Price $ 5.00

GARDNER-DENVER®

13-8-601
2nd Edition

ELECTRA-SCREW®
STATIONARY
BASE-MOUNTED
COMPRESSOR

MODELS
40 HP - EDEQH
50 HP - EDEQJ

Operating and Service Manual

COOPER INDUSTRIES

INDUSTRIAL MACHINERY

GARDNER-DENVER®

WARRANTY
ROTARY SCREW COMPRESSORS
EC ELECTRA-SAVER II®
EA ELECTRA-SAVER®
EB, ED ELECTRA-SCREW®
SE, ST PACKAGES

A warranty registration card is provided with each machine. The card must be completed by the purchaser and mailed (card is preaddressed and postage paid) within ten days after machine start up in order to validate this warranty.

Gardner-Denver/Industrial Machinery (the "Company") warrants to each original retail purchaser ("Purchaser") or its products from the Company or its authorized distributors that such products will be free from defects in material and workmanship caused by Company and shall be warranted as follows:

BASIC COMPRESSOR AIR ENDS

Basic compressor air ends, consisting of all parts within and including the compressor cylinder and gear housing, are warranted for 24 months from date of initial use or 27 months from date of shipment to the first purchaser, whichever occurs first.

The Company will furnish, at its option, air end repairs, a remanufactured replacement air end, or a new replacement air end, FOB factory for any air end which in its judgment proved not to be as warranted within the applicable period.

Purchaser must return, transportation charges prepaid, any air end claimed to be not as warranted to a Gardner-Denver factory. Any disassembly or partial disassembly of the air end, or failure to return the "unopened" air end per Company instructions, will be cause for denial of warranty.

ELECTRIC MOTORS

Electric motors, when specified and furnished by the Company, are warranted for 12 months from date of initial use or 15 months from date of shipment to the first purchaser, whichever occurs first.

The motor manufacturer or authorized service shop will provide at its option, motor repairs or replacement motor FOB manufacturer's location for any motor which in the manufacturer's judgment proves not to be as warranted within the applicable period.

ENGINES

Engines are warranted to the extent of the original manufacturer's warranty to the Company.

OTHER COMPONENTS

All other components are warranted for 12 months from date of initial use or 15 months from date of shipment to first purchaser, whichever occurs first.

The Company will furnish at its option FOB Company location repairs or replacement parts for any component which in the Company's judgment proved not to be as warranted within the applicable period.

GENERAL PROVISIONS AND LIMITATIONS

No warranty is made with respect to:

1. Any product which has been repaired or altered in such a way, in the Company's judement, as to affect the product adversely.

2. Any product which has, in the Company's judgment been subject to negligence, accident, improper storage, or improper installation or application.

3. Any product which has not been operated or maintained in accordance with normal practice and with the recommendations of the Company.

4. Components or accessories manufactured, warranted and serviced by others, except as separately rated.

5. Any reconditioned or prior owned product.

Claims for items descibed in (4) above should be submitted directly to the manufacturer.

The Company's obligation under this warranty is limited to repair or replacement, at its option during normal business hours at an authorized service facility of the Company, of any part which in its judgment proved not to be as warranted within the applicable Warranty Period. The Company may require the return of any part claimed not to be as warranted to one of its facilities as designated by Company, transportation prepaid by Purchaser, to establish a claim under this warranty.

The Company will provide labor for repair or replacement of any product or part thereof which in the Company's judgment is proved not to be as warranted, by Company representative up to the amount specified in the Company's labor rate schedules, or up to the amount the Company determines is reasonable. Labor costs in excess of the Company rate schedule amounts or labor provided by unauthorized service personnel is not provided for by this warranty.

Replacement parts provided under the terms of the warranty are warranted for the remainder of the Warranty Period of the product upon which installed to the same extent as if such parts were original components thereof.

DISCLAIMER

THE FOREGOING WARRANTY IS EXCLUSIVE AND IT IS EXPRESSLY AGREED THAT, EXCEPT AS TO TITLE, THE COMPANY MAKES NO OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY.

THE REMEDY PROVIDED UNDER THIS WARRANTY SHALL BE THE SOLE, EXCLUSIVE AND ONLY REMEDY AVAILABLE TO PURCHASER AND IN NO CASE SHALL THE COMPANY BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES. UNDER NO CIRCUMSTANCES SHALL THE COMPANY BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES, LOSSES OR DELAYS HOWSOEVER CAUSED.

No statement, representation, agreement, or understanding, oral or written, made by any agent, distributor, representative, or employee of the Company which is not contained in this Warranty will be binding upon the Company unless made in writing and executed by an officer of the Company.

This warranty shall not be effective as to any claim which is not presented within 30 days after the date upon which product is claimed not to have been as warranted. Any action for breach of this warranty must be commenced within one year after the date upon which the cause of action occurred.

Any adjustment made pursuant to this warranty shall not be construed as an admission by the Company that any product was not as warranted.

FOREWORD

Gardner-Denver® Electra-Screw® 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.

NOTE:
INFORMATION FURNISHED IN A NOTE WILL INCLUDE GENERAL INFORMATION OR THE HIGHLIGHTS OF A PROCEDURE.

