GARDNER DENVER®

13-8-608X
1st Edition

# GREENLINE STATIONARY

# BASE-MOUNTED COMPRESSORS

**MODELS**

**29.8 KW (40 HP) - EDEQHC**

**37.3 KW (25 HP) - EDEQJC**

**FOR INTERNATIONAL SERVICE**

# OPERATING AND SERVICE MANUAL

Gardner Denver

## FOREWARD

Gardner-Denver Greenline® compressors are the result of advanced engineering and skilled manufacturing. To be assured of receiving maximum service from this machine the owner must exercise care in its operation and maintenance. This book is written to give the operator and maintenance department essential information for day-to-day operation, maintenance and adjustment. Careful adherence to these instructions will result in economical operation and minimum downtime.

**DANGER**

**Failure to observe a DANGER notice could result in injury to, or death of personnel.**

**WARNING**

**Failure to observe a WARNING notice could result in damage to equipment.**

**CAUTION**

**CAUTION notices set forth general reminders of good safety practice, or direct attention to unsafe practices.**

**NOTICE**

**Information furnished in a NOTICE will include general information or the highlights of a procedure.**

This book covers the following models:

| KW (HP) | BARS (PSIG) | Air Cooled |
|---|---|---|
| 29.8 (40) | 6.90 (100), 8.62 (125) | EDEQHC |
| 37.3 (50) | 6.90 (100), 8.62 (125), 10.35 (150) | EDEQJC |

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## SECTION 1
## GENERAL INFORMATION

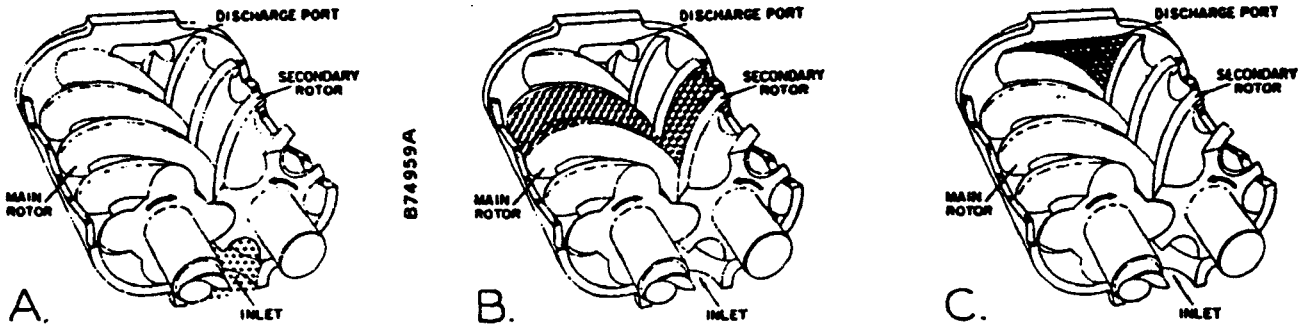



FIGURE 1-1 - COMPRESSION CYCLE

**COMPRESSOR** - The Gardner-Denver® Greenline® compressor is a single stage, positive displacement rotary machine using meshing helical rotors to effect compressor. Both rotors are supported between high capacity roller bearings located outside the compression chamber. Single width cylindrical roller bearings are used at the inlet end of the rotors to carry part of the radial loads. Tapered roller bearings at the discharge end locate each rotor axially and carry all thrust loads and the remainder of the radial loads.

**COMPRESSION PRINCIPLE** (Figure 1-1) - Compression is accomplished by the main and secondary rotors synchronously meshing in a one-piece cylinder. The main rotor has four (4) helical lobes 90° apart. The secondary rotor has six (6) matching helical grooves 60° apart to allow meshing with main rotor lobes.

The air inlet port is located on top of the compressor cylinder near the drive shaft end. The discharge port is near the bottom at the opposite end of the compressor cylinder. *Figure 1-1 is an inverted view to show inlet and discharge ports.* The compression cycle begins as rotors unmesh at the inlet port and air is drawn into the cavity between the main rotor lobes and secondary rotor grooves (A). When the rotors pass the inlet port cutoff, air is trapped in the interlobe cavity and flows axially with the meshing rotors (B). As meshing continues, more of the main rotor lobe enters the secondary rotor grove, normal volume is reduced and pressure increases.

Oil is injected into the cylinder to remove the heat of compression and seal internal clearances. Volume reduction and pressure increase continues until the air/oil mixture trapped in the interlobe cavity by the rotors passes the discharge port and is released to the oil reservoir (C). Each rotor cavity follows the same "fill-compress-discharge" cycle in rapid succession to produce a discharge air flow that is continuous, smooth and shock free.

**AIR FLOW IN THE COMPRESSOR SYSTEM** (Figure 1-5) - Air enters the air filter and passes through the inlet unloader valve to the compressor. After compression, the air/oil mixture passes into the oil reservoir where most of the entrained oil is removed by velocity change and impingement and drops back into the reservoir. The air and remaining oil then passes through tubing connecting the separator and compressor. The air passes through the reservoir discharge manifold, minimum pressure valve and discharge check valve to the plant air lines.

**LUBRICATION, COOLING AND SEALING** - Oil is forced by air pressure from the oil reservoir through the oil cooler, thermostatic mixing valve, and oil filter and discharge into the compressor main oil gallery. A portion of the oil is directed through internal passages to the bearings, gears and shaft oil seal. The balance of the oil is injected directly into the compression chamber to remove heat of compression, seal internal clearances and lubricate the rotors.

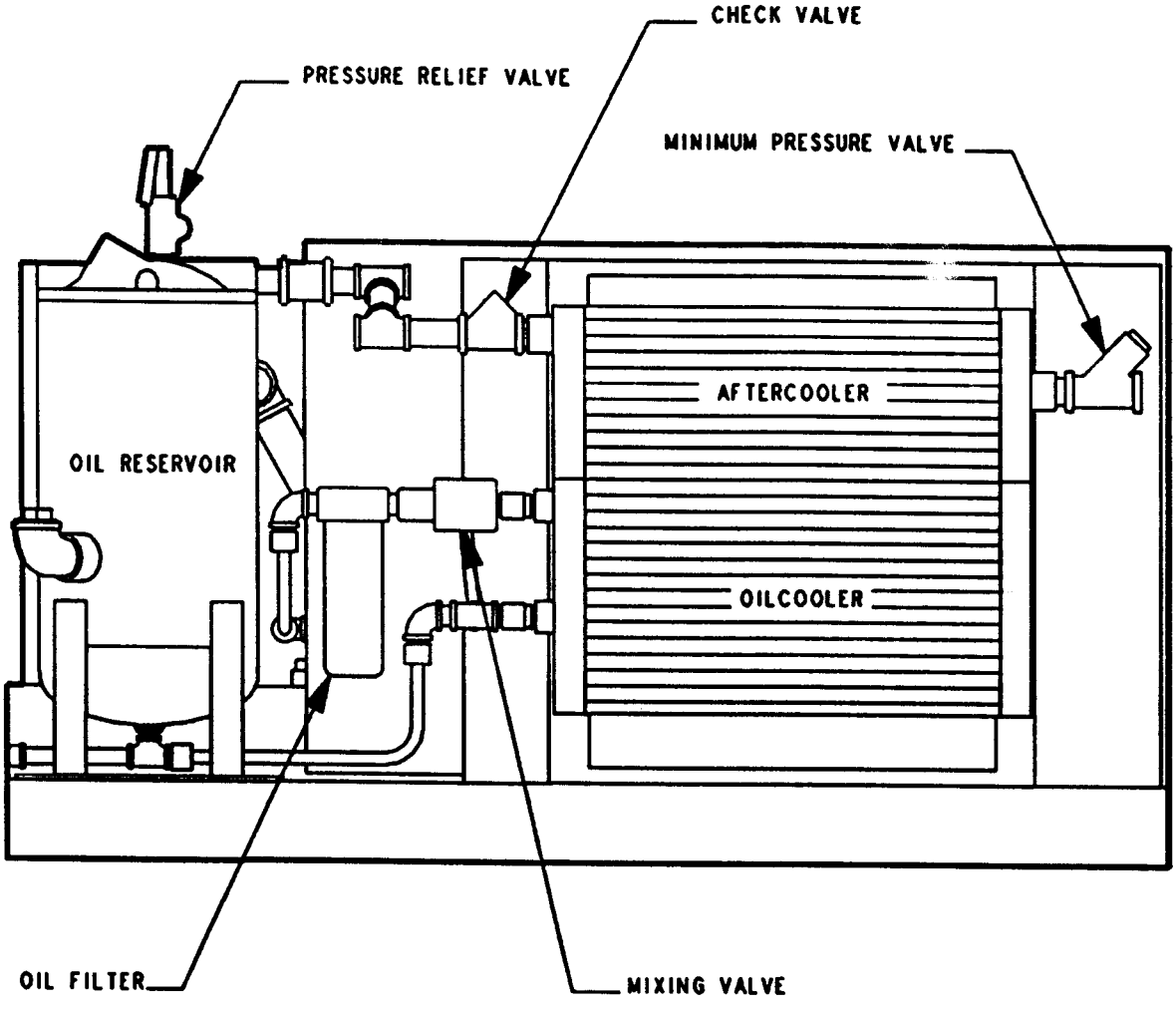

CHECK VALVE
PRESSURE RELIEF VALVE
MINIMUM PRESSURE VALVE
AFTERCOOLER
OIL RESERVOIR
OILCOOLER
OIL FILTER
MIXING VALVE

FIGURE 2-1

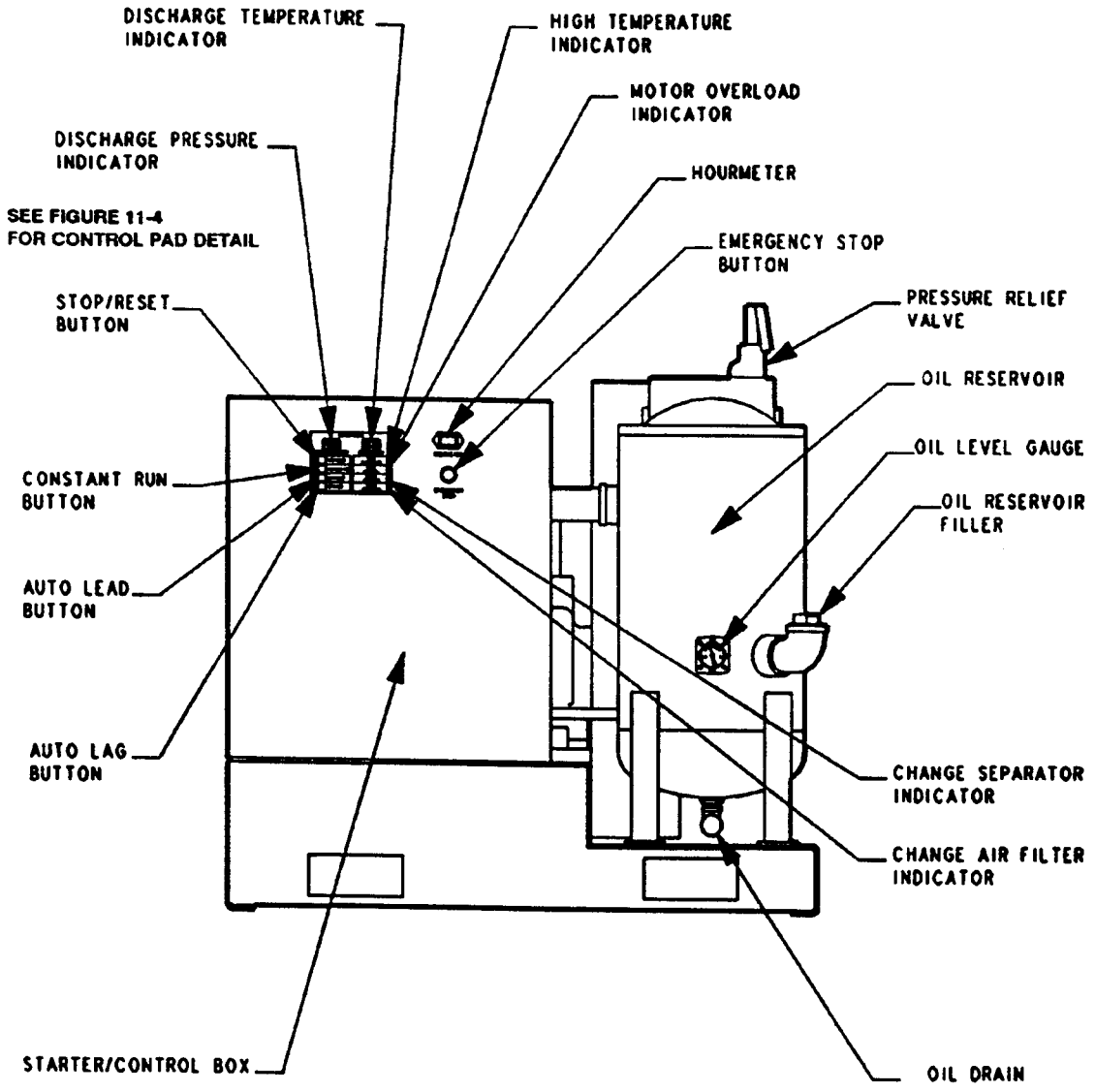

DISCHARGE TEMPERATURE INDICATOR
HIGH TEMPERATURE INDICATOR
MOTOR OVERLOAD INDICATOR
DISCHARGE PRESSURE INDICATOR
HOURMETER
SEE FIGURE 11-4 FOR CONTROL PAD DETAIL
EMERGENCY STOP BUTTON
STOP/RESET BUTTON
PRESSURE RELIEF VALVE
OIL RESERVOIR
OIL LEVEL GAUGE
CONSTANT RUN BUTTON
OIL RESERVOIR FILLER
AUTO LEAD BUTTON
AUTO LAG BUTTON
CHANGE SEPARATOR INDICATOR
CHANGE AIR FILTER INDICATOR
STARTER/CONTROL BOX
OIL DRAIN

FIGURE 3-1

## SAFETY PRECAUTIONS

Safety is everybody's business and is based on your use of good common sense. All situations or circumstances cannot always be predicted and covered by established rules. Therefore, use your past experience, watch out for safety hazards and be cautious.

