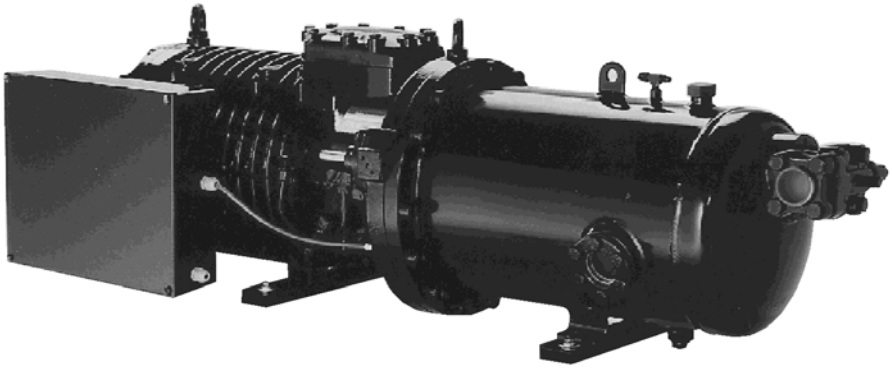
Contour™ Screw Compressors

Semi-Hermetic Compact Operating Instruction

SCH1 High Temp Compressors



Contour

Form No. 99-77

1. Introduction

This series of semi-hermetic compact screw compressors is designed for high and medium temperature applications such as air conditioning or commercial and industrial applications including chillers, etc. These compressor models are of a semi-hermetic design complete with an integral oil separator. A typical installation may include one (1) or two (2) in parallel, compact screw compressors for an individual cooling circuit. Varying motor voltages for both 50 and 60 Hz are available as well as numerous accessories.

Safety Notes

- All work on compressors, air conditioning and refrigeration systems should be carried out by qualified and authorized personnel only.
- Compressors are shipped with a holding charge that is approximately 7.0 to 14.0 psi above atmospheric pressure.
- During normal operation of the compressor surface temperatures in excess of 212°F and below 32°F can be obtained, adequate personnel protection measures need to be taken.

2. Lubricant Types

Refrigerant	Application Range	Oil type	Manufacturer
HFC	H / M	Solest 170	CPI
R22	H / M	CP4214-320	CPI

H – High Temperature, Air conditioning
M – Medium Temperature, Chiller applications

3. Installing Equipment

3.1 Mounting

The compressor must be installed horizontally. The use of anti-vibration mounting pads is recommended to reduce the transmission of noise or vibrations. The anti-vibration mounting pads are included but packed separately from the compressor.

With direct mounting on water-cooled condensers the use of anti-vibration mounting is essential in order to prevent possible stress fracturing of the heat exchanger tubes.

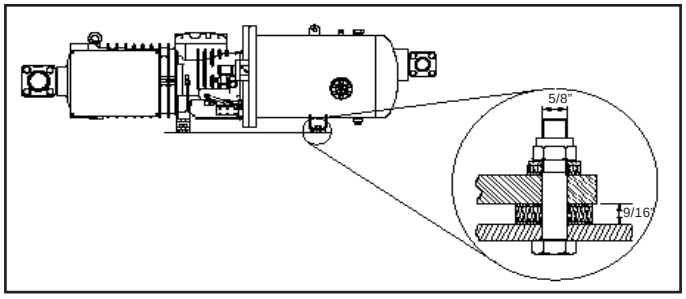


Figure 1
Mounting Pad Installations

The installation of the anti-vibration mounting pads is shown in Figure 1. The bolts should only be tightened so that deformation of the upper rubber disc is just visible.

3.2 Piping Considerations

Pipe Connections

The pipe connections are designed for tubing having nominal “SI” or “Imperial” dimensions. Solder connections have stepped inside diameters, the size the tubing determines how far it can be inserted into the fitting. If desired, the unused (larger diameter) sections of the fitting can be trimmed off.

Pipe Runs

Use only tubing and components that are delivered with an airtight seal which are clean and dry inside, free from oxidation, slag and phosphate coatings. The recommendations in the technical bulletin must be observed. Pipelines should be run so that they cannot be flooded with oil or liquid refrigerant during shut down periods. Connecting piping for the optional refrigerant injection in to the ECO port must initially include a vertical riser (minimum 6 inches) from the injection port on the compressor to avoid oil migration and damage of components through hydraulic peaks. See Figure 2 and recommendations in the technical bulletin. It is recommended, with larger volume systems, that generously sized connections (evacuation points) with shut-off valves be installed in the suction and discharge lines, as well as sections that are isolated by a check valve.