This book covers the following models:

HP	PSIG	Air Cooled
40	100 125	EDEQH
50	100 125 150	EDEQJ

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SECTION 1
GENERAL INFORMATION

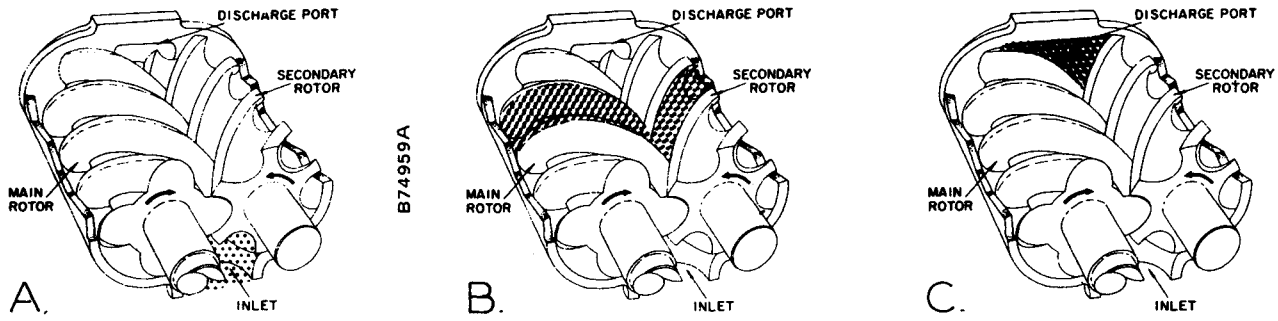

FIGURE 1-1. - COMPRESSION CYCLE

COMPRESSOR - The Gardner-Denver® "EDE" Electra-Screw® compressor is a single stage, positive displacement rotary machine using helical rotors to effect compression. 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 the 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 groove, normal volume is reduced and pressure increases. Oil is injected into the cylinder by proprietary means 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 the oil separator, the separated oil is returned to the system 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 discharges into the compressor main oil gallery. A portion of the oil is directed

through internal passages to the bearings 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.

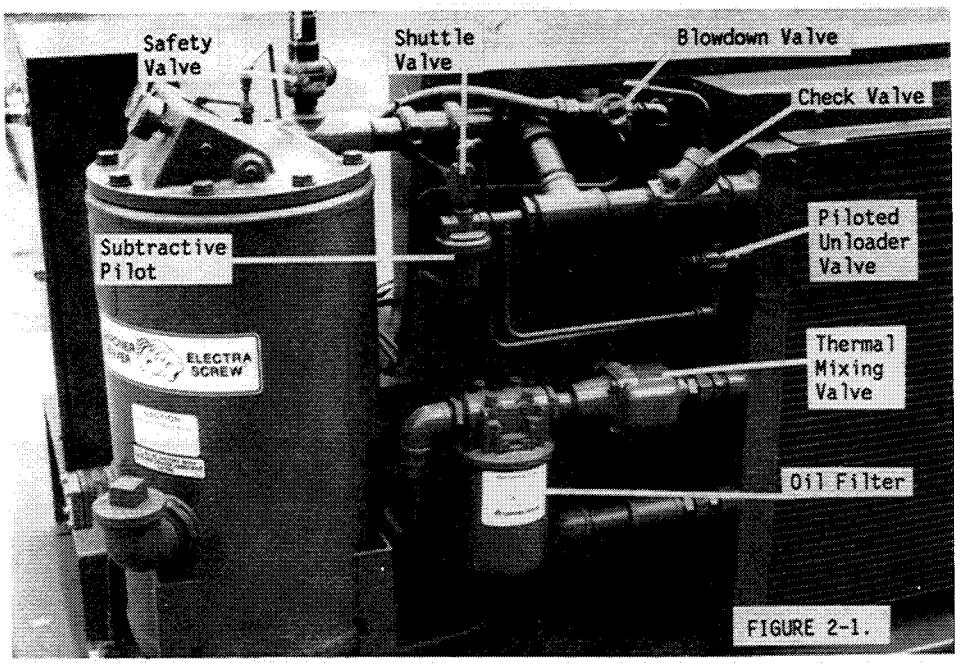

FIGURE 2-1.

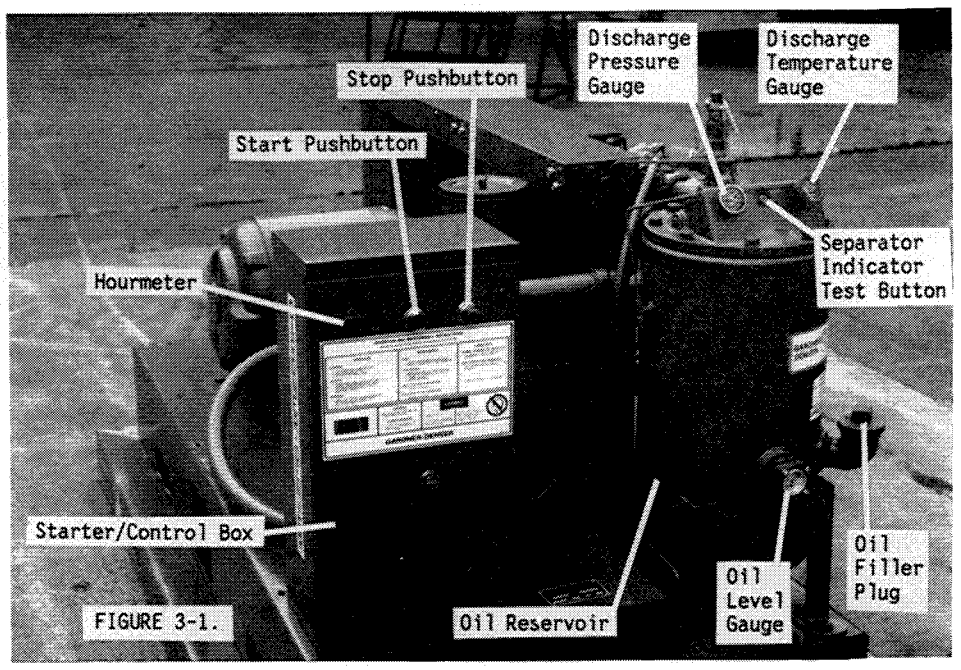

FIGURE 3-1.