Some general safety precautions are given below:

### WARNING

**Failure to observe these notices could result in damage to equipment.**

- **Stop the unit if any repairs or adjustments on or around the compressor are required.**
- **All compressed air supply hoses exceeding 1/2 inch inside diameter should have an excess flow valve. (OSHA Regulation, Section 1518.302)**
- **Do not exceed the rated maximum pressure values shown on the nameplate.**
- **Do not operate unit if safety devices are not operating properly. Check periodically. Never bypass safety devices.**

### DANGER

**Failure to observe these notices could result in injury to or death of personnel.**

- **Keep fingers and clothing away from revolving fan, drive coupling, etc.**
- **Do not use the air discharge from this unit for breathing - not suitable for human consumption.**
- **Do not loosen or remove the oil filler plug, drain plugs, covers, the thermostatic mixing valve or break any connections, etc. in the compressor air or oil system until the unit is shut down and the air pressure has been relieved.**
- **Electrical shock can and may be fatal.**
- **Compressor unit must be grounded in accordance with the National Electrical Code. A ground jumper equal in size to the equipment ground conductor must be used to connect the compressor motor base to the unit base.**
- **Fan motors have been and must remain grounded to the main base through the starter mounting panel in accordance with the National Electrical Code.**
- **Open main disconnect switch before working on the control.**
- **Disconnect the compressor unit from its power source before working on the unit - this machine is automatically controlled and may start at any time.**

## SECTION 2
## INSTALLATION

**GENERAL** - On receipt of the unit, check for any damage that may have been incurred during transit. Report any damage or missing parts as soon as possible.

> **CAUTION**
>
> **Do not electric weld on the compressor or base; bearings can be damaged by passage of current.**

**LIFTING UNIT** - Proper lifting and/or transporting methods must be used to prevent damage.

> **CAUTION**
>
> **Lift compressor unit by base only. Do not use other places such as enclosure, motor, compressor oil discharge manifold and piping as lifting points.**

> **DANGER**
>
> **The eyebolts or lugs provided on the motor are for lifting the motor only and should not be used to lift any additional weight. All eyebolts must be securely tightened. When lifting the motor the lifting angle must not exceed 15 degrees. failure to observe this warning may result in damage to equipment or personal injury.**

Lifting slots are provided in the base for towmotor use. Unit may also be moved into location by rolling on bars.

**LOCATION** - The compressor should be installed, whenever possible, in a clean, well-lighted, well-ventilated area with ample space all around for maintenance. Select a location that provides a cool, clean, dry source of air. In some cases it may be necessary to install the air filter at some distance from the compressor to obtain proper air supply.

**AIR-COOLED UNIT** - A combination oil/aftercooler is supplied as standard equipment on all air-cooled units. The air-cooled unit with the standard enclosure requires sufficient flow, Figure 2-2, for the compressor oil/aftercooling system and electric motor cooling. Air is drawn into the unit at the motor side of the enclosure and is exhausted at the oil cooler side. Do not block the air flow to and from the unit. Allow 600mm (2 ft.) to the nearest obstruction on the starter end and control box end of the unit. Allow 600mm (2 ft.) to the nearest obstruction above and on other sides of unit. For continuous efficiency, oil cooler cores must be periodically cleaned with either vacuum or compressed air. If wet cleaning is required, shield motor and spray on a mild soap solution and flush with clean water.

> **WARNING**
>
> **For aluminum oil coolers, do not use any cleaning solution that is not compatible with aluminum. Use of improper solution may result in damage to cooler.**

**FOUNDATION** - The Greenline® compressor requires no special foundation, but should be mounted on a smooth, solid surface. Whenever possible install the unit near level. Temporary installation may be made at a maximum 10° angle lengthwise or 10° sidewise.

Mounting bolts are not normally required. However, installation conditions such as piping rigidity, angle of tilt, or danger of shifting from outside vibration or moving

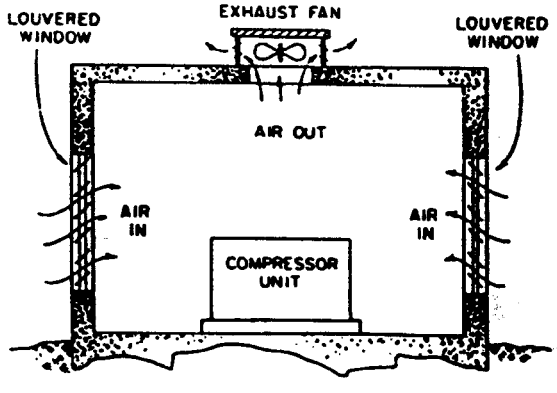



FIGURE 1-2 - TYPICAL COMPRESSOR ROOM

| Minimum Air Flow* For Compressor And Cooling (Cubic Feet/Minute) | |
|---|---|
| | Air Cooled |
| All Models | 170 $M^3$/min (6000 cfm) |

* 26.7°C (80°F) inlet air.

FIGURE 2-2

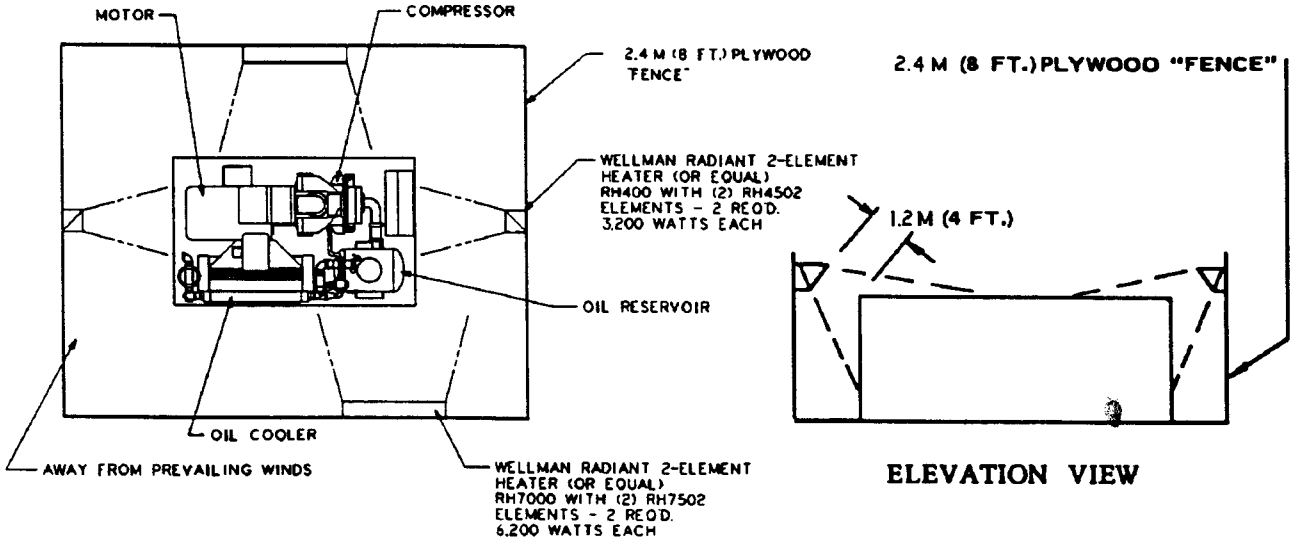



**FIGURE 3-2 - COLD WEATHER INSTALLATION**

vehicles may require the use of mounting bolts and shims to provide uniform support for the base. Belt alignment and tension should be checked after installation.

**OIL RESERVOIR DRAIN** - The oil drain is piped from the bottom of the reservoir to the side of the frame. This drain is approximately 150mm (6 in.) above the floor level. If this is not sufficient to conveniently drain the oil some other methods of providing drain are:

1. Elevate the compressor unit on raised blocks to obtain the desired drain height.

**CAUTION**

**If the compressor unit base is raised above floor level, the space between the floor and the base bottom must be closed with solid material all around to prevent recirculation of hot air from the oil cooler end and over temperature operation.**

2. Construct an oil sump or trough below the floor level and pump or bail the drained oil.
3. Pump oil from the reservoir filler opening or drain to a container.

**ENCLOSURE** - The compressor, electric motor, oil cooler and aftercooler are mounted inside the enclosure.

Service doors are provided for maintenance access. Be sure to allow enough space around the unit for the doors to open completely.

Any of the enclosure doors may be removed by opening the door and lifting it up slightly to disengage the hinges.

**DANGER**

**Do not operate compressor with fan and belt guard removed. Exposed fan and belts may cause injury to personnel.**

The motor inspection/air filter service panel is held by two latches and lifts away from the enclosure. The air outlet panel is attached by screws to the enclosure and is not readily removable.

**INSTALLATION FOR COLD WEATHER OPERATION** - It is recommended that whenever possible the unit be installed inside a shelter that will be heated to temperatures above freezing (0°C, 32°F). This will eliminate many of the problems associated with operating the units outside in cold climates where freezing rain, drifting snow, freezing condensate and bitter cold temperatures are encountered.

Refer to Engineering Data Sheet 13-9-411 for the advantages of using the heat recovered from rotary compressors. This heat recovery could easily pay for an adequate shelter for the unit.

When an outside installation must be made, the precautions required will depend on how severe the environment. The following are general guidelines for outside installations:

**Cold Weather (Down To -12.2°C, + 10°F)**

1. Be sure all control lines, drains and traps are heated to avoid freezing of condensate. Heat tape with thermostat control is generally satisfactory for this purpose and can be obtained at various local plumbing or hardware outlets at nominal cost.
2. If an air-cooled aftercooler is to be used, provisions to bypass the aftercooler must be made. Since cold

air contains very little moisture, successful operation can be achieved without the aftercooler.

3. Provide at least some simple shelter such as a plywood windbreak to protect against drifting snow.
4. Contact your Gardner-Denver Distributor or sales agent for recommended lubricant.
5. Monitor unit carefully during start-up and operation to be sure it is functioning normally.
6. Specify NEMA 4 enclosure for electrical devices.

**Extreme Cold Weather Operation (Down To -40°C, -40°F)**

In addition to the above, the following should be provided:

1. It will be necessary to provide shutters or to block off part of the cooler in some manner since the cooler is greatly oversized for operation in these low temperatures. Since shutters are not provided as a factory option, blocking off a portion of the cooler with plywood should be satisfactory.
2. Auto operation should not be used in extreme environments.
3. Some means of providing heat during shutdown should be provided. There are various methods to accomplish this, but since openings are not provided for sump heaters, the use of radiant heaters is recommended. The heaters should be sized to provide at least a -12.2°C (+10°F) environment for coolers, motor and sump. Figure 3-2 shows how these might be located in a typical installation and sizes required.

Remember unsheltered (outside) installations should be avoided where possible. Installation next to a heated building where enough heat can be used to keep the compressor room above freezing will save many complications in the operation and installation of the unit.

Refer to Engineering Data Sheet 13-9-411, available from an authorized Gardner-Denver distributor, for the advantages of using the heat recovered from rotary compressors. This heat recovery could easily pay for an adequate shelter for the unit.

**AUXILIARY AIR RECEIVER** - An auxiliary air receiver is not required if the piping system is large and provides sufficient storage capacity to prevent rapid cycling. When used, an air receiver should be of adequate size, provided with a relief valve of proper setting, a pressure gauge and a means of draining condensate.

**MOISTURE SEPARATOR/TRAP** - Since unit is equipped with a built-in aftercooler, a combination moisture separator and trap is furnished with the unit.

**CONTROL PIPING** - Control piping is not necessary since the Greenline® unit is factory wired and piped for the control system specified.

**INLET LINE** - Where an inlet line is used between the air filter and the compressor, it must be thoroughly cleaned on the inside to prevent dirt or scale from entering the compressor. **If welded construction is used, the line must be shot blasted and cleaned to remove welding scale.** In either case, the inlet line must be coated internally by galvanizing or painting with a moisture and oil-proof sealing lacquer. Up to 3M (10 ft.) in length, the inlet line should be the full size of the inlet opening on the compressor. If an extra-long line is necessary, the pipe size should be increased according to Inlet Line Chart below.

Accessibility for inlet air filter servicing must be considered when relocating the filters from the unit to a remote location.

**DISCHARGE SERVICE LINE** - The discharge service line connection is made at the upper right hand corner of the cooler, viewed from the oil cooler side. A hand operated valve, (air service valve) must be installed between the unit and the customer's air system. When manifolding two or more Greenline® units on the same line, each unit is isolated by the check valve in the unit discharge line. If an Greenline® unit is manifolded to another compressor, be sure the other compressor has a check valve in the line between the machine and the manifold. If an Greenline® and a reciprocating compressor are manifolded together, an air receiver must be located between the two units.

**DANGER**

**Discharge air used for breathing will cause severe injury or death.**

**Consult filtration specialists for additional filtration and treatment equipment to meet health and safety standards.**

**BLOWDOWN VALVE PIPING** - The blowdown valve is fitted with a muffler for operation indoors. If the installation requires, the muffler may be removed and the blowdown valve piped to the outside with a pipe size the same as the blowdown valve outlet connection.

**ELECTRICAL WIRING** - Standard Units - The Greenline® compressor is factory wired for all starter to motor and control connections for the voltage specified on the order. It is necessary only to connect the unit starter to the correct power supply. The standard unit is supplied

**INLET LINE LENGTHS**

| Length of Inlet Line | Diameter of Pipe Size |
|---|---|
| 0 to 3m (10 ft.) | Same as Compressor Inlet Opening |
| 3m (10 ft.) to 5m (17 ft.) | One Size Larger Than Inlet Opening |
| 5m (17 ft.) to 11.5m (38 ft.) | Two Sizes Larger Than Inlet Opening |

with an open drip-proof motor, a NEMA 12 starter and control enclosure. See "Location" paragraph for distance to nearest obstruction on starter and control box sides of the unit.

Lower operating voltages (200/208) require that the unit starter be remote mounted since the starter is too large to be mounted within the control enclosure. If not supplied with the compressor unit, the starter is to be a size 6 full voltage non-reversing type in NEMA (CEMA) enclosure suitable for the environment, with two (2) rejection type control circuit fuses (size according to motor starter manufacturer's standard), a 200 (208) volt coil, and three (3) overload heaters for 200 (208) volt 100 HP, 1.15 service factor motor. The overload heaters are to be selected according to starter manufacturer's tables based on motor nameplate full load amperage.

