry wide in many different refrigeration and AC applications. The compressor is also applied to many different types of equipment designs. 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 combination of designs and applications prevents 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 supersede the maintenance activities required by the equipment manufacturer who originally applied the HITACHI Screw Compressor to an equipment design.

**Times are provided as a reference only; actual times may vary.*

<u>Schedule</u>	<u>Estimated Time Required*</u>
DAILY	
1. Check alarms.	5 Minutes/Unit
2. Observe refrigeration unit for any abnormal sounds, vibrations, or other operating conditions	5 Minutes/Unit
WEEKLY	
1. Visually inspect oil level and condition (color or agitation) in the compressor sight glass.	2 Minutes/Unit
2. Ensure 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	
Monthly	
1. Inspect 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. Ensure that the compressor operates a minimum of 30 seconds fully unloaded when restarted. Also ensure 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 starts.	20 Minutes/Unit
3. Observe the compressor capacity control functions. Ensure that the compressor loads and unloads normally when the signal is applied.	10 Minutes/Unit
4. Inspect all "manual-rest" safety controls for operational temperatures and pressures. Ensure that the set-points are correct, and the controls have not been manually jumped.	30 Minutes/Unit
5. Inspect the refrigerant sight glass for the refrigerant charge levels and the moisture indication for the refrigerant.	30 Minutes/Unit
6. Record the operational hours of each compressor.	30 Minutes/Unit
Semi-Annually	
1. Inspect the operation of the discharge check valve. Ensure that it seals tightly upon shutdown of the compressor.	10 Minutes/Unit 30 Minutes/Unit
2. Refrigerant leak-check the system, carefully inspecting service areas of the compressor. (Check joint, terminal plate seal bushing areas, piping flange areas, etc.)	
Yearly	
1. Sample Compressor oil. (ACCS Part # OTK1A01A)	30 Minutes/Unit
2. Inspect the complete refrigeration system for signs of abnormal wear. This activity would include items such as loose or blocked piping lamps, 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 Horizontal Screw Compressors: Trouble-Shooting Guide

1. 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. b. Broken or bad wiring connection
	2 Verify 3-phase supply voltage is present at "line" side of the motor magnetic contactor.	a. Blown fuse/s. 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. Then, follow good practices for the cleanup of the refrigeration system after hermetic motor failure. (Test or change the compressor oil after 40 hours of run time, changing filter driers, etc.) KIT1A08A OTK1A01A b. Broken or bad wiring connection at "load" side of contactor. Repair or replace wiring.
	3 Verify 3-phase voltage present on "load" side of magnetic contactor, when energized.	a. Contact points burned; replace the contacts or complete contactor. b. Broken or bad wiring connection on "load" side of contactor. Repair or replace wiring.
	4 Verify 3-phase power present on main terminal plate of the compressor.	a. If not, broken or bad wiring between "load" side of the magnetic contactor and compressor terminal plate. Replace or repair bad 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. Then, follow good practices for cleanup of refrigeration system after hermetic motor failure. (Test or change the compressor oil after 40 hours of run time, changing filter driers, etc.) KIT1A08A or OTK1A01A
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 "run" demand normal.	a. Cooling demand satisfied. b. Lead/Lag compressor rotation changed. c. Loss of air/fluid flow through evaporator.
	3 Verify 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 contactor coil and/or contactor.

Page 1

AC COMPONENT SPECIALISTS, INC. (417-859-6067) PO BOX 500, MARSHFIELD, MO 65706
Authorized Nationwide HITACHI Screw Compressor, Replacement Parts Distributor and Remanufacturer.