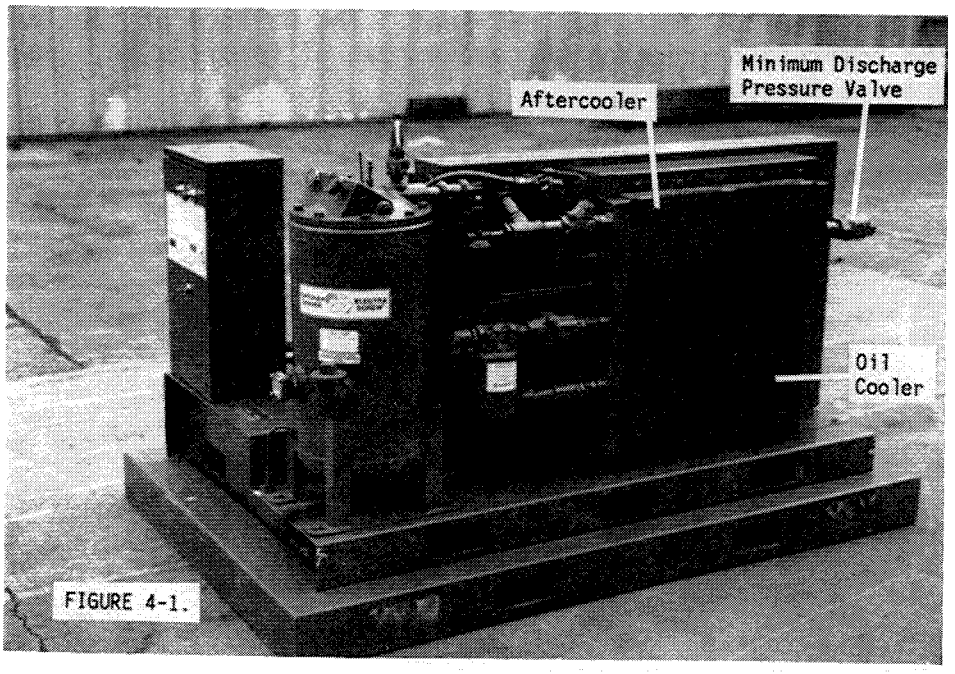

FIGURE 4-1.

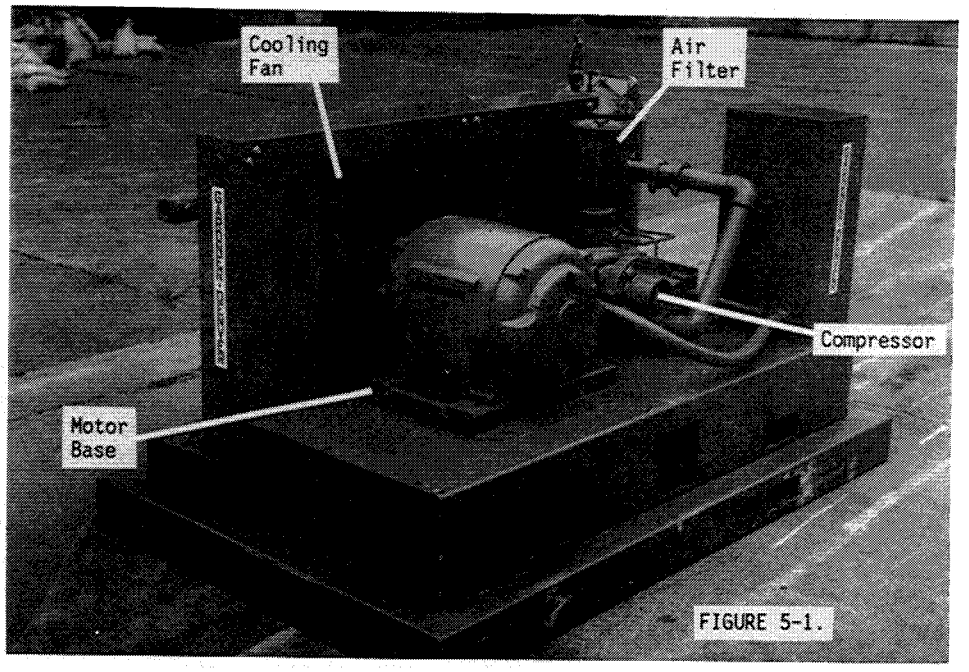

FIGURE 5-1.

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 BELTS, ETC.*
- *DO NOT USE THE AIR DISCHARGED 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.*
- *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 TIGHTEN. 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. A combination oil/aftercooler is supplied as standard equipment. Sufficient air flow, Figure 2-2, for the compressor oil/after cooling system and for electric motor cooling is required. Air is drawn into the unit at the motor end of the enclosure is exhausted at the oil cooler. Do not block the air flow to and from the unit. Allow two (2) feet to the nearest obstruction on the control box end of the unit. Allow two (2) feet to the nearest obstruction above enclosure.

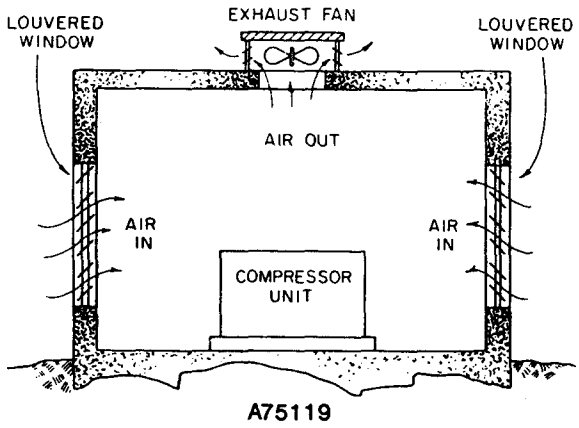

FIGURE 1-2. - TYPICAL COMPRESSOR ROOM

Minimum Air Flow For Compression And Cooling (Cubic Feet/Minute)
All Models (Air Cooled).....6000 cfm

FIGURE 2-2.