**WARNING**

**Electrical shock can cause injury or death. open main disconnect switch before working on starter/control box.**

**GROUNDING** - Equipment must be grounded in accordance with Table 250-95 of the National Electrical Code.

**MOTOR LUBRICATION** - Long time satisfactory operation of an electric motor depends in large measure on proper lubrication of the bearings. The following charts show recommended grease qualities and regreasing intervals for ball bearing motors. For additional information refer to the motor manufacturer's instructions. The following procedure should be used in regreasing:

1. Stop the unit.
2. Disconnect the unit from the power supply.
3. Remove the relief plug and free hole of hardened grease.
4. Wipe lubrication fitting clean and add grease with a hand-operated grease gun.
5. Leave the relief plug temporarily off. Reconnect unit and run for about 20 minutes to expell the excess grease.
6. Stop the unit. Replace the relief plug.
7. Restart the unit.

**WARNING**

**Rotating machinery can cause injury or death. Open main disconnect before working on electric motor.**

**GREASE RECOMMENDATIONS**

| | Standard Service | High Temperature |
|---|---|---|
| Worked Penetration | 265-296 | 220-240 |
| Viscosity, SSU At 37.8° C (100°F) | 400-550 | 475-525 |
| Soap Type | Lithium | Lithium |
| N-H Bomb, Minimum Hours For 1.38 Bar (20 PSI) Drop at 98.9°C (210°F).. | 750 | 1000 |
| Bleeding, Maximum Weight % In 500 Hours 100°C (212°F.) | 10 | 3 |
| Rust Inhibiting | Yes | Yes |

**REGREASING INTERVAL**

| Type of Service | Typical Examples | Rating | Relubrication Interval |
|---|---|---|---|
| Standard | One- or Two-Shift Operation | 111.9 KW (150 HP) & Below | 18 Months |
| Severe | Continuous Operation | 111.9 KW (150 HP) & Below | 9 Months |
| Very Severe | Dirty Locations, High Ambient Temperature | 111.9 KW (150 HP) & Below | 4 Months |

## SECTION 3
## STARTING & OPERATING PROCEDURES

**PRESTART-UP INSTRUCTIONS** - A new unit as received from the factory has been prepared for shipping only. Do not attempt to operate the unit until checked and serviced as follows:

1. **Compressor Oil** - Check oil level in the reservoir. Add oil only if the oil level gauge reads in the red "ADD OIL" range. Do not mix different type oils. Unit is shipped filled with Gardner-Denver® AEON™ 800 Lubricating Coolant which is suitable for the first 2000 hours under normal operating conditions.

   **REPLACE OIL FILTER EVERY 1000 HOURS.**

   Initial fill, or filling after a complete draining of the system, may show the oil level in the yellow "EXCESS OIL" range. After start-up, the oil will fall into the green operating range as system components are filled. If necessary, add oil to bring the level to the top of the green range as read when the unit is operating at full load and normal pressure. See Figure 4-5.

**NOTICE**

**Regular maintenance and replacement at required intervals of the oil filter, air filter and air-oil separator is necessary to achieve maximum service and extended drain intervals of AEON™ 800 lubricant. Use only genuine Gardner-Denver filters designed and specified for this compressor.**

**DANGER**

**Always stop the unit and release air pressure before removing oil filler plug. Failure to relea[illegible] pressure may result in personal injury or death.**

   During unloaded operation and after shutdown, the system will partially drain back into the oil reservoir and the oil level may read higher than when operating on load. DO NOT DRAIN OIL TO CORRECT; on the next loaded cycle or start, oil will again fill the system and the gauge will indicate the operating level.

2. **Air Filter** - Inspect the air filter to be sure it is clean and tightly assembled. Refer to Section 6, "Air Filter," for complete servicing instructions. Be sure the inlet line, if used, is tight and clean.

3. **Piping** - Refer to Section 2, "Installation," and make sure piping meets all recommendations.

4. **Electrical** - Check the wiring diagrams furnished with the unit to be sure it is properly wired. See Section 4, "Controls and Instruments," for general wiring diagrams and Section 2 for installation instructions.

5. **Rotation** - Check for correct motor rotation using "JOG MODE." Compressor drive shaft rotation must be clockwise standing facing the compressor sheave.

**WARNING**

**Operation with incorrect motor rotation can damage equipment and cause oil eruption from the compressor inlet. When checking motor rotation, induce minimum rotation (less than one revolution if possible). Never allow motor to reach full speed.**

6. **System Pressure** - Set the controls to the desired load pressure. DO NOT EXCEED MAXIMUM OPERATING PRESSURE ON COMPRESSOR NAMEPLATE. See Section 4, "Controls and Instruments," for procedure.

**WARNING**

**Operation at excessive discharge air pressure can cause personal injury or damage to equipment. Do not adjust the full discharge air pressure above the maximum stamped on the unit nameplate.**

7. **Operating Mode** - Refer to Section 4 for detailed information on the control system.

8. **Enclosure** - Check for damaged panels or doors. Check all screws and latches for tightness. Be sure doors are closed and latched.

**STARTING THE UNIT** - OBSERVE UNIT COLD OR HOT STARTING PROCEDURES

**Unit Cold** - Close the air service valve (furnished by customer) between the main air system and the unit check valve. If the unit is a water-cooled heat exchanger model, open any manual water inlet valves wide open. Start the unit by pushing either the "CONSTANT RUN" button or one of the "AUTO" buttons. Run for approximately one minute and then open the air service valve. Since the unit is equipped with a minimum (4.48 Bars, 65 psig) pressure discharge valve, no special procedure to maintain unit reservoir pressure is required.

**Unit Hot** - No warm-up period is required. Close the air service valve (furnished by customer). If the unit is a water-cooled heat exchanger model, open any manual water inlet valves wide open. Start the unit by pushing either the "CONSTANT RUN" button or one of the "AUTO" buttons. Open the air service valve.

**DAILY CHECK** - Refer to Section 8, "Maintenance Schedule."

**STOPPING THE UNIT** - Close the air service valve (furnished by customer), allow the unit to build up to full unloaded pressure and unload. Wait a short period to allow the oil reservoir to blow down. Press "STOP-RESET" button.

Stopping the unit at a pressure below full unloaded may cause oil carry-over. The oil reservoir will automatically blow down as the motor stops. Open air service valve.

## SECTION 4
## CONTROLS & INSTRUMENTATION

**GENERAL** - The Gardner-Denver® "EDE" Greenline® compressor is supplied with a factory mounted starter and complete controls as standard equipment. The standard control system consists of constant run load/unload operation, or auto start/timed stop operation. Lead/Lag operation of two EDE compressors is also possible without additional equipment. Inlet valve modulation is available as an option.

**PROTECTIVE DEVICES** - All compressors incorporate the following protective devices:

**Motor Protection Devices** - Overload heaters are furnished for the starter in the voltage range specified. There are three (3) overloads in the starter of proper size for the starter and its enclosure. An overload trip is indicated by the "MOTOR OVERLOAD" LED located on the control keypad.

**Optional Motor Protective Devices - Wye-Delta Starter** - Overload heaters are furnished for the starter in the voltage range specified. There are three (3) overloads in the starter of proper size for the starter and its enclosure. Note that motor nameplate current must be multiplied by .577 for wye-delta starters. Proper starter coil and contact action is also monitored to ensure proper operation.

**Separator Differential Pressure** - The Separator differential pressure is continually monitored by the microprocessor controller. At a differential of approximately .55 Bar (8 PSI), the "CHANGE SEPARATOR" LED located on the control keypad is flashed indicating required maintenance. If the warning is ignored, and the separator differential continues to increase, the microprocessor controller will stop the unit and the LED will remain on steady. See "Control System Operation" in this section for further information on operation of the microprocessor controller.

**High Discharge Temperature** - The compressor is protected from high discharge temperature by two independent thermistor probes. One probe is located in the compressor discharge housing to sense compressor discharge air-oil mixture temperature. The second probe is located at the separator discharge and senses the temperature of the air at the oil separator.

The microprocessor controller will shut the compressor down if temperature sensed at either location exceeds 107.2°C (225° F). See "Control System Operation."

**CAUTION**

**Machine damage will occur if repeatedly restarted after high temperature stops operation. Find and correct the malfunction before resuming operation.**

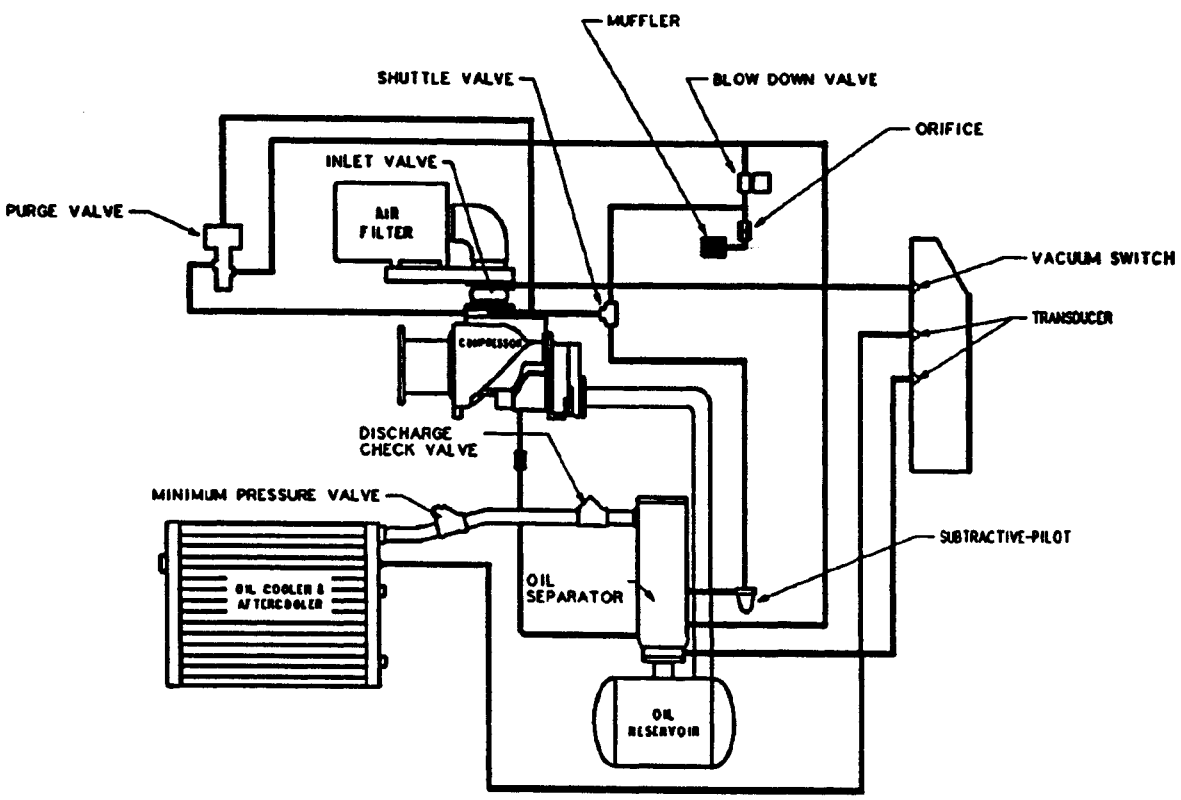



FIGURE 1-4 - CONTROL SCHEMATIC

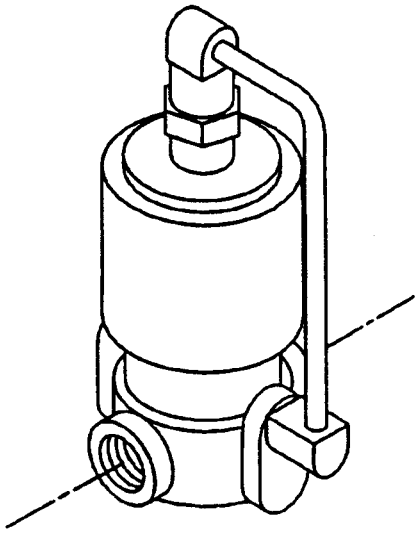


FIGURE 2-4 - BLOWDOWN VALVE

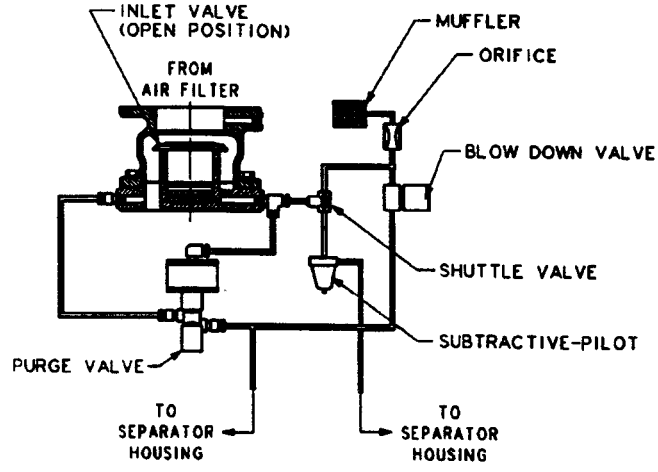



FIGURE 3-4 - INLET VALVE

**Relief Valve** - A pressure relief valve(s) is (are) installed in the final discharge line and set at the factory to approximately 120% of the unit's full load operating pressure for protection against overpressure. Periodic checks should be made to insure its proper operation.

The relief valves should be tested for proper operation at lease once every year. To test the relief valve, raise the system operating pressure to 75% of the relief valve set pressure and manually open the valve with the hand lever. Hold the valve open for a few seconds and allow it to snap shut.

## WARNING

**When relief valve opens, a stream of high velocity air is released, resulting in a high noise level and possible discharge of accumulated dirt or other debris. Always wear eye and ear protection and stand clear of the discharge port when testing the relief valve to prevent injury.**

## CAUTION

**Never paint, lubricate or alter a relief valve. Do not plug vent or restrict discharge.**

## WARNING

**Operation of unit with improper relief valve setting can result in severe personal injury or machine damage. Insure properly set valves are installed and maintained.**

**Blowdown Valve** (Figure 2-4) - The blowdown valve releases pressure from the oil reservoir. See description under "Air Control Components" in this section for construction and operation information.

**INSTRUMENTS** - All units incorporate the following instruments and indicators:

**Oil Sight Gauges** (Figure 3-1) - These gauges indicate the level of the oil in the reservoir. See Section 5, "Lubrication, Oil Cooler, Oil Filter and Separator", for information on how to correctly read these gauges. All other instruments are a part of the microprocessor controller. See "Control System Operation."