Preventative Maintenance Schedule

© ACCS May 2000

HITACHI Horizontal Screw Compressors: Trouble-Shooting Guide

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. d. Too frequent motor restarts (more than 6 starts/hour). Limit Compressor restarts. e. Motor coil insulation failure. Send compressor in for analysis, repair and return, or replace compressor. f. Starting the compressor in the loading mode. Correct electrical control problem and restart.
	3 Discharge temperature too high, trips "manual-reset" safety protection.	a. Operation of the compressor without adequate lubrication. Ensure adequate level of approved refrigerant oil. Ensure > 70 PSIG difference between suction and discharge pressure while operational. b. Restriction in the internal oil strainer, inhibiting lubrication. Clean or replace oil strainer and oil, STR1A01A & KIT1A08A. c. Return Gas Superheat too high. Adjust TXV. d. Inadequate heat rejection in the condenser. Correct the condenser problem and restart.
	4. Suction pressure too low.	a. Lack of refrigerant. System sight glass indicates low charge. b. Too little load on the evaporator. c. No flow of refrigerant though TXV valve. TXV head has lost its charge. d. Loss of air/flow though evaporator. e. Clogged liquid refrigerant line filter. f. Hot gas "bypass" valve (if applicable) setting is too low. Adjust setting.

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Preventative Maintenance Schedule

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HITACHI Horizontal Screw Compressors: Trouble-Shooting Guide

b. COMPRESSOR CAPACITY CONTROL SYSTEM IS NOT FUNCTIONING PROPERLY	1. Compressor will not load up.	a. Solenoid "C" is not receiving signal to open. Check electrical control function. b. Solenoid "C" electrical coil is open. Replace coil, COL1A02A. c. Solenoid "C" valve does not open when signal is applied. Replace solenoid valve, SOL1A01A & GSK1A17A. d. Solenoid valve "B" or "A" is not energized. Correct the electrical control function. e. Solenoid valve "B" or "A" is not closed when de-energized. Replace solenoid valve, SOL1A01A & GSK1A17A. f. The oil capillary tubing, coming from the rear of the compressor to the front, is plugged. Clean or replace tubing, UNP1A01A (please specify length needed). g. Capacity control piston rod seal, internal to the compressor, is leaking. Slipper ring replacement kit required. KIT1A16A 5005/6005 Models KIT1A17A 4005 Model KIT1A27A 5002/6002 Models KIT1A28A 4002 Model
	2. Compressor will not load.	a. Solenoid "A" is not energized. Check electrical control function. b. Solenoid "A" electrical coil is open. Replace coil, COL1A02A. c. Solenoid "A" does not open when signal is applied. Replace coil, COL1A02A. 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, UNP1A01A (please specify length needed). f. Internal compressor oil level too low. Add approved refrigerant oil, OIL1A21A. g. The capacity control piston seal, internal to the compressor, is damaged. Slipper ring replacement kit required. KIT1A16A 5005/6005 Models KIT1A17A 4005 Model KIT1A27A 5002/6002 Models KIT1A28A 4002 Model

Page 3

HITACHI Horizontal Screw Compressors: Trouble-Shooting Guide

	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, COL1A02A. c. Solenoid "B" does not open when signal is applied. Replace solenoid valve, SOL1A01A & GSK1A17A. d. Capacity control piston internal to compressor is stuck. Slipper ring replacement kit required. KIT1A16A 5005/6005 Models KIT1A17A 4005 Model KIT1A27A 5002/6002 Models KIT1A28A 4002 Model
C. COMPRESSOR OPERATES, HOWEVER IS NOISY.	1. Verify that the noise is coming from the internals of compressor, not from loose terminal box or piping hangers, etc.	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 and oil, STR1A01A & KT1A08A. 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. Repair the unusual operating conditions and recharge with approved refrigeration oil, OIL1A21A. e. Bearing failure. Send compressor in for analysis and determination of 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, STR1A02A & GSK1A01A.

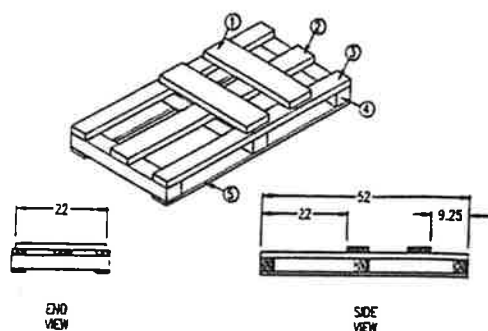
This bulletin is designed as a troubleshooting guide for checking the operation of the HITACHI screw compressor. Dangerous voltages and currents, as well as high temperatures are associated with the service of any refrigeration compressor. For that reason, only qualified refrigeration technicians should be attempting any repairs or troubleshooting 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 the affected area 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 code and ordinances should be paramount. It is not the intent of this bulletin to supersede any codes or safety practices while performing troubleshooting or maintenance activities to the HITACHI compressor.