FOUNDATION - The 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 20° angle lengthwise or 20° 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 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 six (6) inches above the floor level. If this height is not sufficient to conveniently drain the oil some other methods of providing oil drain are:

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

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 - Service doors are provided for access to the motor and compressor. Be sure to allow enough space around the unit for the doors to open completely. Both of the two (2) doors may be removed by opening the door and lifting it up slightly to disengage the opposite end. The doors can then be removed.

⚠ DANGER

DO NOT OPERATE COMPRESSOR WITH FAN AND BELT GUARD REMOVED. EXPOSED FAN AND BELTS MAY CAUSE INJURY TO PERSONNEL.

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 (32° F, 0° C). 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.

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 -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 should 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. Use only Gardner-Denver® GD800 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° F)

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

1. It will probably 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. Avoid extended periods of unloaded operation in extreme environments.

3. Some means of providing heat to the oil reservoir and cooler 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 -10° F environment for the coolers, motor and sump.

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 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 - A moisture separator/trap should be included downstream of the aftercooler to drain condensate.

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 ten (10) feet 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 accordingly:

Length of Inlet Line	Diameter of Pipe Size
0 to 10 Feet	Same As Compressor Inlet Opening
10 to 17 Feet	One Size Larger Than Inlet Opening
17 to 38 Feet	Two Sizes Larger Than Inlet Opening

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 Electra-Screw® units on the same line, each unit

is isolated by the check valve in the unit discharge line. If an Electra-Screw 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 Electra-Screw® and a reciprocating compressor are manifolded together, an air receiver must be located between the two units.

DANGER

DO NOT USE THE AIR DISCHARGED FROM THIS UNIT FOR BREATHING - IT IS NOT SUITABLE FOR HUMAN CONSUMPTION. USE OF THIS AIR FOR BREATHING MAY RESULT IN PERSONAL INJURY OR DEATH.

ELECTRICAL WIRING - The Electra-Screw 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. See Section 4 for general wiring diagrams. These diagrams are general only - use the wiring diagrams supplied with the compressor for exact connections. The standard unit is supplied with an open drip-proof motor, a NEMA 3R starter and control enclosure. See "Location" paragraph for distance to nearest obstruction on starter/control box side of the unit.

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 the 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 expel the excess grease.
6. Stop the unit. Replace the relief plug.
7. Restart the unit.

GREASE RECOMMENDATIONS

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

REGREASING INTERVAL

Type of Service	Typical Example	Rating	Relubrication Interval
Standard	One or Two Shift Operation	150 HP & Below	18 Months
Severe	Continuous Operation	150 HP & Below	9 Months
Very Severe	Dirty Location, High Ambient Temperature	150 HP	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 range. Do not mix different type oils. Unit is shipped filled with Gardner-Denver® GD800 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 range. After start-up, the oil will fall into the green 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 operating pressure. See Figure 3-5 for oil system capacities.

   DANGER
   ALWAYS STOP THE UNIT AND RELEASE AIR PRESSURE BEFORE REMOVING OIL FILLER PLUG. FAILURE TO RELEASE 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. **Alignment** - Check all bolts and cap screws for tightness. Check drive sheaves for alignment; refer to Section 7, "Drive" for procedure.

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

5. **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.

6. **Rotation** - Check the motor rotation by momentarily jogging the motor. Compressor drive shaft rotation is clockwise standing facing the compressor sheave.

   WARNING
   DO NOT REPEATEDLY JOG THE MOTOR UNLESS ROTATION IS CORRECT. SEVERE COMPRESSOR DAMAGE CAN RESULT.

7. **System Pressure** - Set the inlet valve subtractive pilot and piloted unloader valve to the desired unload pressure and differential. DO NOT EXCEED MAXIMUM OPERATING PRESSURE ON COMPRESSOR NAMEPLATE. See Section 4, "Controls and Instruments", for procedure.

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

9. **Enclosure** - Check for damaged panels or doors. Check all screws and latches for tightness. Be sure doors are in place.

STARTING THE UNIT - OBSERVE UNIT COLD OR HOT STARTING PROCEDURES

Unit Cold - Close the air service valve between the main air system and the unit check valve. Start the unit by pushing the START button. Run for approximately one minute and then open the air service valve. Since the unit is equipped with a minimum (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). Start the unit by pushing the START button. Open the air service valve.

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

STOPPING THE UNIT - Close the air service valve, allow the unit to build up to full unload pressure and unload. Wait a short period to allow oil reservoir to blow down. Push the "STOP" button.

Stopping the unit at a pressure below full unload may cause oil carry-over. Also, the oil reservoir will continue to blow down after the motor stops.

Open the air service valve.

SECTION 4
CONTROLS & INSTRUMENTATION

GENERAL - The Gardner-Denver® "EDE" Electra-Screw® compressor is supplied with a factory mounted starter and complete controls as standard equipment. The standard control system consists of both a modulating system to control capacity when system demand is high, and a load/unload system with reservoir blowdown for maximum economy when demand is low.

SAFETY DEVICES - All compressors incorporate the following safety 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. When replacing or changing overloads, be sure to select them from a 3-overload heater table, since the use of a third overload for a given enclosure due to the extra heat. An overload from a 2-overload heater table would be undersize.

The overload heaters have a high-low adjustment of ±6% determined by the position of the heater in the overload relay. The high or low position is shown on the overload heater table inside the starter enclosure. Motor nameplate amperage is used to determine high-low position.

High Discharge Temperature Switch - The compressor is protected from high discharge temperature by two independent temperature switches. One switch is located in the compressor discharge housing to sense compressor discharge air-oil mixture temperature. The second probe is located on the reservoir cover and senses the temperature of the air at the oil separator.

These switches are factory set at 225° F. They may be checked by immersing the probe in an oil bath.