**AIR CONTROL COMPONENTS** - All units incorporate the following air control components. See Figure 1-4 for schematic tubing diagram.

**Inlet Valve** (Figure 3-4) - The inlet valve is a pilot-actuated valve that restricts the inlet to control capacity and closes to unload the compressor. At shutdown the inlet valve closes to function as a check valve and prevent backflow of air.

As control pressure is increased the valve will begin to close, restricting the inlet and reducing compressor capacity. Approximately 1.24 Bar (18 psig) of control pressure is required to close the inlet valve completely. When closed, the inlet valve prevents the flow of air in either direction. With modulating control feature: When the control pressure is less than 1.24 Bar (18 psig), the inlet valve will modulate to match compressor capacity to system demand.

**Blowdown Valve** (Figure 2-4) - The blowdown valve is a two-way solenoid valve that is piped into the oil separator outlet, but ahead of the check valve. When the solenoid is de-energized, the blowdown valve opens, and the oil system is blown down. When the solenoid is energized, the blowdown valve closes, and allows the oil system to pressurize.

**Minimum Discharge Pressure Valve (Figure 4-4)** - An

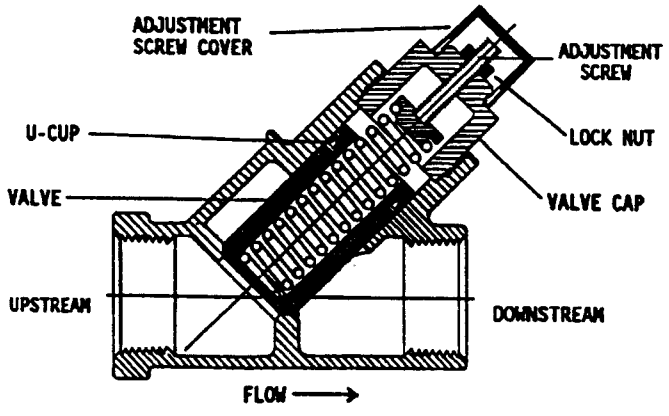



**FIGURE 3-4 - MINIMUM DISCHARGE PRESSURE VALVE**

internal spring-loaded minimum pressure valve used in the final discharge line to provide a positive pressure on the oil system even when the air service valve is fully open. The valve senses upstream pressure. If demand for air exceeds the compressor capacity, the valve throttles the flow to maintain a minimum pressure on the upstream (oil reservoir) side of the valve. When the pressure rises above the minimum pressure (normally adjusted to 4.48 Bar, 65 PSIG) the valve reaches the full open position.

The valve does not routinely require maintenance or adjustment. If the valve fails to function check the following:

**DANGER**

**Air and oil under pressure will cause severe personal injury or death. Shut down compressor and relieve system of all pressure before removing valves, caps, plugs, fittings, bolts, and filters.**

1. Turn the adjustment screw counterclockwise until all load is off the spring. Verify that the valve moves freely.
2. Verify that the U-cup is intact.
3. Inspect the valve seat for dirt or burrs.
4. Verify that the breather hole in the valve cap is not plugged.

The valve is adjustable within a small range. To adjust minimum pressure:

1. Start the compressor.
2. Reduce pressure downstream of the valve below the desired minimum pressure. DO NOT REDUCE UPSTREAM PRESSURE OR ADJUST VALVE BELOW 4.48 BAR (65 PSIG).
3. Loosen the locknut, turn adjustment screw clockwise to increase the minimum pressure, counterclockwise to reduce the minimum pressure.
4. Hold adjustment screw at the desired setting and secure the locknut.

**Check Valve (Final Discharge)** (Figure 2-1) - A renewable seat swing type check valve in the final discharge line prevents backflow of air from the shop air line when the unit stops, unloads or is shut down.

**STARTER/CONTROL BOX** (Figure 3-1) - The following control components are located on the combination starter/control box.

**Hourmeter** - A continuous reading (nonreset) type hourmeter displays the accumulated operating time of the unit and provides a convenient means for scheduling changes of oil and servicing of filters, separators and other devices.

**Microprocessor Controller With Keypad** - Monitors and controls compressor operation. **Emergency Stop Pushbutton** - Removes power from the microprocessor controller outputs to provide a positive means of stopping the unit in an emergency situation.

**Control System Operation** - See Figure 1-4.

**"STOP/RESET" Button With LED** - This button is used to stop the compressor under ordinary conditions. It is also used to extinguish any fault LED's that are illuminated. In addition, it is used in the procedure to adjust the operating pressure. See "Adjusting the Operating Pressure." The LED is illuminated whenever the unit is stopped for any reason EXCEPT a normal shutdown in one of the "AUTO" modes. A flashing LED indicates that a reset is required.

**CAUTION**

**Machine damage will occur if repeatedly restarted after any one of the shutdown modes stops operation of the unit. Find and correct the malfunction before resuming operation.**

**"CONSTANT RUN" Button With LED** - This button is used to operate the unit in the constant run mode. In this mode, the compressor runs continuously, loading and unloading in response to air demand. It will continue to run until stopped, either manually or by a protective shutdown. The LED is illuminated at all times while running in this mode.

**"AUTO LEAD" Button With LED** - This button is used to operate the unit in the "Auto-Start-Timed-Stop" mode, either by itself, or as the lead compressor in a Lead/Lag arrangement. Loading and unloading occurs as in the "CONSTANT RUN" mode, however, if the compressor runs unloaded for a period of 10 minutes, the unit is stopped. At this point, the compressor remains in the "AUTO LEAD" mode and will restart when the system pressure reaches the 'load' setpoint programmed into

the controller. The LED will remain illuminated throughout the cycle.

**WARNING**

**Unit can automatically restart causing personal injury.**

**Know operating mode before working on or near machine.**

**"AUTO LAG" Button With LED** - This button is used to select the 'lag' unit in a lead-lag arrangement. Operation is identical to "AUTO LEAD" except that the start-load and unload setpoints are automatically .34 Bar (5 PSI) lower than programmed.

**NOTICE**

**Any mode may be selected at any time without stopping the compressor.**

**"HIGH AIR TEMPERATURE" LED** - This LED is used to indicate an over temperature condition at either the compressor or oil separator discharge. At the time of a high temperature shutdown, the LED is illuminated and the temperature digital readout is locked on to the offending temperature. Illumination of the decimal point in the lower right hand corner of the digital readout indicates that the temperature displayed is at the oil separator. A non-illuminated decimal point indicates compressor discharge. Pressing "STOP/RESET" will extinguish the LED (if the temperature has lowered below 107.2°C, 225°F) and revert the digital readout to displaying actual discharge temperature.

**"MOTOR OVERLOAD" LED** - This LED indicates that the motor overload relay has tripped. The overload relay itself must be reset before pressing "STOP/RESET" will extinguish the LED.

**"CHANGE SEPARATOR" LED** - This LED will flash when the differential pressure across the oil separator reaches approximately .55 Bar (8 PSI). At this point, the separator element should be scheduled for service at the earliest opportunity. (See Section 5 for separator maintenance.) Should the condition be ignored and allowed to further deteriorate, the compressor will be shutdown and the LED illuminated steadily when the differential pressure reaches 1.03 Bar (15 PSI).

**CAUTION**

**Machine damage will occur if repeatedly restarted after any one of the shutdown modes stops operation of the unit. Find and correct the malfunction before resuming operation.**

**"CHANGE AIR FILTER" LED** - This LED is used to signal when the air filter requires servicing or changing. It is a reminder only and will not stop or impede the operation of the unit. Operating the compressor with the LED illuminated risks collapse of the filter and ingestion into the compressor.

**CAUTION**

**Machine damage can occur with extended operation after "Change Air Filter" LED illuminates. Service air filter as soon as possible.**

**Pressure And Temperature Digital Readouts** - These readouts normally indicate pressure at the discharge checkvalve and temperature at the air end discharge. See "High Air Temperature LED" for a description of readout action during a high temperature condition. Alternately, these readouts can be selected to display oil reservoir pressure and separator air temperature. To obtain such display while the compressor is running, simply press the operating mode button that corresponds to the current operating mode of the unit. (For Example: If the unit is operating in "AUTO LEAD" mode, press the "AUTO LEAD" button.) This will cause the readout to display the alternate parameters. This alternate display mode is indicated by illuminated decimal points in the lower right hand corner of each display. After releasing the button, the display will revert to its normal mode in 5 seconds.

The digital readouts are also used to display error messages. These error messages correspond to various indications concerning condition of the pressure and

| Pressure Readout | | Temperature Readout | |
|---|---|---|---|
| Error # | Meaning | Error # | Meaning |
| E01 | Failure of final discharge pressure sensor | E01 | Failure of compressor temperature sensor |
| E02 | Failure of oil sump pressure sensor | E02 | Failure of separator temperature sensor |
| E03 | Failure of both pressure sensors | E03 | Failure of both temperature sensors |
| E04 | EMERGENCY STOP | | |

**FIGURE 4-4 - DEFINITIONS OF ERROR MESSAGES**

temperature sensors and EMERGENCY STOP condition.

**DEFINITIONS OF ERROR MESSAGES** - Refer to chart in Figure 4-4 below for definitions.

An error message will stop the compressor, if running, and prevent it from restarting. The failed sensor must be replaced to clear the error.

Any condition requiring the control panel to be reset will be indicated by a flashing "STOP/RESET" LED. If all readouts and LED's are flashing, a power interruption has occurred, requiring the control panel to be reset.

**Programming The Load-Unload Pressure Setpoints** - Programming of the Load and Unload Pressure setpoints can only be accomplished with the unit not running.

Step 1: Stop the compressor and remove all power from the unit by opening main disconnect.

**WARNING**

**Electrical shock can cause injury or death. Open main disconnect and any other circuits before working inside control box.**

Step 2: Turn the "Setup" switch located on the controller circuit board (inner side of control box door) to the "+" position. Close control box door and restore power.

**NOTICE**

**This switch is provided to prevent unauthorized programming of the setpoints. If this level of security is not required, the "Setup" switch can be left in the "+" position, eliminating Steps 1 and 2.**

Step 3: With the unit already in the STOP/RESET condition, press the "STOP/RESET" button a second time. This puts the controller in the program mode. The displays will read as follows:

Pressure: the current unload setpoint

Temperature: Ud indicating that the pressure value is the "unload" value.

Step 4: Press the "AUTO LEAD" button to raise the unload setpoint. Press "AUTO LAG" to lower the unload setpoint. See Figure 7-4.

**WARNING**

**Operation at excessive discharge air pressure can cause personal injury or damage to equipment. Do not set unload pressure above the maximum stamped on the unit nameplate.**

Step 5: When the desired unload setpoint is displayed in the pressure readout, press the "STOP/RESET" button. This will enter the desired unload setpoint and advance the programming function to the load setpoint. The displays will now read:

Pressure: the current load setpoint

Temperature: Lod indicating that the pressure value is the "load" value.

Step 6: Raise or lower the load setpoint in the same manner as the unload setpoint in Step 4.

**NOTICE**

**The load setpoint cannot be set within 8 PSI of the unload setpoint. See Figure 7-4.**

Step 7: When the desired load setpoint is displayed in the pressure readout, press the "STOP/RESET" button, entering the new load setpoint and completing the programming.

Step 8: The displays will now read:

Pressure rCr

Temperature n or y

If this compressor is equipped with the expansion board for the remote control option this must be set to "y". The standard setting is "n". This value is toggled by pressing either "Auto" button. Press the "Stop/Reset" button to continue to the next step.

Step 9: The display now indicates either

PSI °F

or

bar °C

Pressing any mode key will toggle the display from one set of units to the other. PSI/°F causes the controller to display pressures in pounds per square inch and temperatures in degrees fahrenheit. bar/°C causes the controller to dis-

play the parameters in bars and degrees Centigrade. Press "Stop/Reset" when the desired units are visible in the display to continue.

Step 10: The displays now indicate: JOG
At this time, compressor rotation may be checked by pressing any of the three operating mode buttons. The starter will be momentarily energized giving a slight rotation that is short enough in duration to prevent reverse oil flow in the event that rotation is reversed. Press "Stop-Reset" to exit the jog mode.

Step 11: When display shows dashes (--- ---):

a) Press "Stop-Reset" - the pressure display now shows the current "zero" pressure for the final discharge transducer in the left window, and "P1" in the right window.

b) Press "Stop-Reset" again - this will zero the circuit board on the final discharge pressure transducer and move the display to the next step. The left window will read the current "zero" pressure for the oil reservoir transducer and the right window will now read "P2."

c) Press "Stop-Reset" again - this will zero the circuit board on the oil reservoir pressure transducer and move display program back to the normal setup mode. The display should read "0" pressure in the left window, and --- current sump temperature in the right window.

Step 12: Move circuit board slide switch back to the "set" position (right). You may now proceed with normal start up procedure.

**NOTICE**

**A. To readjust, the slide switch must be in the left position.**

**B. If procedure is repeated, the transducer zero operation may be bypassed by not pressing "Stop-Reset" while the dashes (---- ----) are displayed.**

**C. Transducer must be zeroed only while at zero "0" pressure, or invalid shutdowns may occur.**

**LEAD-LAG OPERATION OF TWO COMPRESSORS** - The microprocessor controller provides the capability of true lead-lag operation without the need to purchase any additional equipment and without complicated interconnecting wiring.

Follow these steps to operate two compressors in a lead-lag arrangement:

Step 1: Program the load and unload pressure set-

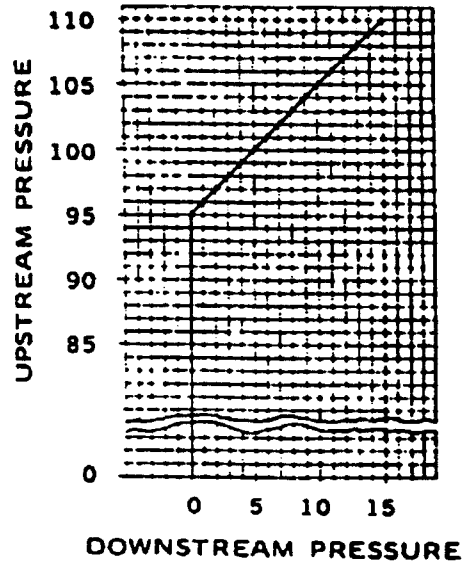



FIGURE 5-4

point on both units to the same value. For example: Compressor "A" load at 92 PSI; unload at 100 PSI. Compressor "B" load at 92 PSI; unload at 100 PSI. See page 6, this section, for complete information on programming the setpoints.