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HITACHI — SRM Refrigerating Screw Compressors

SHIPPING CONTAINERS AND INSTRUCTIONS

ACCS Service Bulletin #108 is designed as an aid for the aftermarket service of the HITACHI Horizontal Screw Compressor. When off-site service, repair and return, core shipment, or the replacement of the compressor is necessary, the following information may be helpful regarding the shipping of the compressor.



ITEM #	Description	Qty Required
1	2 x 6 x 22"	2
2	2 x 6 x 51"	1
3	2 x 4 x 51"	2
4	4 x 4 x 24"	3
5	1 x 4 x 51"	2
4 each ½" x 5" bolts and washers for securing compressor to #1		

FIGURE 1 details the construction and the materials required to fabricate a skid which can provide adequate strength for the support of a compressor during shipment. Figure 2 represents the skid/crate combination that is furnished when a replacement compressor is purchased from ACCS. This skid/crate is also provided for the return shipment to the customer, when a compressor is sent to ACCS for repair and return (unless the customer specifies the return of their shipping container). This container should be reused for the return of a core for credit.

Shipping weights for ACCS Remanufactured HITACHI screw compressor, crated as shown in Fig. 2, are as follows:

Model 4002 - 873 lbs
 Model 5002 - 1041 lbs
 Model 6002 - 1103 lbs
 Model 4005 - 865 lbs
 Model 5005 - 991 lbs
 Model 6005 - 1051 lbs



	Total
Length	51 in.
Width	24 in.
Height	36 in.

FIGURE 2 If compressors and cores are shipped on The ACCS skid only, as shown in Figure 1 (without a protective covering) Damages increase. They go up even higher when a different skid or pallet are used and cannot support compressor and core weight.

When the compressor is shipped on a ACCS skid and is crated with a corrugated box, as in Figure 2, the following shipping class, NMFC#, and density must appear of the bill of lading papers:

NMFC#.....123280-XX

Machinery **Sub** will vary based on Density

Machinery **Class** will vary based on Density

*** A substantially lower damage rate is seen when compressor and cores are shipped with a protective box and on an ACCS skid.**

KIT1A08A Add 20 lbs Each crate if an oil change kit is included and strapped inside the crate.

OIL1A21A, OIL1A24A, and PTO1A01A Add 10 lbs each for these parts numbers.

TPA1A01B Terminal plate adds 16 lbs to the weight.

AC COMPONENT SPECIALISTS, INC PO BOX 500, Marshfield, MO 65706 (417) 859-6067

Authorized nationwide HITACHI Screw Compressor and Replacement Parts Distributor

ACCS Service Bulletin #108 5/97

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STANDARD TERMS AND CONDITIONS
REVISED 12/12/2022

ORDERS: THE FOLLOWING TERMS AND CONDITIONS CONTROL AND APPLY TO ALL ORDERS AND SUPERSEDE AND REPLACE ANY STANDARD TERMS AND CONDITIONS OF BUYER'S PURCHASE ORDER. Orders are effective only upon written acceptance by AC Component Specialists, Inc (hereinafter referred to as "ACCS"), by the issuance by ACCS of this Order Acknowledgement. A purchase order will be required before shipment and must include ACCS payment terms, individual part numbers, individual part prices, shipping method (standard or expedited), shipping terms (prepay and add, collect, or third party), ship to address (with contact name, phone number, dock hours, special needs for delivery), and bill to address. Acceptance of shipment by Buyer shall constitute acceptance of these standard terms and conditions, which shall supersede, replace, and amend any conflicting, omitted, or additional terms in Buyer's Purchase Order. Shipment by ACCS shall not constitute acceptance of any terms and conditions of any purchase order issued by Buyer, unless acknowledged in writing by an authorized officer of ACCS.