⚠ CAUTION

DO NOT CONTINUE TO RESET THE CIRCUIT IF THE SAME MALFUNCTION OCCURS WITHIN A SHORT PERIOD OF TIME. FIND AND CORRECT THE TROUBLE BEFORE RESUMING OPERATION.

Pressure Relief Valve - A pressure relief valve is installed in the final discharge manifold and set at the factory to approximately 120% of the specified operating pressure for protection against overpressure.

The pressure relief valve should be tested for proper operation at least once every year, but no more often than once every two months. To test the pressure relief valve, raise the system operating pressure to 75% of the pressure 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 A PRESSURE 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 A PRESSURE RELIEF VALVE TO PREVENT INJURY.

⚠ CAUTION

NEVER PAINT, LUBRICATE OR ALTER A PRESSURE RELIEF VALVE. DO NOT PLUG VENT OR RESTRICT DISCHARGE.

⚠WARNING

DO NOT OPERATE THE COMPRESSOR WITHOUT THE PROPER PRESSURE RELIEF VALVE. OVERPRESSURE OPERATION MAY CAUSE SEVERE DAMAGE TO EQUIPMENT.

Blowdown Valve (Figure 2-1) - 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:

Discharge Air Pressure Gauge (Figure 3-1) - This direct reading air pressure gauge indicates final discharge air pressure at the discharge manifold. Minimum air pressure is limited by the minimum discharge pressure valve to 65 psig. Maximum air pressure is controlled by the subtractive pilot.

Discharge Air Temperature Gauge (Figure 3-1) - This direct reading gauge indicates compressor discharge air temperature. Normal operating temperature is 170-200° F. Maximum discharge air temperature is limited to 225° F by the High Discharge Temperature Switch (see description under "Safety Devices" in this section).

Separator Indicator Pressure Button (Figure 3-1) - This button allows the discharge air pressure gauge to be used to measure separator differential. See Section 5, "Lubrication, Oil Cooler, Oil Filter and Separator" for instructions.

Oil Level Gauge (Figure 3-1) - This float type gauge indicates 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 this gauge.

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

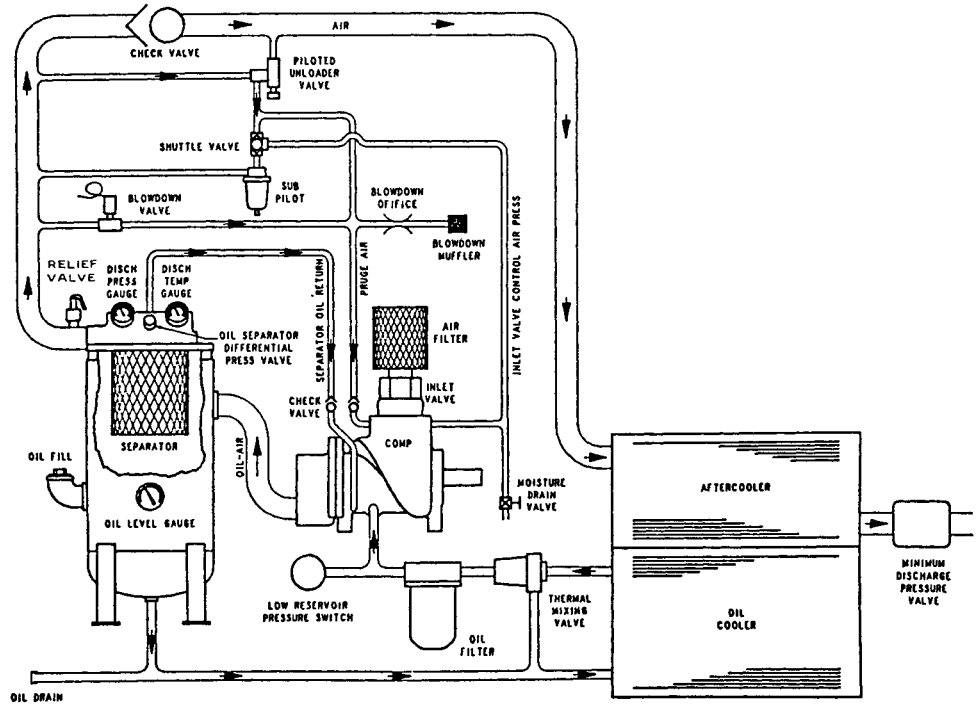

FIGURE 1-4. - CONTROL SCHEMATIC

Subtractive Pilot - 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 2-4, the downstream pressure equals the upstream pressure minus 95 psi. When the upstream pressure rises to 100 psig, the downstream pressure rises to 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 2-4 the downstream pressure is vented below 95 psig.

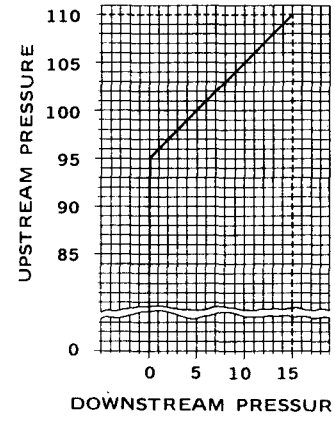

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FIGURE 2-4.