**WARNING**

**Operation at excessive discharge air pressure can cause personal injury or damage to equipment. Do not set unload pressure above the maximum stamped on the unit nameplate.**

Step 2: Operate one compressor in the "Auto Lead" mode. This compressor will now be the "Lead" or "Base Load" compressor.

Step 3: Operate the second compressor in the "Auto Lag" mode. This compressor will now be the "lag" or "trim" compressor. It will automatically be brought on line, if required, by a large air demand. After the demand is satisfied, the lag unit will unload, time out and stop, ready to start again when needed.

Step 4: Periodically reverse the roles of the units by changing each unit's mode of operation from "Auto Lead" to "Auto Lag" and vice versa. By using the hourmeters on the control panel to schedule the mode changes, the operating hours can be kept as close as possible, equalizing machine wear and minimizing maintenance costs.

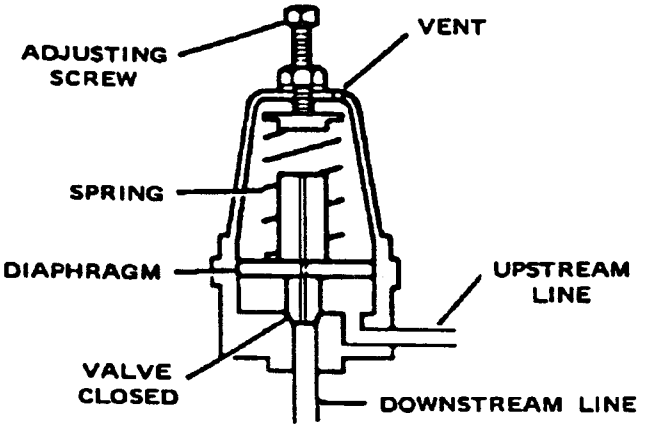



FIGURE 6-4 - SUBTRACTIVE PILOT (CLOSED)

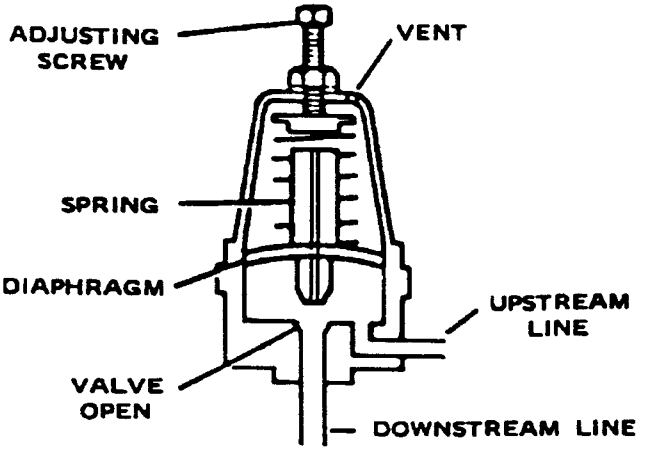



FIGURE 7-4 - SUBTRACTIVE PILOT (OPENED)

**WARNING**

**Unit can automatically restart causing personal injury.**

**Know operating mode before working on or near machine.**

**Subtractive Pilot** (Modulating Feature) - The subtractive pilot is an adjustable, spring-loaded diaphragm valve that controls pressure in relation to the upstream (discharge) pressure.

The downstream pressure is maintained equal to the upstream pressure minus a constant which is adjustable. In the example shown in Figure 4-4, the downstream pressure equals the upstream pressure minus 6.55 Bar (95 psi). When the upstream pressure rises to 6.90 Bar (100 psig), the downstream pressure rises to .34 Bar (5 psig). This 1 to 1 psi rise is constant above the set point.

Below the set point, the valve seat is closed and the downstream pressure is vented. In the example of Figure 5-4 the downstream pressure is vented below 6.55 Bar (95 psig).

Figure 6-4 shows a schematic cross section of the subtractive pilot with the valve seat closed and the downstream line vented. Figure 7-4 shows the pilot with the valve seat open, holding a downstream pressure which is adjustable with the screw. In this position it is normal for the valve to continually bleed air through the small vent hole in the bowl.

Moisture, oil and dirt in the control system lines and components can cause the set point of the subtractive pilot to shift or be erratic. The subtractive pilot can be disassembled and the diaphragm and ports cleaned when necessary.

**Operating Air Pressure Adjustment** - The microprocessor controller load and unload pressure setpoints should already be programmed. See page 6 and Figure 8-4 of this section.

**WARNING**

**Operation at excessive discharge air pressure can cause personal injury or damage to equipment. Do not set unload pressure above the maximum stamped on the unit nameplate.**

To adjust the subtractive pilot:

1. With the unit off, loosen the locknut and back out the adjusting screw several turns so the subtractive pilot will fully unload the compressor before the unload pressure setpoint of the microprocessor controller is reached.
2. Close the air service valve and start the unit in the "CONSTANT RUN" mode. Allow unit to reach the pressure at which the subtractive pilot fully unloads the compressor.
3. Turn-in the adjusting screw until the unload pressure setpoint is reached and the microprocessor controller allows the unit to blow down.
4. Turn-in the adjusting screw an additional one-eighth (1/8) turn and tighten the locknut. As a result, the subtractive pilot will not fully unload the compressor before the microprocessor controller's unload pressure setpoint is reached.
5. Using the air service valve, cycle the unit between load and unload several times to be certain that the unit will reach the microprocessor controller's unload pressure setpoint and blow down.

| NAMEPLATE FULL LOAD OPERATING PRESSURE BAR (PSIG) | MODULATING CONTROL SYSTEM | |
|---|---|---|
| | LOAD BAR (PSIG) | UNLOAD BAR (PSIG) |
| 6.90 (100) | 6.90 (100) | 7.45 (108) |
| 8.62 (125) | 8.62 (125) | 9.17 (133) |
| 10.35 (150) | 10.35 (150) | 10.90 (158) |

**NOTICE**

**Load setpoint cannot be set within .55 Bar (8 psi) of the unload setpoint.**

**Minimum operating pressure is 4.48 Bar (65 PSI).**

FIGURE 8-4 - MAXIMUM SETPOINTS FOR MICROPROCESSOR CONTROLLER, BAR (PSIG)