CREDIT: All orders shall be at all times subject to the approval of ACCS's credit department. ACCS may at any time delay, suspend or decline any order or shipment until receipt of payment in full, or agreement by ACCS to other acceptable security or terms and conditions satisfactory to ACCS's credit department.

PRICING: All goods shall be invoiced when shipped. Initial orders will require prepayment (Credit Card, Money Order, Certified Check, Company Check, ACH, or Bank Wire Transfer only) until a line of credit has been established, at which time terms of payment shall be net 30 days from date of invoice, unless otherwise agreed by ACCS in writing or subject to the credit terms above. A service charge of 1 1/2% per month (18% per annum) will be charged on all past due amounts. All prices, terms, and specifications are subject to change without notice. Orders will be filled at the prices that are in effect at the time of order, unless Buyer requests that shipment be delayed thirty (30) days or more from the date of the order; in which case orders will be filled at the prices that are in effect at the time of shipment.

SHIPPING: ACCS reserves the right to split shipments among multiple carriers, or make multiple partial shipments as the Order may be filled and ready for shipment, at its sole discretion and without notice to Buyer. ACCS shall not be obligated or committed to comply with any reference to a "Ship Date" or "Shipping Date"; however, ACCS will use good faith efforts to comply with any specified shipping date.

TAXES/FREIGHT: Unless otherwise agreed in writing by ACCS, Buyer shall be responsible for and pay for all transportation, shipping and freight charges, and all other taxes, fees, duties, or other charges now or hereafter imposed by any governmental authority upon the sale, purchase, resale, delivery, manufacture, production or possession of the ordered goods. All shipments are F.O.B. Shipping Point. All risk of loss shall pass to Buyer upon ACCS placing the goods with a third-party carrier or shipper.

GOVERNING LAW/ENFORCEMENT: In addition to all remedies available in law and in equity with respect to any dispute or proceeding between ACCS and Buyer with respect to the goods, ACCS shall be entitled to recover from the Buyer all cost and expenses reasonably incurred in the collection of any amounts owing hereunder by the Buyer, or successfully prosecuting or defending any such dispute or proceeding, including, without limitation, reasonable attorney's fees and court costs incurred by ACCS in connection therewith. These terms and conditions, and any orders, or any disputes or proceedings with respect thereto between ACCS and Buyer, shall be construed in accordance with and governed by the laws of the State of Missouri, AND JURISDICTION AND VENUE IN ANY LITIGATION OR PROCEEDINGS IN CONNECTION THEREWITH SHALL BE EXCLUSIVELY IN WEBSTER COUNTY, MISSOURI.

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DISCLAIMER OF WARRANTIES: THE LIMITED PRODUCT WARRANTY REFERENCED ABOVE IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, EACH OF WHICH ARE HEREBY EXPRESSLY DISCLAIMED, AND EXCLUDED FROM THIS AGREEMENT. ACCS SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES SUFFERED BY THE BUYER OR ANY THIRD PARTY FOR ANY REASON WHATSOEVER. THE USE, INSTALLATION OR STORAGE OF ANY PRODUCT NOT IN ACCORDANCE WITH ACCS'S SPECIFICATIONS WILL VOID ALL OF THE LIMITED WARRANTY. Buyer acknowledges that product degradation may result from storage of goods, and ACCS disclaims any and all liability, therefore.

FORCE MAJEURE: ACCS SHALL NOT BE RESPONSIBLE OR LIABLE FOR NON-DELIVERY OR DELAY IN DELIVERY DUE TO DELAYS, DAMAGES OR LOSSES RESULTING FROM STRIKES, RIOTS, FIRES, FLOODS, INABILITY TO SECURE MATERIALS OR OTHER ACCIDENTS OR OCCURRENCES BEYOND ITS REASONABLE CONTROL.

LIMITATION OF LIABILITY: IT IS UNDERSTOOD AND AGREED THAT ACCS'S LIABILITY, WHETHER IN CONTRACT, IN TORT, UNDER ANY WARRANTY, IN NEGLIGENCE, OR OTHERWISE SHALL NOT EXCEED THE RETURN OF THE AMOUNT OF THE PURCHASE PRICE PAID BY BUYER AND UNDER NO CIRCUMSTANCES SHALL SELLER BE LIABLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES. THE PRICE STATED FOR THE PRODUCTS IS A CONSIDERATION IN LIMITING ACCS'S LIABILITY. NO ACTION, REGARDLESS OF FORM, ARISING OUT OF THE TRANSACTIONS UNDER THIS AGREEMENT MAY BE BROUGHT BY BUYER MORE THAN ONE (1) YEAR AFTER THE CAUSE OF ACTION HAS ACCRUED.