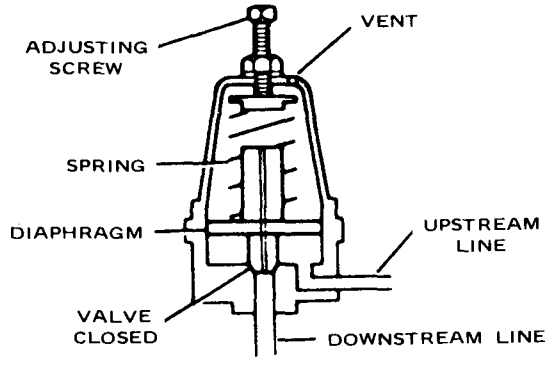

FIGURE 3-4. -
SUBTRACTIVE PILOT (Closed)

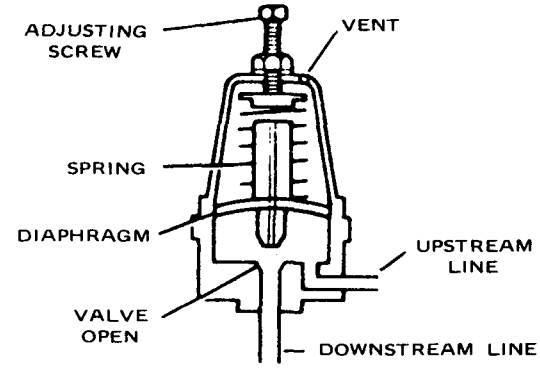

FIGURE 4-4. -
SUBTRACTIVE PILOT (Opened)

Figure 3-4 shows a schematic cross section of the subtractive pilot with the valve seat closed and the downstream line vented. Figure 4-4 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. The pilot can be adjusted from 65 to 150 psig.

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. Daily draining of the control air lines will minimize any problems. The subtractive pilot can be disassembled and the diaphragm and ports cleaned when necessary.

See "Control System Operation" in this section for a description of how the subtractive pilot responds during operation. See "Operating Air Pressure Adjustment" in this section for instructions on adjusting the subtractive pilot.

Piloted Unloader Valve (Figure 5-4) - The piloted unloader valve is a combination unloader pilot and pilot actuated two-way valve. When the pilot pressure at port 1 exceeds the upper set point, the unloader pilot opens, shifting the two-way valve to the open position. In this position, port 3 is open to port 2 and port 4 is open to port 1. As of this printing, port 4 must remain plugged.

When the pilot pressure at port 1 drops below the lower set point, the unloader pilot closes, shifting the two-way valve to the closed position.

Both load pressure and differential are adjustable. A lockout screw is provided to keep the valve in the closed position.

See "Control System Operation" in this section for a description of how the piloted unloader responds during operation. See "Operating Air Pressure Adjustment" in this section for instructions on adjusting the piloted unloader.

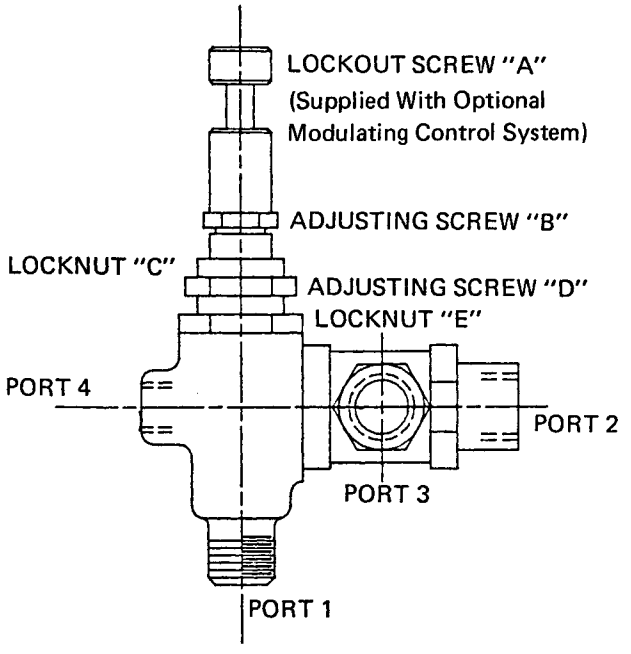

FIGURE 5-4.

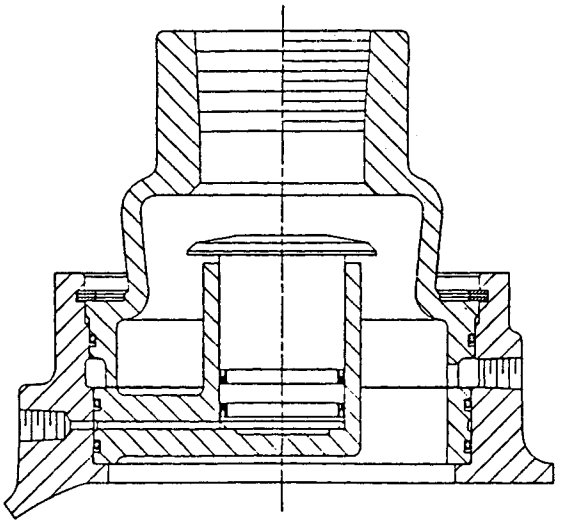

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FIGURE 6-4. - INLET VALVE

Inlet Valve (Figure 6-4) - 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 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. When the control pressure is less than 18 psig, the inlet valve will modulate to match compressor capacity to system demand.

Blowdown Valve (Figure 2-1) - The blowdown valve is a two-way solenoid valve that is piped into the oil reservoir discharge manifold ahead of the check valve. When the solenoid is de-energized, the blowdown valve opens, and the reservoir is blown down. When the solenoid is energized, the blowdown valve closes, and allows the reservoir to pressurize.

Reservoir Pressure Switch (Figure 1-4) - A pressure switch is connected to the discharge manifold and wired to the motor control circuit to prevent attempted starting of the unit when there is more than 6 psig pressure in the oil reservoir. This protects the unit from starting against load when the oil reservoir has not had enough time to blow down. Blowdown time is usually about one-half (1/2) to one (1) minute. This switch is set at the factory and is not intended to be adjusted in the field.

⚠WARNING

DO NOT RESET THE SWITCH HIGHER THAN 6 PSIG OR RENDER THE SWITCH INOPERATIVE; SEVERE DAMAGE TO MOTOR CAN OCCUR IF STARTED WITH PRESSURE IN OIL RESERVOIR.