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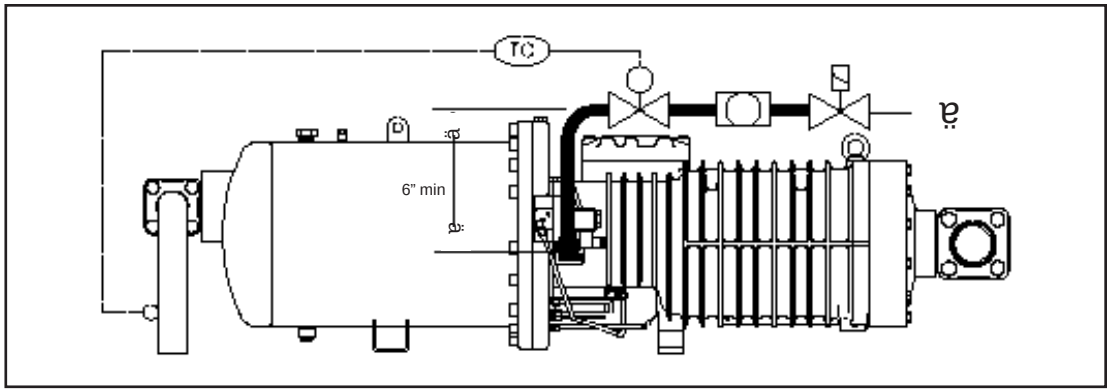

Figure 2
Direct Refrigeration Injection Connection

Caution

The compressor is shipped with a holding charge, the suction and discharge service valves should remain closed until you evacuate the system.

Start Unloading/Capacity Control

Control is accomplished electrically via the solenoid valves located on the discharge flange of the compressor (see Figure 3).

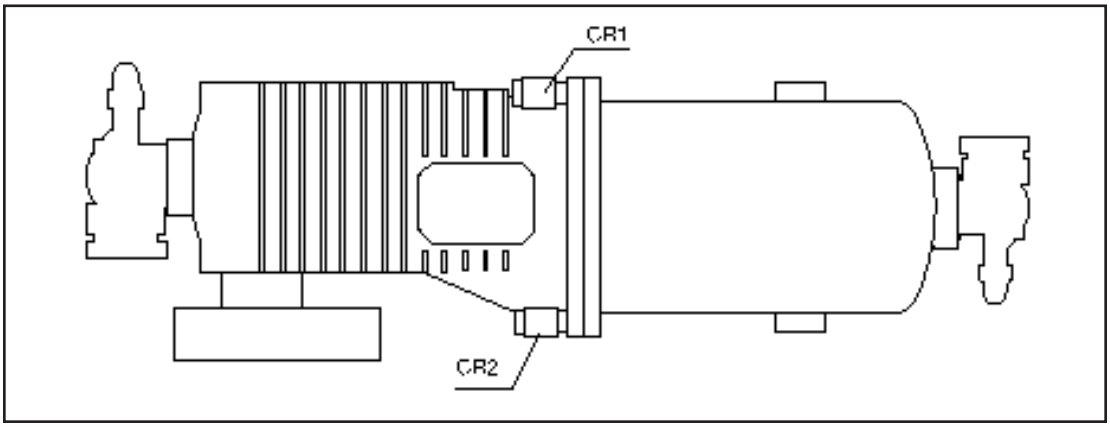

Figure 3
Location of Capacity Control Solenoids

Capacity Control

Compressor Model	Full Load (100%)	Step 1 (approx.75%)*	Step 2 (approx. 50%)*	Start Unloading
SCH1-5000/6000	CR1= ● CR2= ●	CR1= O CR2= ●	CR1= O CR2= O	CR1= O CR2= O
SCH1-7000/8000/9000	CR1= ● CR2= ●	CR1= ● CR2= O	CR1= O CR2= O	CR1= O CR2= O

* **Effective capacity stages are dependent on operating conditions**
● = Solenoid valve energized
O = Solenoid valve de-energized