RETURNS: No goods may be returned for credit unless written authorization by ACCS has been given in advance. Returned Product that was shipped as ordered is subject to a minimum 15% restocking charge and possibly more, depending on the condition and age of the returned goods. The return of obsolete, discontinued, modified, or special goods is not permissible; Product shipped in error will be allowed full credit upon return. ANY PRODUCT NOT STORED BY BUYER TO ACCS'S SPECIFICATIONS WILL NOT BE AUTHORIZED FOR RETURN.

CANCELLATIONS: There will be a 5% handling charge for order cancellations by Buyer; except that orders cancelled by Buyer within five (5) days of scheduled shipment shall be nonrefundable and payment in full will be required. Special orders for items not normally stocked are non-cancelable by Buyer and nonrefundable, and payment in full will be required.

GENERAL: This Agreement contains the entire understanding between the parties and supersedes any prior or contemporaneous oral or written agreements or communications between them relating to the subject matter hereof, and may not be assigned, modified, or canceled by Buyer without the prior written consent of ACCS. No delay or omission to exercise any right, power or remedy accruing to ACCS upon breach or default by Buyer under this Agreement shall impair any such right, power or remedy of ACCS, or shall be construed as a waiver of any such breach or default.

NOTICE: Any notice to ACCS under this Agreement shall be in writing and shall be served upon ACCS by personal service or by leaving a copy of such notice at the address set forth below, whereupon service of the notice shall be deemed completed, or by mailing a copy of such notice by certified mail, postage prepaid, with return receipt requested, addressed AC Component Specialists, Inc., PO Box 500, 899 South Prairie Lane, Marshfield, Missouri, 65706.

WARRANTY

- A. AC COMPONENT SPECIALISTS, Inc. (ACCS) warrants that new and/or rebuilt products sold by ACCS will be free from defects in material and workmanship, and will be delivered free from liens and encumbrances with the term of said warranty being twelve (12) months from the invoice date; or In the case of spare parts and semiconductor components, sixty (60) days from the date of shipment to the customer, provided that:
1. ACCS is promptly notified (within the warranty period) of any warranty claim; and
 2. Customer provides ACCS with the means and access to examine and test the products within a reasonable period of time, and at the customer's cost; and
 3. ACCS's examination of such items shall disclose to its reasonable satisfaction that the claimed defect in the product(s) constitutes a breach of the above warranty and was not caused by such occurrences as misuse, abuse, neglect, improper handling, installation, operation, maintenance, unauthorized repair, alteration, or accident. Modifications of the product(s) by the customer, or at the customer's direction, unless specifically authorized by ACCS, shall invalidate the warranty.
- B. ACCS's liability under this warranty is limited to providing necessary replacement parts to the customer, repairing, or replacing product, or issuing a credit in the amount of the product agreement price, at its election, for any such claim.
- C. The provision of replacement parts, or the repair or replacement of the product will not extend the warranty period. If ACCS elects to replace a defective part, ACCS's obligation is limited to making a replacement part available to the customer, FOB ACCS, and does not include such items as:
1. The provision of any labor involved or connected therewith, such as that which is required to diagnose trouble, service faults, etc., or removing or installing product or part; and
 2. Responsibility for any transportation expense other than delivery to FOB point; and
 3. Any taxes, duties, or the like in connection therewith.

THIS WARRANTY CONSTITUTES THE CUSTOMER'S SOLE REMEDY. THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MECHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THIS WARRANTY IS EXTENDED TO ACCS'S CUSTOMER ONLY AND IS NOT TRANSFERABLE TO SUBSEQUENT PURCHASERS OR USERS OF GOODS AND MERCHANDISE.