⚠CAUTION

DO NOT CONTINUE TO RESTART THE UNIT IF THE SAME MALFUNCTION OCCURS WITHIN A SHORT PERIOD OF TIME. FIND AND CORRECT THE TROUBLE BEFORE RESUMING OPERATION.

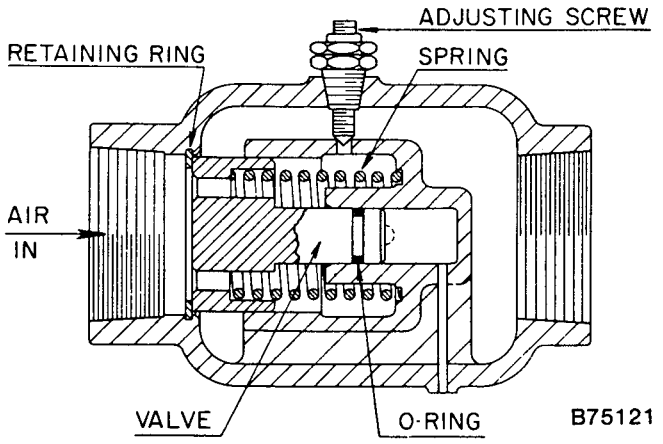


FIGURE 7-4. - MINIMUM DISCHARGE PRESSURE VALVE

Minimum Discharge Pressure Valve (Figure 2-1 and 7-4) - An internal spring-loaded minimum pressure valve is used in the final discharge line to provide a positive pressure on the oil system of compressor even when the air service valve is fully open.

A valve incorporates an orifice which, when air is flowing through it, maintains approximately 65 psig in the oil reservoir. A spring-loaded piston valve senses air pressure on the upstream (oil reservoir side) of the valve. When the system pressure rises above 65 psig, the spring is overridden and the valve opens to full porting.

The valve does not require maintenance or adjustment. If the valve fails to function, check the valve stem o-ring for sealing, valve orifices for restriction, or valve and valve seat for burrs and dirt.

The valve is adjustable within a small range. It is adjusted by a screw on the side of the valve body. The minimum pressure can be adjusted as follows:

1. Start the compressor.
2. Reduce pressure downstream of minimum pressure valve to below desired minimum pressure. DO NOT REDUCE UPSTREAM PRESSURE OR ADJUST VALVE BELOW 65 PSIG.
3. Loosen locknut on adjusting screw.
4. Turn set screws in to increase, or out to decrease minimum pressure to be held.
5. Hold set screw at desired point and tighten locknut.

Check Valve (Oil Reservoir) (Figure 2-1) - A renewable seat swing type check valve in the final discharge manifold 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.

Stop Switch - To stop the compressor press the stop pushbutton. See Section 3, "Starting and Operating Procedures", for complete operating instructions.

Start Switch (Figure 3-1) - This pushbutton switch is used to start the compressor. See Section 3, "Starting and Operating Procedures", for complete operating instructions.

For information concerning the components inside the starter/control box, refer to the wiring diagrams supplied with the compressor. Shown at the end of this section are general wiring diagrams. Use the wiring diagram supplied with the compressor for exact connections.

CONTROL SYSTEM OPERATION - The standard control system for the "EDE" compressor will automatically modulate the compressor when system demand is high, and unload the compressor and blow down the oil reservoir for maximum economy when demand is low.

As the demand for compressed air decreases, the system air pressure increases. When the air pressure exceeds the setting of the subtractive pilot, the pilot passes pressure to the inlet valve and the inlet valve closes enough to match air system demand, see Figure 1-4 and 3-4.

As long as the system demand remains between 20% and 100% of compressor capacity, the subtractive pilot will open and close the inlet valve to match air system demand.

A drop in system demand below 20% of compressor capacity will cause the air pressure to exceed the upper limit of the piloted unloader valve. When this pressure is exceeded the piloted unloader valve will open, see Figure 1-4 and 4-4.

When the piloted unloader valve opens, pressurized air is directed to three separate locations (Figure 1-4):

1. Pressurized air is directed via the shuttle valve to the inlet valve closing the inlet valve completely.

2. Pressurized air flows into the compressor inlet through the purge air line to prevent hydraulic knock that occurs in oil flooded rotary screw compressors when unloaded.

3. Pressurized air is exhausted to the atmosphere through the blowdown muffler to blow down the oil reservoir.

As the reservoir pressure drops, pressure to the inlet valve also drops; when discharge pressure drops to approximately 30 psig, the inlet valve will begin to open. As a result the discharge pressure will be maintained at approximately 30 psig to prevent oil foaming and carry-over problems which can occur when an oil reservoir is blown down completely.

The compressor will remain unloaded and blown down until air system demand increases. As air system demand increases, system pressure decreases. When air pressure downstream of the discharge check valve decreases to the low setting of the piloted unloader valve, the valve will close, allowing the compressor to load.

OPERATING AIR PRESSURE ADJUSTMENT - Start the compressor. Adjust the air service valve to bring the compressor to full load and proceed as follows:

Inlet Valve Subtractive Pilot Setting:

1. Turn the lockout screw "A" on the piloted unloader valve clockwise to deactivate the piloted unloader valve.

2. Close the air service valve and allow the compressor to build to full pressure and unload. Full unload pressure should be 10 psi above desired operating pressure but must not exceed 10 psi above compressor rating.

3. Pressure Too High:

   a. Loosen the inlet valve subtractive pilot locknut. Back the adjusting screw out about one turn.

   b. Open the air service line valve and bleed air from the unit so that the compressor loads again. Close the valve and allow the compressor to unload.

   c. Repeat steps a and b until the proper pressure is obtained. Tighten the locknut.

4. Pressure Too Low:

   a. Loosen the inlet vale subtractive pilot locknut.

   b. Turn the adjusting screw in until the proper pressure is obtained.

   c. Tighten the locknut.