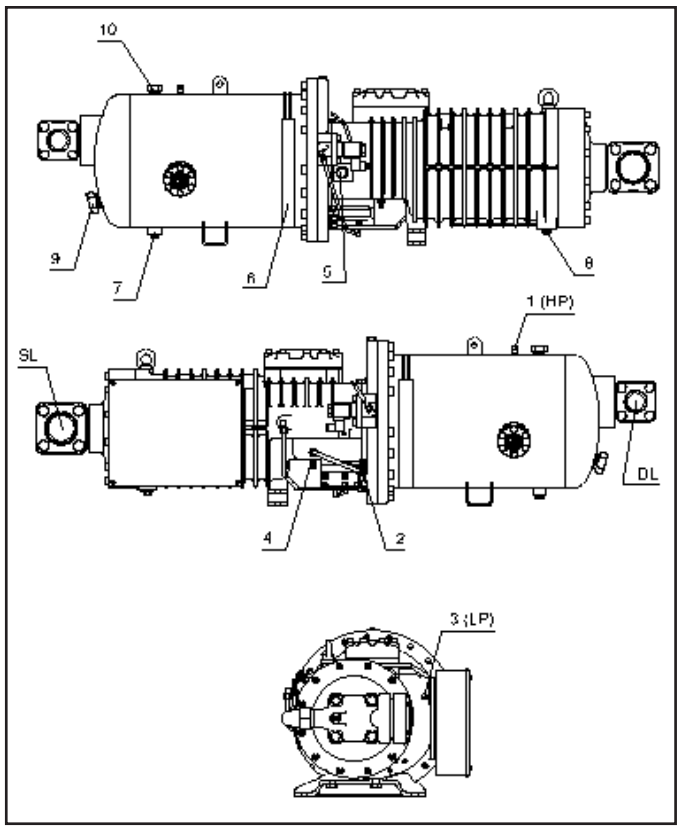

Figure 4
Connections Locations on SCH1 Series Compressors

1. High Pressure Control Connection
2. Discharge Gas Temperature Sensor
3. Low Pressure Control Connection
4. Oil Pressure (Schrader Connection)
5. Direct Refrigerant Injection / Economizer Connection
6. Oil Heater (Optional)
7. Oil Separator Oil Drain
8. Compressor Oil Drain
9. Optional Oil Level Control Connection
10. Oil Fill Plug

4. Electrical Connection

4.1 General Recommendations

The electrical installation should be done in accordance to the wiring diagram shown in the terminal box and in the technical manual, with consideration given to safety standards and local codes and regulations.

- Voltage and frequency data on the nameplate should be compared to the electrical supply data, the motor may only be connected when these agree.

- The wiring of the motor terminals should be made according to the instructions on the terminal box cover.

Caution

- Screw compressors may only be operated in one direction of rotation otherwise substantial mechanical damage will occur in a very short period of time.

- Incorrect wiring of part-winding motors results in opposing or displaced phase fields that lead to locked rotor conditions and the possibility of damage to the motor.

- The terminals 1-5/B1-B2/T1-T2 on the compressor and motor protection device must not come into contact with the supply or control voltage.

Safety Note

The selection of the motor contactors, cables and fuses should be based on the maximum running current and maximum power consumption (see name plate and application manual).

4.2 Safety Devices

Compressor Protection Device INT69VSY-II

The INT69VSY-II compressor protection device is mounted in the terminal box and is factory wired.

The INT69VSY-II monitors:

- Winding Temperature
- Discharge gas temperature
- Direction of rotation / phase sequence
- Cable break in the PTC sensor circuit

Electronic Overload Relay Furnas 958

The Furnas 958-overload relay is not included with standard delivery of the SCH1 compressors.

The Furnas 958-overload relay is a self-powered, heaterless design with phase loss protection (trips within 3 seconds upon loss of one phase of a three-phase motor branch circuit)

- Manual reset
- “Must hold amps” adjustment dial
- Rated 50/60 Hz

Recommended Relays

Compressor Model No.	Voltage	RLA	Must Trip Amps	Over Load Relay	Amp Range
SCH1 5000 FWD	460	79	111	958EA32A	75–150
SCH1 6000 FWD	460	98	137	958EA32A	75–150
SCH1 7000 FWD	460	120	168	958FA32A	90–180
SCH1 8000 FWD	460	126	176	958FA32A	90–180
SCH1 9000 FWD	460	146	204	(2)958EA32A	(2)75–150

Notes : 1) Compressor must trip and RLA values are maximum figures
2) Compressor operating amps at any specific condition can be obtained from the performance curves

Crankcase Heater

The installation of a crankcase heater (see page 5) prevents dilution of the oil with refrigerant (reduced lubrication properties) during long off-periods. Connect according to the schematic wiring diagram.

Additional insulation of the oil separator may be required with low ambient temperatures and for plants with a high temperature level on the high-pressure side during off periods (e.g. heat pumps).

Monitoring the oil circuit

There are two basic ways to monitor the oil level, depending on the type of refrigeration circuit involved.

For short refrigeration circuits that do not employ refrigerant injection for additional oil cooling and for small volume systems with small refrigerant charges, indirect monitoring of the oil can be employed. By this method, the standard INT69VSY-II electronic module monitors the discharge temperature and the compressor is shut down by excessive discharge temperature caused by insufficient oil.

For systems with refrigerant injection for additional oil cooling and/or systems with greater refrigerant charges, direct monitoring is accomplished by means of an oil level control in the oil separator (optional item, supplied separately).

Installation: First isolate the compressor electrically and mechanically and relieve the pressure Raise the oil separator end and remove the seal plug (Pos. 9 on page 2), install the oil level float with the float in the downward position and tighten the nut. For recommended electrical connection see wiring diagram in the applications manual.