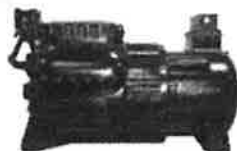


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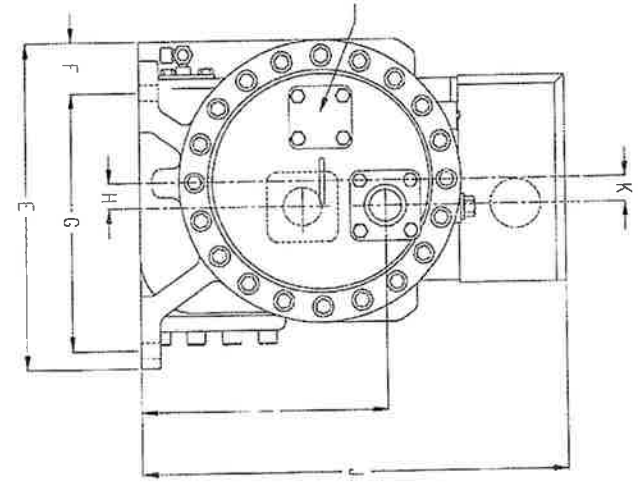
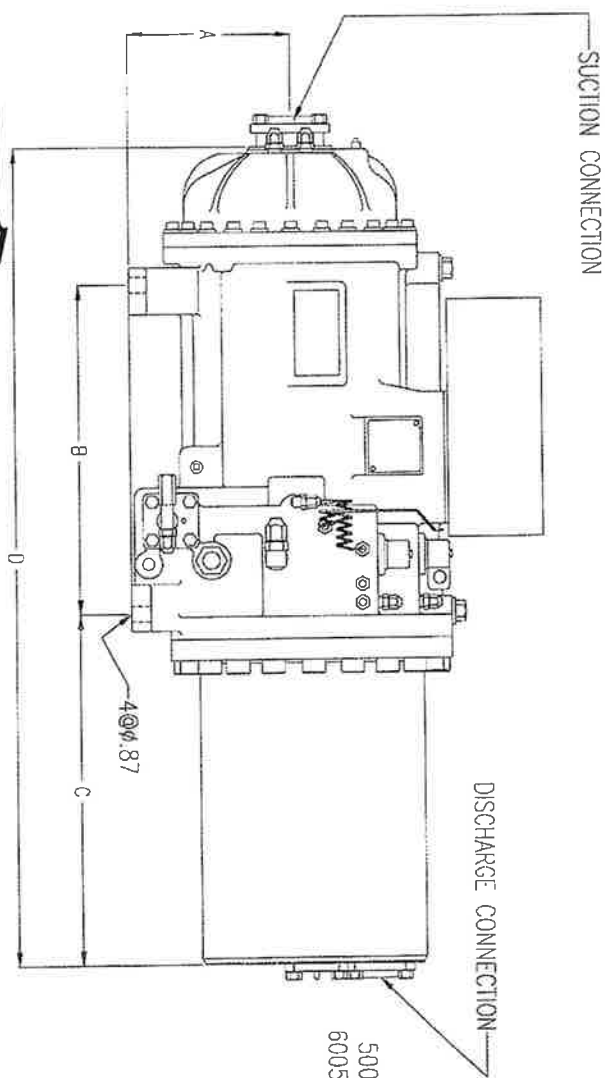
Notes:

[illegible]

Compressor Maintenance History

[illegible]

MODEL #	A	B	C	D	E	F	G	H	I	J	K
4005SC-Z	7.87	13.19	19.65	41.38	16.26	3.07	11.81	1.10	12.60	22.28	0.12
5005SC-Z	8.86	17.52	20.59	44.76	17.91	2.76	14.17	1.58	13.58	23.27	1.58
6005SC-Z	8.86	17.52	20.59	45.95	17.91	2.76	14.17	1.58	13.58	23.27	1.58



COMPONENT SPECIALISTS

SPECIALISTS P. D. Box 500 937 Prairie Lane Houston, TX 77055 Phone (417) 859-2109 Fax (417) 859-2109		DWG NO.: 01010090 DATE: 01/05/99 SCALE: NONE	DRAWN BY: RSI CHECKED BY: RSI SHEET: 1 OF 1
TITLE: "C" SERIES COMPRESSOR DIMENSIONAL DATA 4005, 5005 & 6005			

AC Component Specialists, Inc.