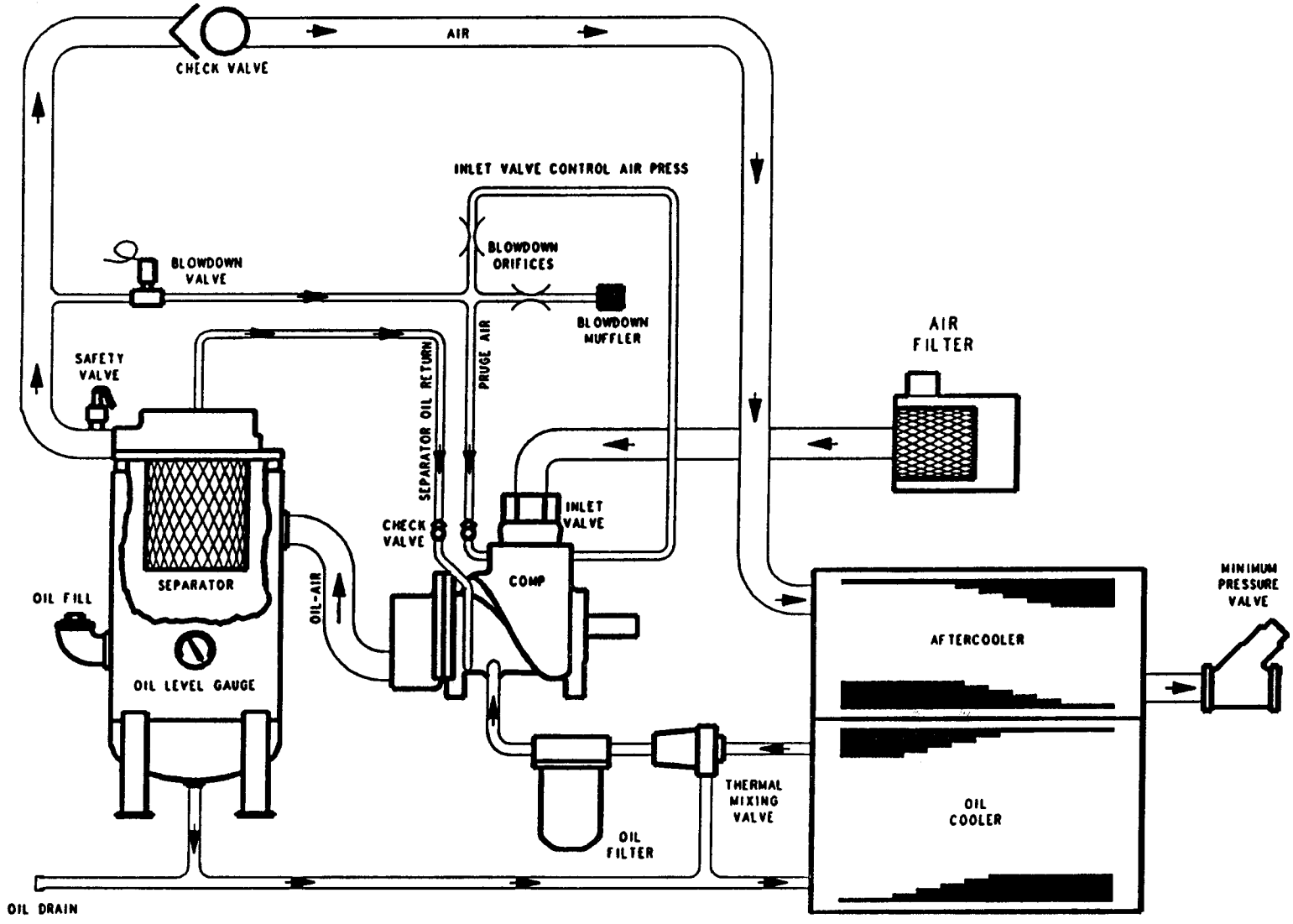



**FIGURE 9-4 - DUAL CONTROL SCHEMATIC**

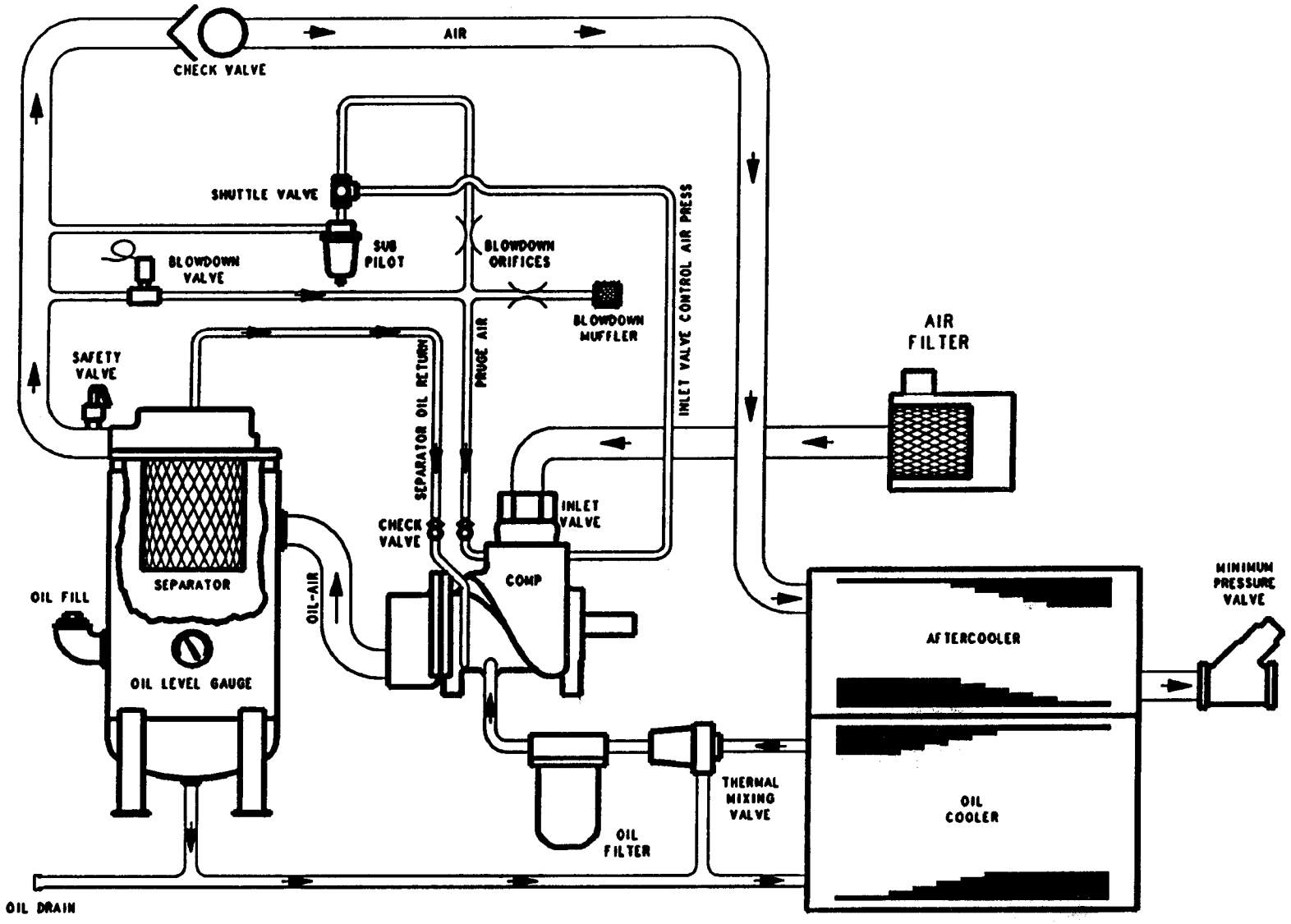



**FIGURE 10-4 - MODULATING CONTROL SCHEMATIC**

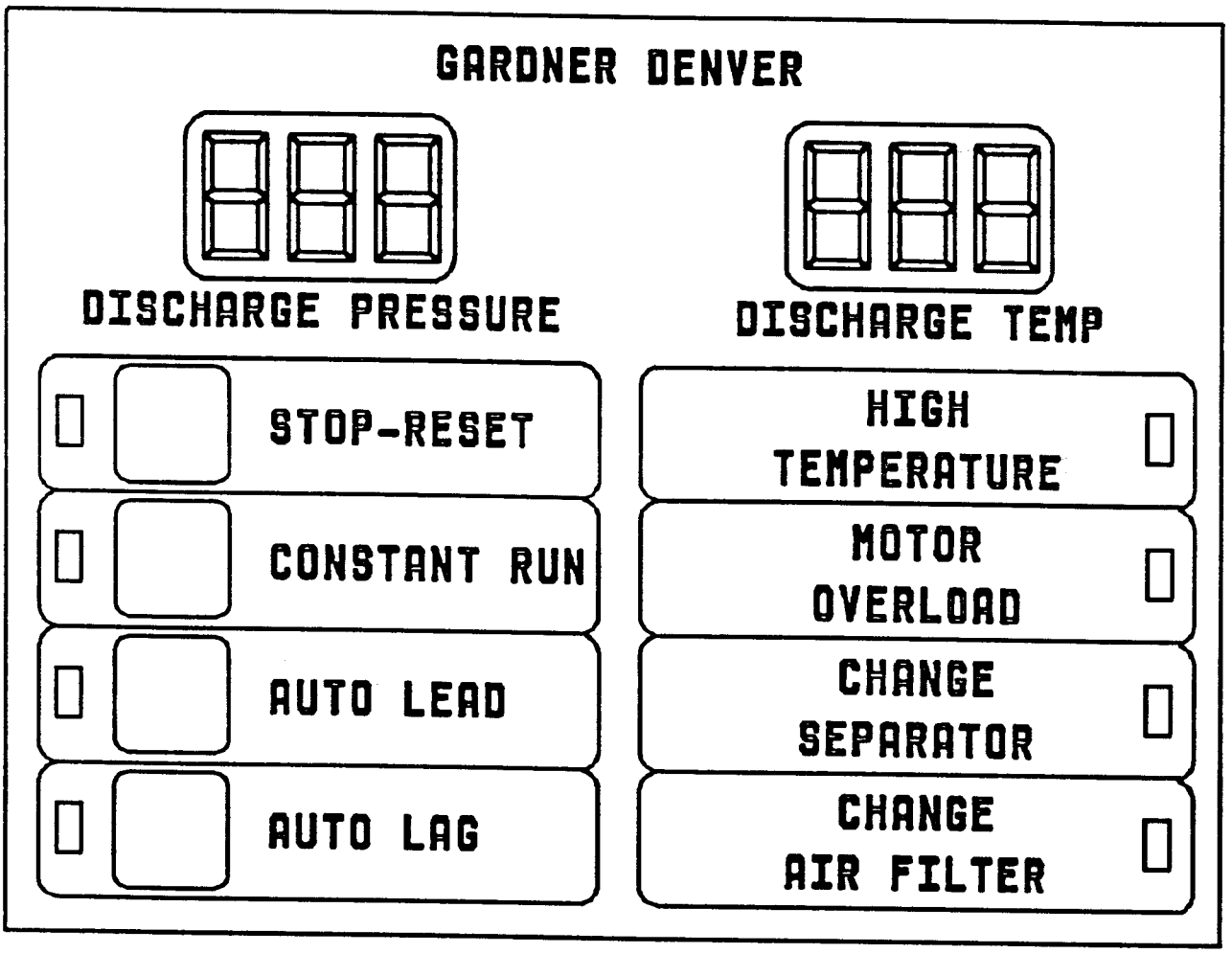



FIGURE 11-4 - AUTO SENTRY "S" SOLID STATE CONTROL TOUCH PAD

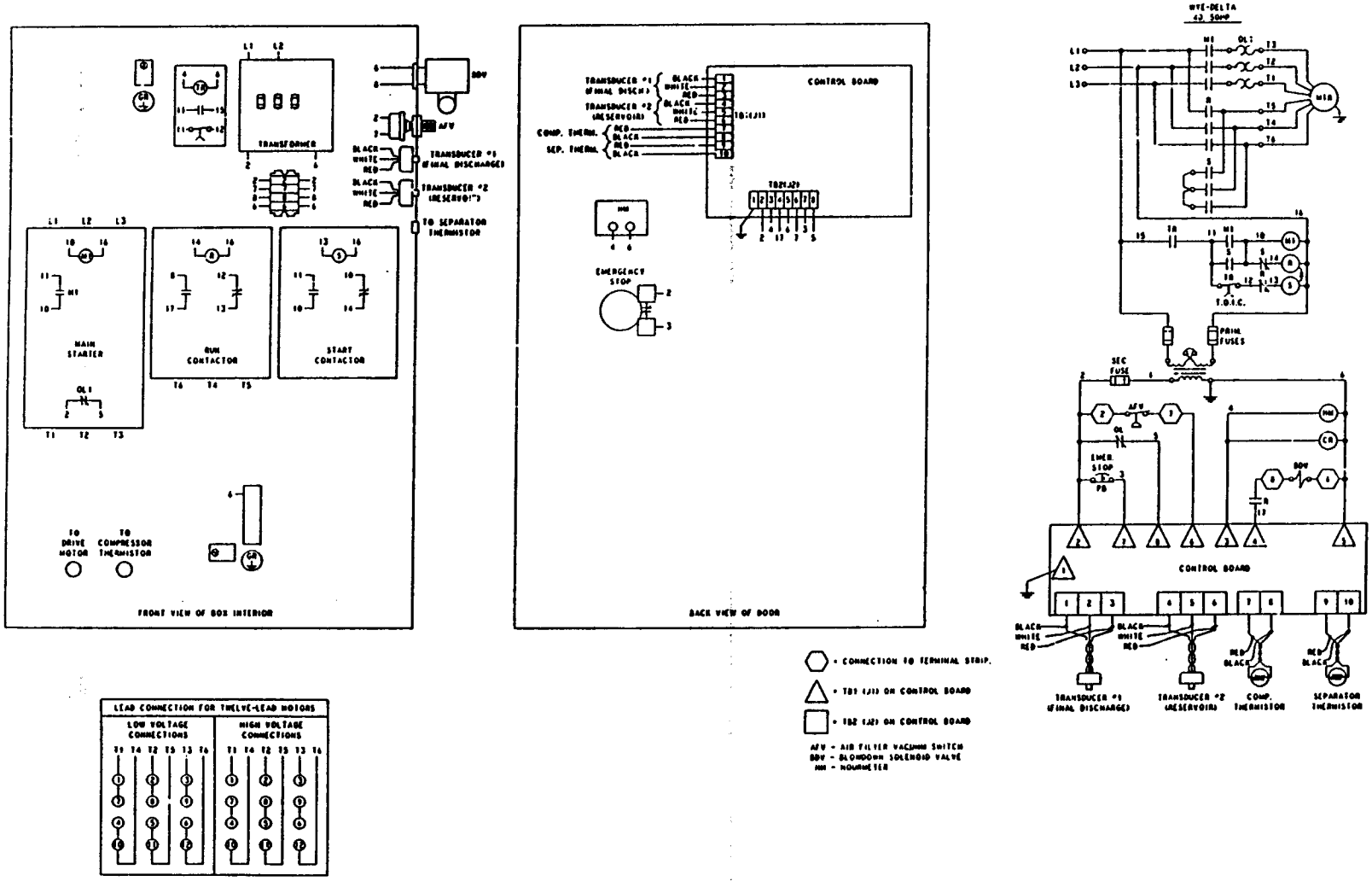






**FIGURE 12-4 - WIRING DIAGRAM**

## SECTION 5
## LUBRICATION
## OIL COOLER, OIL FILTER & SEPARATOR

**COMPRESSOR OIL SYSTEM** (Figures 1-5) cools the compressor, lubricates moving parts and seals internal clearances in the compression chamber.

The oil inlet line is connected at the bottom of the oil reservoir. Air pressure in the oil reservoir forces oil through the oil cooler, thermostatic mixing valve, oil filter and into the compressor main oil gallery.

The oil passes through internal passages for lubrication, cooling and sealing. The air-oil mixture is then discharged to the oil reservoir where a large part of the entrained oil drops out of the air stream; the air then passes through the final oil separator where most of the remaining oil is removed. The separated oil is returned to the compressor and the air passes to the final discharge line.

**RECOMMENDED LUBRICANT** - Gardner-Denver compressors are factory filled with AEON™ lubricants. These lubricants are formulated to the highest quality standards and are factory authorized, tested and approved for use in rotary screw compressors. AEON™ lubricants are available through your authorized Gardner-Denver compressor distributor.

**OIL SPECIFICATIONS** - The recommended compressor lubricant is Gardner-Denver AEON™ 800 Lubricating Coolant which can be used for year-round operation except as noted in the "High Temperature Operation" paragraph below. AEON™ 800 Lubricating Coolant is an ATF type rotary screw compressor lubricant formulated and containing additives for use in Gardner-Denver compressors.

### CAUTION

**Use of improper lubricants will cause damage to equipment. Do not mix different types of lubricants or use inferior lubricants.**

**HIGH TEMPERATURE OPERATION** - If the discharge temperature is sustained between 200-210°F for a period of more than four (4) hours due to continuing high ambient air temperature, contact your Gardner-Denver Distributor or sales agent for recommended lubricant. Short periods of up to four (4) hours of sustained discharge temperatures up to 210°F do not require a change from the recommended year-round lubricant.

### CAUTION

**Improper equipment maintenance with use of synthetic lubricants will damage equipment. See maintenance schedule, Section 8.**

### DANGER

**Oil under pressure will cause severe personal injury or death. Shut down compressor and relieve system of all pressure before removing valves, caps, plugs, fittings, bolts and filters.**

### WARNING

**High temperature operation can cause damage to equipment or personal injury. Do not repeatedly restart after high temperature stops operation. Find and correct the malfunction before resuming operation.**

Material Safety Data Sheets (MSDS) are available for all AEON™ lubricants from your authorized Gardner-Denver distributor or by calling 217-222-5400.

**COLD AMBIENT OPERATION** - See "Installation for Cold Weather Operation," Section 2.

**ADDITION OF OIL BETWEEN CHANGES** must be made when the oil level is in the red range on the gauge as read while the unit is on. Be sure the unit is completely off and that no air pressure is in the oil reservoir. Wipe away all dirt around the oil filler plug. Remove the oil filler plug and add oil as required to return the oil level to the green range on the gauge. DO NOT OVERFILL. The quantity required to raise the oil level from the red range to the yellow range on the gauge is shown in Figure 3-5. Repeated addition of oil between oil changes may indicate excessive oil carry-over and should be investigated.

### DANGER

**Air/oil under pressure will cause severe personal injury or death. Shut down compressor and relieve system of all pressure before removing valves, caps, plugs, fittings, bolts, and filters.**

### CAUTION

**Excessive oil carryover can damage equipment. Never fill oil reservoir above "FULL" marker.**

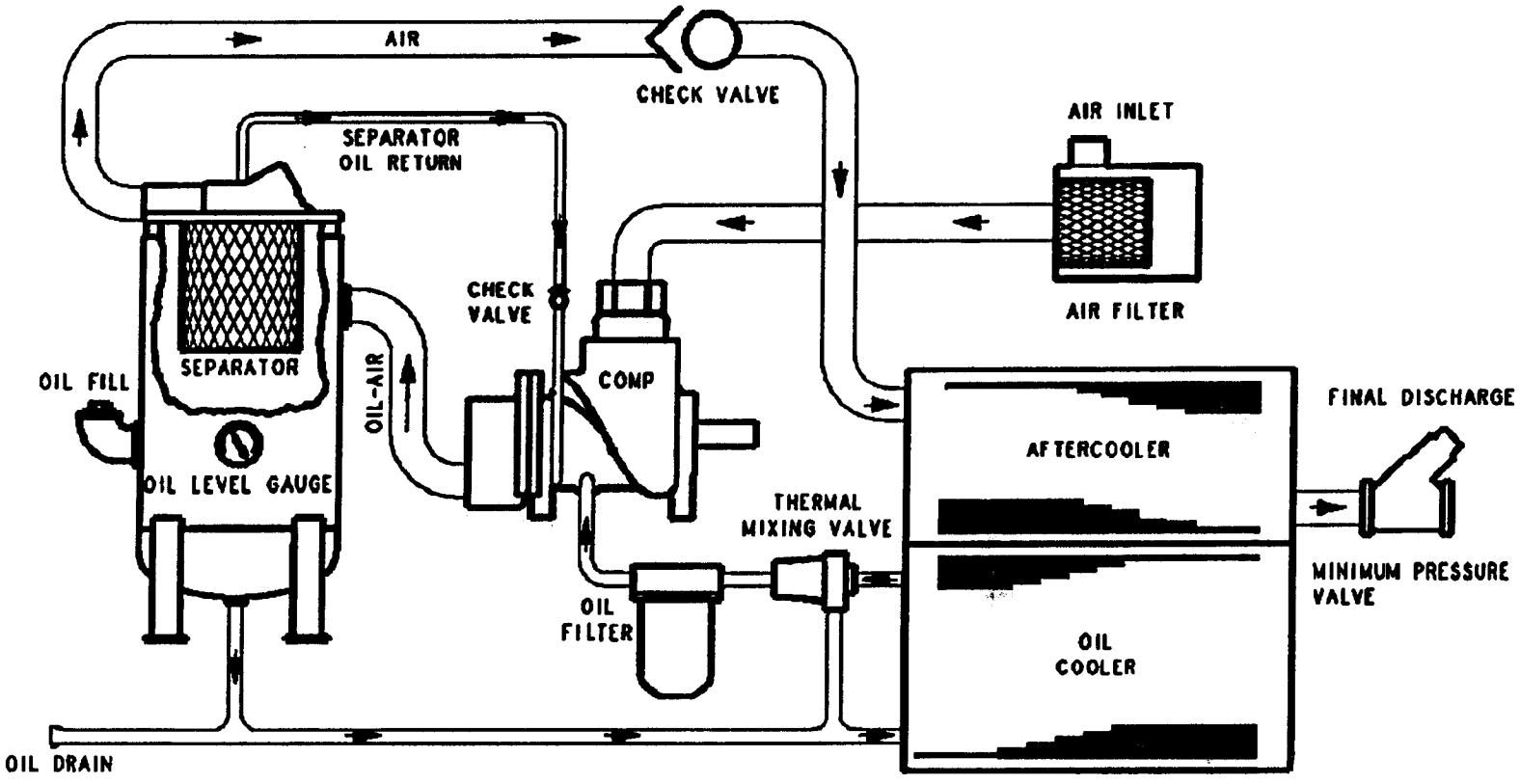



**FIGURE 1-5 - FLOW DIAGRAM - AIR/OIL SYSTEMS**

| | |
|---|---|
| Reservoir Capacity to Yellow Range | 22.7 Liters (6 U.S. Gallons) |
| System Capacity: Reservoir Plus Oil Cooler and Piping | 32.2 Liters (8.5 U.S. Gallons) |
| Red Range to Yellow Range | 3.8 Liters (1 U.S. Gallon) |

**FIGURE 2-5 - APPROXIMATE OIL SYSTEM CAPACITIES**

**OIL LEVEL SIGHT GAUGES** (Figure 3-1) indicates the amount of oil in the oil reservoir. Read oil level only when unit is off and all pressure is relieved. In operation the oil level will fluctuate as the compressor loads and unloads. Add oil only when the oil level is at or below the "ADD" marker as read when the compressor is off. Drain oil only when the oil level is above the "FULL" marker as read when the compressor is off.