High and Low Pressure Controls

These are safety switches that are necessary to maintain the system operating pressures within desirable operating limits. For setting these switches see section 5.

Safety Note

Follow manufacturers installation guide, additional safety devices may be required.

5. Commissioning

Pre-commissioning and commissioning checks and testing should be carried out.

5.1 Pressure Test / Evacuation / Leak Testing

Pressure test the system with dry nitrogen. If the refrigeration system is tested with dry air the compressor must be isolated and not included in the test. Evacuate the entire system including the compressor and sections isolated by check valves.

- The crankcase heater should be switched on during evacuation.
- The solenoid valve in the oil injection line should be closed (coil removed), all other shut-off valves open.
- 1000 micron standing vacuum should be attained and held.
- Repeat several times if required.

Leak test the system once it is charged with refrigerant (static and dynamic tests).

Caution

Never start the compressor under vacuum.

5.2 Refrigerant Charging

- Switch on the crankcase heater.
- Following the correct codes of practice charge the system with refrigerant as a vapor, liquid or blend, by whichever method is necessary according to type of refrigerant, system design and size of the system.

Caution

Refrigerant blend charging can cause “wet” compression therefore controlled charging is necessary with a discharge temperature at least 50°F above condensing temperature.

Insufficient refrigerant charge causes low suction pressure and high superheating (Be careful to remain within the operating limits of the compressor).

5.3 Checks Before Starting

- Visual (safety) check of compressor/system.
- Compressor oil level
- Safety features/devices are all in position, calibrated and tested.
- Service valves are in the correct running position.
- Check the set point values of the timing relays
- Oil temperature in the oil separator should be more than 27°F above the ambient temperature (measured near the bottom of the oil separator).

5.4 Starting

Check the Direction of Rotation

Caution

Screw compressors may only be operated in one direction of rotation otherwise substantial mechanical damage will occur.

Although the phase field is monitored by the INT69VSY-II, the following test is recommended:

- Connect a compound gauge to the suction service valve, fully front seat the suction service valve and then open one full turn.
- Bump start the compressor - switch on then off quickly (approximately 0.5 to 1 second).

If the direction of rotation is correct the suction pressure will drop immediately. A rise in suction pressure or a cut-out of the rotation protection device will indicate a wrong direction of rotation. If this happens change over two electrical phases at the terminals of the common supply line.

Start

Start the compressor again and slowly open the suction service valve.

Oil Level Check

- The oil level should be seen through the sight glass when the compressor is operating, the oil level can drop slightly below the sight glass during shut down.
- Oil foam can be generated during the starting phase, but should dissipate after 2 to 3 minutes. If it does not this can indicate excessive liquid refrigerant in the suction gas.

Caution

The discharge gas temperature must be at least 54°F above the condensing temperature.

Setting the High and Low Pressure Switches

These devices should be set in accordance with the application limits. They should be set based on specific system operating parameters.

Check Operating Data

- Evaporation temperature
- Suction gas temperature
- Condensing temperature
- Discharge gas temperature, minimum 54°F above condensing temperature maximum 212°F

For application limits see application manual.

Setting the Condenser Pressure Control

The setting must be made so that the minimum pressure differential (see application limits) is reached within 20 seconds. A rapid reduction in pressure must be avoided by employing a finely calibrated pressure control.

Vibrations

The entire system as well as the pipe runs (especially the small diameter tubes) must be checked for abnormal vibrations. If necessary, additional supports or dampers must be installed.

6. Maintenance

Oil Change

The oil types listed in section 2 are characterized by a high degree of stability. If the plant is correctly assembled or if fine filters are installed on the suction side an oil change is not normally needed. When compressor or motor damage occurs an acid test should be made. When required, clean up measures must be initiated, such as the installation of an acid retaining suction side filter, purging of the system from the highest point on the discharge side, or an oil change. *Note*: The oil must be drained out of the oil separator **and** the compressor (pos. 7 & 8 on page 5) It may be necessary to repeat these measures.

Caution

Ester oils such as Solest 170 are extremely hygroscopic careful handling is required. Moisture is chemically bonded with these oils and cannot, or only insignificantly, be removed by evacuation. Dispose of waste oil in an ecologically beneficial way (chloritic oil is pollutive waste).

Maintenance and Repair Work

Screw compressors do not have any valves and are therefore relatively maintenance free. The following points should however be regularly checked:

- Operating data
- Oil supply (see section 5.5)
- Safety devices
- Integrated check valve. After shut down the compressor runs backward for a short time, until the pressure in the oil separator and the compressor equalizes. When the check valve is dirty or faulty this period of backward rotation increases and the valve must be replaced. Access to the check valve is accomplished by removing the discharge service valve in the gas outlet of the oil separator.

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