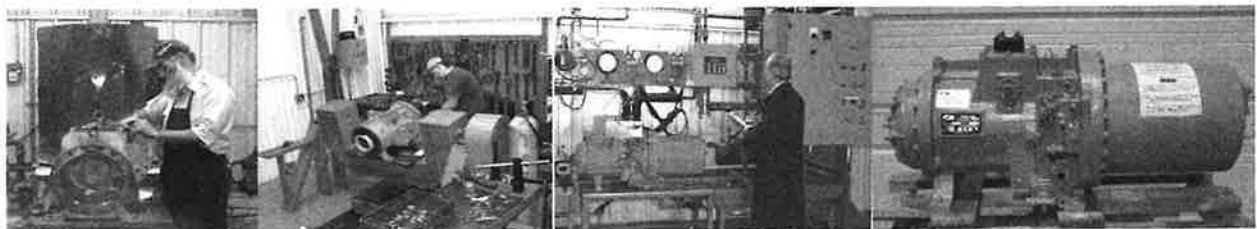


THE NORTH AMERICAN DISTRIBUTOR FOR HITACHI REFRIGERATION SCREW COMPRESSORS AND REPLACEMENT PARTS

AC Component Specialists Inc. (ACCS) has been the **ONLY** North American distributor for Hitachi refrigeration screw compressors for over 30 years.

ACCS can proudly say we have maintained a warranty rate of **less than 1%** in our remanufacturing program to date.

We always strive to provide quality service and reliability in a timely and professional manner. At ACCS, there is educated support staff to help answer any technical questions about your Hitachi screw compressors. ACCS also offers additional products and services to compliment the excellent quality of the Hitachi screw compressors.



Disassembly

Reassembly

Test

Finished Product

ACCS strives to maintain a full inventory of factory approved remanufactured Hitachi screw compressors. Currently our remanufactured compressors are available in these models 4002SC-H, 5002SC-H, 6002SC-H, 4005SC-Z, 5005SC-Z, and 6005SC-Z.

All of our HITACHI compressors are available in 230 volt and 460 volt. The 5 series compressors are equipped with a redesigned terminal plate, higher efficiency, and the capability of applying multiple refrigerant applications of R-22, R-134a or R-407C.

Compressor Tear Down Evaluation

AC Component Specialists, Inc. also offers compressor teardown evaluation reports to help determine the cause of questionable compressor failures.

Repair and Return

Do you know the cause of failure on a young compressor and want it repaired? ACCS can perform multiple levels of repair and return options to suite your needs. If a full remanufacture is required, ACCS recommends purchasing a compressor that is built and on our shelf. Call for details today!

Extensive Testing

ACCS has two unique mock chiller test stands. Each ACCS Remanufactured screw compressor is tested for a hour to ensure quality and durability. The compressors are ran loaded and unloaded for several cycles, readings are recorded, and files are kept on each reman. Electrical testing, leak checks, and several other quality assurance procedures are followed and recorded to ensure the best for our customers.



To ensure the future of our remanufactured compressor program, ACCS will buy back your unwanted 2 series and 5 series Hitachi Screw compressor cores.

We allow you to ship them back to us freight collect on our preferred freight line. When received at ACCS we will credit you for each core that you send us. (Contact ACCS parts and sales office for core return information)



Hitachi Repair Specialty Tool Kit

KIT1A46A INCLUDES:

ACCS Custom Wrench

Torque Wrench

Hand Ratchet

Pick Hook Set

Service Wrench

5 Varying MM Sockets

2 Socket Bit Inserts

Socket Extension

Tool Bag

Tools for field service repairs and replacements;
Slipper Ring Replacements, Oil Changes, Terminal
Plate Changes, Installs, and more.



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PO Box 500, Marshfield, MO 65706

Office: 417-859-6067 Text or Call: 417-630-9492

sales@accscompressor.com

Open 7:30am to 4:30pm Central



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