**MOISTURE IN THE OIL SYSTEM** - In normal humidity and with normal operating temperatures and pressures, the thermal mixing valve controls the oil temperature and prevents moisture contamination of the oil. Unusual cooling of the oil reservoir, short loaded cycle in high humidity, malfunctions of the thermal valve or cooling water system may result in moisture in the oil system which is detrimental to compressor lubrication. If moisture is observed in the oil reservoir, drain the moisture and correct the condition causing the accumulation. See "Compressor Oil System Check" and "Thermal Control (Thermostatic Mixing) Valve" in this section.

**OIL CHANGE INTERVAL** - Recommended oil change intervals based on oil temperature. When operating conditions are severe (very dusty, high humidity) it will be necessary to change the oil more frequently. Operating conditions and the appearance of the drained oil must be surveyed and the oil change intervals planned accordingly by the user. A good lubricant analysis program is helpful in planning the change interval.

**AEON 800**

| Discharge Temperature | Oil Change Interval |
|---|---|
| Up to 180°F | 2000 hrs. |
| 180 to 190°F | 1500 hrs. |
| 190 to 200°F | 1000 hrs. |
| 200 + | 500 hrs. |

**DRAINING AND CLEANING OIL SYSTEM -**

**DANGER**

**Air/oil under pressure will cause severe personal injury or death. Shut down compressor and relieve system of all pressure before removing valves, caps, plugs, fittings, bolts, and filters.**

Always drain the complete system. Draining when the oil is hot will help to prevent varnish deposits and carry away impurities. To drain the system, use one of the following methods:

If the unit is not elevated high enough to use the oil reservoir drain line to drain oil, a small hand, electric or air operated pump should be used to drain reservoir through the oil filler opening or from the drain valve.

If the unit is elevated so that the oil reservoir drain can be used, empty the oil reservoir through the drain valve to a suitable container or sump.

If the drained oil and/or the oil filter element are contaminated with dirt, flush the entire system: reservoir, oil cooler, mixing valve and lines. Inspect the oil separator elements for dirt accumulation; replace if necessary. If a varnish deposit exists, contact the factory for recommendations for removal of the deposit and prevention of varnish.

**FILLING OIL RESERVOIR -**

**DANGER**

**Air/oil under pressure will cause severe personal injury or death. Shut down compressor and relieve system of all pressure before removing valves, caps, plugs, fittings, bolts, and filters.**

Wipe away all dirt before removing the oil filler plug. Refer to Figure 3-5 for the oil quantity required to fill the compressor oil system. Add oil until oil level reaches "FULL" marker. Operate unit for about a minute allowing oil to fill all areas of the system. Shut down the unit and be certain all pressure is relieved. Add oil if necessary to bring level to full. On unloaded operation and after shutdown some oil will drain back into the oil reservoir and the oil level will read over "FULL". DO NOT DRAIN OIL TO CORRECT. On the next start, oil will again fill the system and the gauge will indicate operating oil level. DO NOT OVERFILL as oil carryover will result. Use only CLEAN containers and funnels so no dirt enters the reservoir. Provide for clean storage of oils. Changing oil will be of little benefit if done in a slipshod manner.

**CAUTION**

**Excessive oil carryover can damage equipment. Never fill oil reservoir above "FULL" marker.**

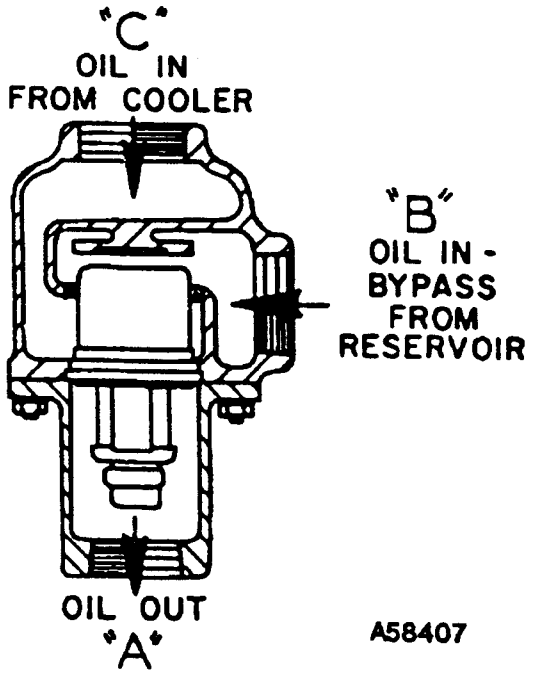



FIGURE 3-5 - THERMOSTATIC MIXING VALVE

COMPRESSOR OIL FILTER (Figure 5-1) - This replaceable element filter is a vital part in maintaining a trouble-free compressor, since it removes dirt and abrasives from the circulated oil. The filter is equipped with a relief valve that opens in the event the element becomes dirty enough to block the flow of oil.

**CAUTION**

**Improper oil filter maintenance will cause damage to equipment. Replace filter element every 1000 hours of operation. more frequent replacement could be required depending on operation conditions. Filter element left in service too long may damage equipment.**

Use only the replacement element shown on the filter tag or refer to the parts list for the part number. Use the following procedure to replace the filter element. Do not disturb the piping.

**DANGER**

**Air/oil under pressure will cause severe personal injury or death. Shut down compressor and relieve system of all pressure before removing valves, caps, plugs, fittings, bolts, and filters.**

1. Stop unit and be sure no air pressure is in the oil reservoir.
2. Remove the spin-on element.
3. Clean the gasket face of the filter body.
4. Coat the new element gasket with clean lubricant used in the unit.
5. Screw new element on filter body and tighten by hand. DO NOT OVERTIGHTEN ELEMENT.
6. Run the unit and check for leaks.

COMPRESSOR OIL COOLER - (Figure 5-1) - The cooler fan is mounted on the compressor motor shaft; air is exhausted through the oil cooler and away from the unit. Do not obstruct air flow to and from the oil cooler. Allow a minimum of 1M (3 ft.) clearance around the cooler. Keep both faces of the cooler core clean for efficient cooling of the compressor oil.

THERMAL CONTROL (THERMOSTATIC MIXING) VALVE (Figure 3-5) is installed in system as shown in Figure 1-5. This valve is used to control temperature of the oil both air-cooled radiator and water-cooled heat exchanger type oil cooler systems. On start-up with unit cold, element is open to bypass, allowing oil to pass directly from the reservoir to compressor during warm-up. As oil warms, element gradually closes to the bypass allowing more of the oil from the cooler to mix with oil from the bypass.

After the unit is warmed up, mixing valve maintains oil injection temperature into the compressor at a minimum of 65.6°C (150°F). This system provides proper compressor warm-up and prevents moisture contamination of the oil.

To check element, heat in oil - it should be fully extended at 65.6°C (150°) F. If unit shuts down due to high air discharge temperature, the cause may be that the element is stuck open to the bypass, in which case bypass lines (Figure 1-5) will be hot to touch and lines out of mixing valve much cooler. When flushing the oil system, remove mixing valve and clean all parts thoroughly.

OIL RESERVOIR - The oil reservoir-separator combines multiple functions into one vessel. The lower half is the oil reservoir, providing oil storage capacity for the system and the top portion, a primary oil separation means. The reservoir also provides limited air storage for control and gauge actuation.

COMPRESSOR (G-D ELIMINATOR) OIL SEPARATOR located in the upper half of the oil reservoir consists of a renewable cartridge-type separator element and provides the final removal of oil from the air stream (Figure 7-5).

Oil impinging on the inside of the separator element drains directly back into the oil reservoir by gravity. Oil collected outside the element is returned through tubing to the compressor cylinder.

Oil carryover through the service lines may be caused by a faulty oil separator, faulty minimum pressure valve, over-filling of the oil reservoir, oil that foams, or oil return line malfunction. If oil carryover occurs, inspect the separator only after it is determined that the oil level is

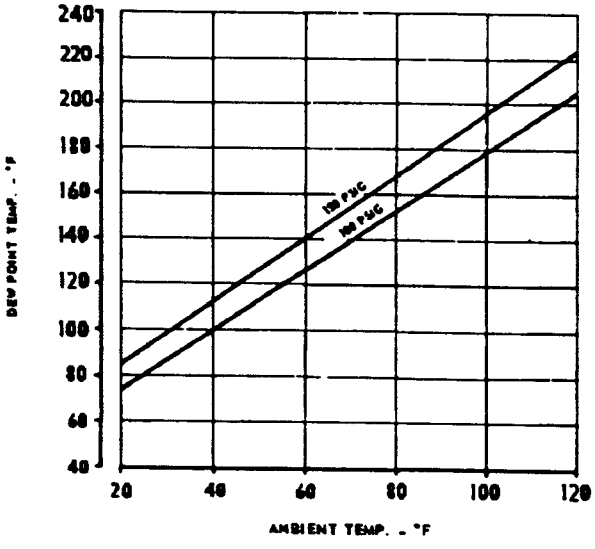



FIGURE 4-5 - DEW POINT TEMPERATURE VS. AMBIENT TEMPERATURE (100% RELATIVE HUMIDITY)

not too high, the oil is not foaming excessively, and the oil return line from the separator housing to the compressor cylinder is not clogged or pinched off.

Oil carryover malfunctions of the oil separator are usually due to using elements too long, heavy dirt or varnish deposits caused by inadequate air filter service, use of improper oil or using oil too long for existing conditions. A ruptured or collapsed separator element is usually due to heavy dirt or varnish buildup in the filtering material. Excessive tilt angle of the unit will also hamper separation and cause oil carryover.

Oil separator element life cannot be predicted; it will vary greatly depending on the conditions of operation, the quality of oil used and the maintenance of the oil and air filters. The condition of the separator can be determined by pressure differential gauging or by inspection.

**Pressure Differential Gauging** - The "CHANGE SEPARATOR" message will flash when the pressure differential across the oil separator reaches approximately .55 Bars (8 PSI). Replace the oil separator element at this time. If ignored, the unit will shut down and the display will indicate shutdown and change separator when the pressure differential reaches 1.03 Bars (15 PSI).

To measure the pressure differential, see "Pressure and Temperature Digital Readouts" in Section 4. Simply subtract downstream reading from upstream reading.

**CAUTION**

**Using an oil separator element at excessive pressure differential can cause damage to equipment. Replace separator when "Change Separator" message flashes.**

**NOTICE**

**A sudden drop to zero pressure differential or sudden heavy oil carryover may indicate a ruptured element.**

**Inspection** - After removal of separator element, shine a light inside the element to reveal areas of heavy dirt or varnish deposits or breaks (ruptures) in the element media.

**Removal Of Oil Separator For Inspection Or Replacement:**

**DANGER**

**Air/oil under pressure will cause severe personal injury or death. Shut down compressor and relieve system of all pressure before removing valves, caps, plugs, fittings, bolts, and filters.**

1. Disconnect oil return to the compressor tubing at tube elbow on reservoir cover.
2. Loosen nut on fitting at reservoir cover and completely withdraw the tubing through the fitting.
3. Disconnect all other tubing from discharge manifold.
4. Loosen and slide flexible coupling in reservoir to aftercooler piping.
5. Remove screws holding the cover to the oil reservoir. Lift cover from the oil reservoir.
6. Lift the separator from the oil reservoir.
7. Inspect and/or replace the separator as necessary. Before installing (or reinstalling) any separator be sure gaskets bonded to the separator flanges are not damaged. Remove any gasket material adhering to cover or reservoir flange from old separator.
8. Lower separator into oil reservoir.
9. Seat cover to oil reservoir flange; install and tighten all cap screws.
10. Reconnect the flexible coupling and all tubing.
11. Install original oil return by slipping tube through the fitting at the discharge manifold flange until ferule bottoms in fitting. If a new fitting and return tube is used, slip tube through fitting until it touches the bottom of the separator, then raise the tube about 6mm (1/4) inch off the bottom and tighten fitting nut securely. Connect the other end of the tube to the compressor oil return tube elbow. Do not bend tube or raise further than 6mm (1/4 in.) to 13mm (1/2 in.) from bottom of separator.
12. Reconnect the compressor oil return tube to the tube elbow.

**COMPRESSOR OIL SYSTEM CHECK** - The following readings are based on ambient temperature of 26.7 °C (80°F) for air-cooled oil cooler, with the system in good condition. Compressor should be at operating temperature at the time of checks. One-half hour of loaded operation is usually sufficient to reach level-out operating temperatures.

**Air and Oil Discharge Temperature** - 76.7 to 93.3°C (170° to 200° F) - Read at gauge on the instrument panel or check with a thermometer at the discharge housing.

**Compressor Oil Inlet Temperature** - 65.6 to 71.1°C (150° to 160° F) - Install tee at oil filter outlet and check with thermometer.

**Oil Inlet Pressure** - Check at the fitting in the line near the compressor oil inlet. With air receiver pressure at 6.90 Bar (100 psi), oil inlet pressure should be 4.48 to 5.17 Bar (65-75 psig).

**Oil Cooler Oil Pressure Differential (Air-Cooled Radiator)** - Check differential across oil system by measuring oil inlet pressure as described above.

**Oil Cooler Temperature Differential (Air-Cooled Radiator)** - The oil temperature differential depends on the temperature of the air at the oil cooler fan and cleanliness of the core faces. As ambient temperatures and core restrictions increase, the oil cooler outlet temperature will increase. The oil inlet temperature is approximately the same as air discharge temperature - see gauge on instrument panel. The outlet oil temperature may be checked by installing a tee at the oil filter outlet.

## SECTION 6
## AIR FILTER

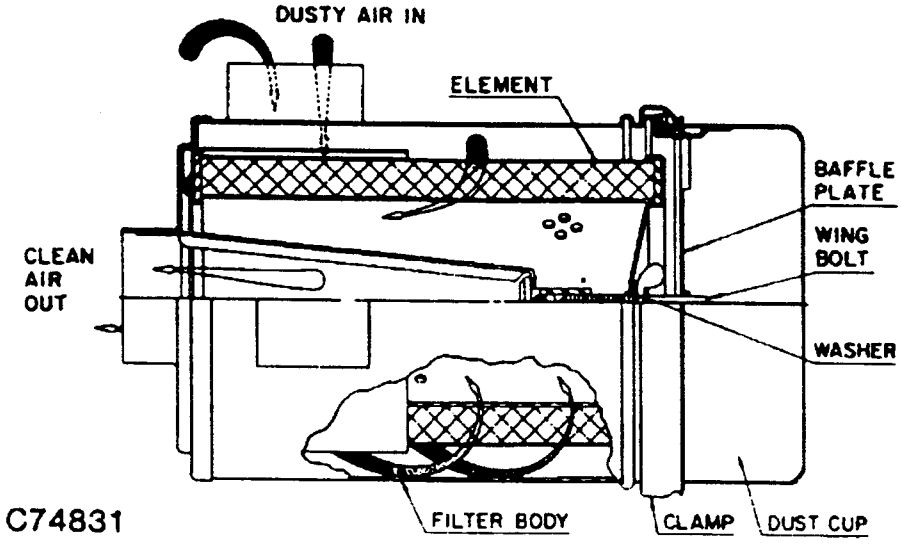



FIGURE 1-6 - HEAVY DUTY AIR FILTER (STANDARD)

**HEAVY-DUTY AIR FILTER** (Figure 1-6) furnished as standard equipment on units with an enclosure is a heavy-duty washable element dry type air filter. The air filter must receive proper maintenance if maximum service is to be obtained from the unit. Establishing adequate and timely filter service is MOST IMPORTANT. Improperly maintained air filter can cause a loss of compressor air delivery.

**Dust Cup** - Service every 4 to 120 hours depending on dust conditions. To service, loosen the retaining band clamp and remove the dust cup. Do not wash the dust cup - wipe clean with a clean dry cloth. Do not bend the edge of the cup by striking on a hard surface. When installing dust cup, make sure clamp is securely tightened to prevent leakage.

**Filter Element** - Service the air filter element when the "CHANGE AIR FILTER" LED is illuminated. Clean every 50 to 150 operating hours depending on dust conditions.

**NOTICE**

**Use only genuine Gardner-Denver air filter elements on Gardner-Denver compressor units. Genuine parts are available through your authorized Gardner-Denver distributor.**

To service:

1. Loosen retaining band clamp and remove the dust cup from the body of the filter.
2. Visually inspect the element in place. If cleaning is not necessary, reinstall the dust cup on the filter. If the element requires cleaning, unscrew the wing bolt and withdraw the element from the body.
3. Wash the element by soaking about 15 minutes in warm water with a mild nonsudsing detergent. Rinse the element thoroughly with clean water; a hose may be used if the water pressure does not exceed 2.76 Bar (40 psig).
4. Inspect the element for ruptures or cracks in the pleated media; replace the element if any are found. Inspect the gasket on the bottom (outlet end) of the element; replace the entire element if the gasket is damaged.
5. Allow the element to air dry COMPLETELY. Do not expose the element to heat over 65.6°C (150° F). Install the element in the filter body and fasten securely with the wing bolt. Reinstall the dust cup and retaining band clamp. Make sure the clamp is tightened securely to prevent leakage.

**WARNING**

**Do not oil this element. Do not wash in inflammable cleaning fluids. Do not use solvents other than water. Improper cleaning may damage element.**

## CAUTION

**Never operate the unit without the element. Never use elements that are damaged, ruptured or wet. Never use gaskets that won't seal. Keep spare elements and gaskets on hand to reduce downtime. Store elements in a protected area free from damage, dirt and moisture. Handle all parts with care.**

**Filter Element Life** - The element should be replaced after six (6) cleanings or if:

1. Visual inspection indicates a rupture, crack or pin hole in the pleated media. Inspection should be done by placing a bright light inside the element.
2. Pressure drop through a filter with a freshly cleaned element is below three (3) inches of water with compressor running at full load - this would indicate a rupture or crack.

**Inlet Screen and Tube** - Inspect the inlet screen and tube for dirt accumulation each time the filter is serviced. Clean the tube when required by ramming a clean dry cloth through the tube. Wipe the inside of the filter body to remove any dirt falling from the inlet tube before reinstalling the element.

Causes of short element life include: severe dust conditions, infrequent servicing, improper cleaning, or contamination by oil or chemical fumes.

## SECTION 7
## COUPLING

Proper drive belt tension and alignment are provided at the factory, however, good practice dictates checking the drive alignment and tension after shipment and before initial start-up. Sheaves should align straight across the front with a straight edge. The best tension is just enough tension to keep belts from "squealing" on start-up.

**CAUTION**

**Excessive belt tension can damage the equipment. Tension the belts as shown in Table 1-7.**

Belts can be changed when necessary by first removing the wire guard. Then loosen, but do not remove, the four motor foot nuts. Next, use the adjusting screws in the motor base to loosen belt tension. Remove the belts over the fan.

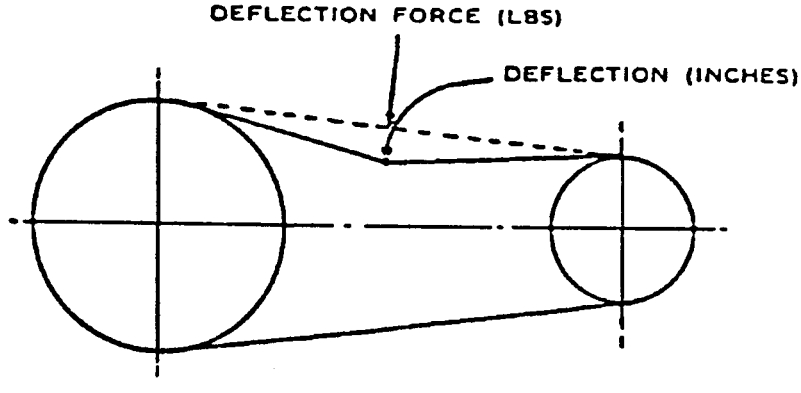
**CAUTION**

**Interference between the fan and the orifice can damage equipment. Be certain the orifice has even clearance around the fan before starting the unit.**

**CHECKING BELT TENSION** - Using a spring scale, apply a perpendicular force to each belt at the midpoint of the span and measure the deflection. Correct deflection force and deflection are shown in Table 1-7. To tighten belts, merely increase the center distance.

**NOTICE**

**When a new set of belts is installed on a drive, the initial deflection force should be 1/3 greater than shown in Table 1-7. Recheck tension frequently during the first 24 hours of operation.**




| Motor KW (HP) | No. Of Belts | Deflection Force Pounds (per belt) | Deflection In mm (Inches) |
|---|---|---|---|
| 29.8 (40) | 4 | 6.0 - 8.5 | 9.5 (3/8) |
| 37.3 (50) | 4 | 7.0 - 10.0 | 9.5 (3/8) |

**TABLE 1-7 - BELT TENSION VX BELTS**

# SECTION 8
# MAINTENANCE SCHEDULE

## SERVICE CHECK LIST -

**Air Filter** - Operating conditions determine frequency of service. The "CHANGE AIR FILTER" display will flash to signal that the air filter requires servicing or changing. See "Air Filter," Section 6.

**Oil Separator** - Operating conditions determine frequency of service. The "CHANGE SEPARATOR" display will flash to signal that oil separator element requires changing. See "Compressor Oil Separator" in Section 5.

Refer to "Compressor Oil Separator" in Section 5 for further details.

**Motor Lubrication** - Refer to Section 2 and Maintenance Schedule Chart below.

### Every 8 Hours Operation

1. Check the reservoir oil level - add oil if required. See Section 5. If oil consumption is high, refer to "Excessive Oil Consumption" in Section 9.
2. Observe if the unit loads and unloads properly.
3. Check discharge pressure and temperature.
4. Drain the moisture trap in the control system. See Section 4.

### Every 125 Hours Operation

1. Check for dirt accumulation on oil/aftercooler core faces and the cooling fan. If cleaning is required, clean the exterior fin surfaces of the cores by blowing compressed air carrying a nonflammable safety solvent in a direction opposite that of the cooling fan air flow. This cleaning operation will keep the exterior cooling surfaces clean and ensure effective heat dissipation.

### Every 1000 Hours Operation

1. Change oil filter element.

### Every 2000 Hours Operation

1. Change the compressor lubricant. UNDER ADVERSE CONDITIONS, CHANGE MORE FREQUENTLY (refer to "Oil Change Interval" in Section 5). Flush system if required.

### Every 4000 Hours Operation

1. Inspect oil separator element. See Section 5.

### Every Year

1. Check the relief valve for proper operation. See Section 4.

**MAINTENANCE SCHEDULE (See detail notes above)**

| Maintenance Action | As Indicated By Panel LED | Every 8 Hours Operation | Every 125 Hours Operation | Every 1000 Hours Operation | Every 4000 Hours Operation | Every 2000* Hours Operation | Every Year |
|---|---|---|---|---|---|---|---|
| Change Air Filter | ● | | | | | | |
| Change Oil Separator | ● | | | | | | |
| Check Reservoir Oil Level | | ● | | | | | |
| Check For Proper Load/Unload | | ● | | | | | |
| Check Discharge Pressure/Temp. | | ● | | | | | |
| Check Dirt Accumulation on Cooler | | | ● | | | | |
| Change Oil Filter Element | | | | ● | | | |
| Inspect Oil Separator Element | | | | | ● | | |
| Change Compressor Lubricant | | | | | | ● | |
| Check Relief Valve | | | | | | | ● |

* See Continuous Operating Temperature Chart for specific lubricant life.

## SECTION 9
## TROUBLE SHOOTING

| Symptom | Possible Cause | Remedy |
|---|---|---|
| Compressor fails to start. | 1. Wrong lead connections. | 1. Change leads. |
| | 2. Blown fuses in control box. | 2. Replace fuse. |
| | 3. Motor starter overload heaters tripped. | 3. Reset and investigate cause of overload. |
| | 4. Pressure in reservoir. | 4. Inspect blowdown valve and muffler. |
| | 5. Read error message on control panel. See Section 4. | 5. Replace switch. |
| | 6. Remote Contact is open (terminals 6 & 9). | 6. Replace switch or jumper. |
| Compressor starts but stops after a short time. | 1. High discharge temperature. | 1. See "High Discharge Air Temperature" in this section. |
| | 2. High discharge temperature switch malfunction. | 2. Replace switch. |
| | 3. Blown fuse in starter/ control box. | 3. Replace fuse (investigate if fuses continue to blow). |
| | 4. Motor starter overload heaters trip. | 4. Reset and investigate cause of overload. |
| Compressor does not unload (or load). | 1. Improperly adjusted control. | 1. Refer to Section 4 and adjust control. |
| | 2. Air leak in control lines. | 2. Determine source of leak and correct. |
| | 3. Restricted control line. | 3. Clean control lines. |
| | 4. Blowdown valve malfunction. | 4. Repair, clean or replace valve. |

| Symptom | Possible Cause | Remedy |
|---|---|---|
| Compressor cycles from load to unload excessively. | 1. Insufficient receiver capacity. | 1. Increase receiver size. |
| | 2. Restriction in control tubing. | 2. Inspect and clean control tubing. |
| Compressor is low on delivery and pressure. | 1. Restricted air filter. | 1. Clean or replace filter. |
| | 2. Sticking inlet valve. | 2. Inspect and clean inlet valve. |
| | 3. Unload pressure adjusted too low. | 3. Adjust unload pressure. pressure. See Section 4. |
| | 4. Minimum pressure valve stuck closed. | 4. Disassemble and clean valve. |
| High discharge air temperature. | 1. Thermostatic mixing valve stuck open. | 1. Repair or replace valve. |
| | 2. Dirty or clogged cooler face. | 2. Clean cooler. |
| | 3. Insufficient cooling air flow. | 3. Provide unrestricted supply of cooling air. |
| | 4. Clogged oil filter or cooler (interior). | 4. Replace filter or clean cooler. |
| | 5. Low Compressor oil. | 5. Add oil to proper level. |
| Excessive Oil Consumption | 1. Oil carryover through lines. | 1. See "Oil Carryover in this section. |
| | 2. Oil leaks at all fittings and gaskets. | 2. Tighten or replace fittings or gasket. |

| Symptom | Possible Cause | Remedy |
|---|---|---|
| Oil Carry-Over | 1. Overfilling the reservoir. | 1. Drain excess oil from system. |

**DANGER**

**Air/oil under pressure will cause severe personal injury or death. Shut down compressor and relieve system of all pressure before removing valves, caps, plugs, fittings, bolts, and filters.**

| | |
|---|---|
| 2. Clogged, broken or loose oil return lines | 2. Tighten or replace faulty lines. |
| 3. Ruptured oil separator element. | 3. Replace element. |
| 4. Loose assembly. | 4. Tighten all fittings and gaskets. |
| 5. Foam caused by use of incorrect oil. | 5. Use Gardner-Denver® AEON 4000 or 9000 Lubricating Coolant. |
| 6. Inoperative minimum pressure valve. | 6. Clean out or replace. |

**NOTICE**

**Gardner-Denver factory remanufactured replacement compressor air end units are available from your authorized distributor, on an exchange basis, for all rotary screw compressor units.**

Gardner Denver

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Telephone (217) 224-8800 • FAX 217-224-7814 • Telex 404332.

Specifications subject to change without notice.

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