5. Turn the locknut screw "A" on the piloted unloader valve counterclockwise to reactivate the piloted unloader valve.

Piloted Unloader Valve Setting (Figure 5-4):

1. Adjust subtractive pilot setting if necessary.

2. For best results adjust lower set point (load pressure) first. To adjust load pressure:

   a. Confirm piloted unloader valve is activated by turning locknut screw "A" counterclockwise.

   b. Close air service valve and allow compressor to build to full pressure and unload.

   c. Open air service valve slowly and note system pressure (between compressor and air service valve) at which compressor loads. Load pressure should be the same as the desired operating pressure.

   d. Loosen locknut "C". Turn adjusting screw "B" clockwise to increase or counterclockwise to decrease load pressure.

e. Repeat steps b-d until desired load pressure is obtained. Tighten locknut "C".

3. To adjust differential (unload pressure):

   a. Close air service valve and note pressure at which compressor unloads. Unload pressure should be 7-8 psi above desired operating pressure but must not exceed 8 psi above compressor rating.

   b. Loosen locknut "E". Turn adjusting screw "D" very slightly clockwise to increase or counterclockwise to decrease unload pressure.

   c. Open air service valve to load compressor.

   d. Repeat steps a-c until desired unload pressure is obtained. Tighten locknut "E".

   NOTE:
   IF DIFFERENTIAL IS BADLY OUT OF ADJUSTMENT, IT CAN BE PRESET BY TURNING ADJUSTING SCREW "D" CLOCKWISE UNTIL IT LIGHTLY BOTTOMS OUT AND THEN TURNING IT COUNTERCLOCKWISE 1/3 TURN.

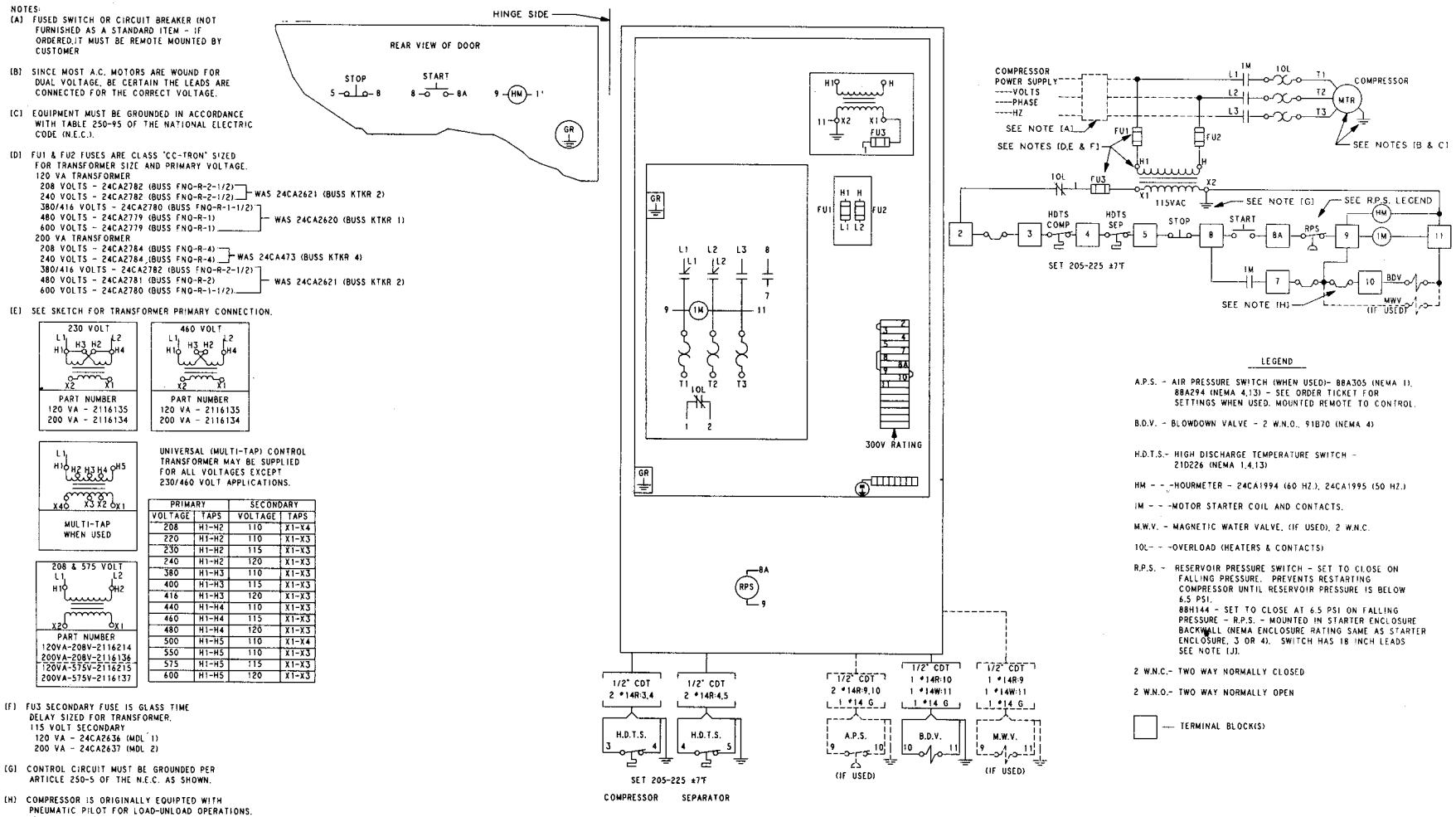


FIGURE 8-4. - WIRING DIAGRAM - CONSTANT SPEED

SECTION 5
LUBRICATION
OIL COOLER, OIL FILTER & SEPARATOR

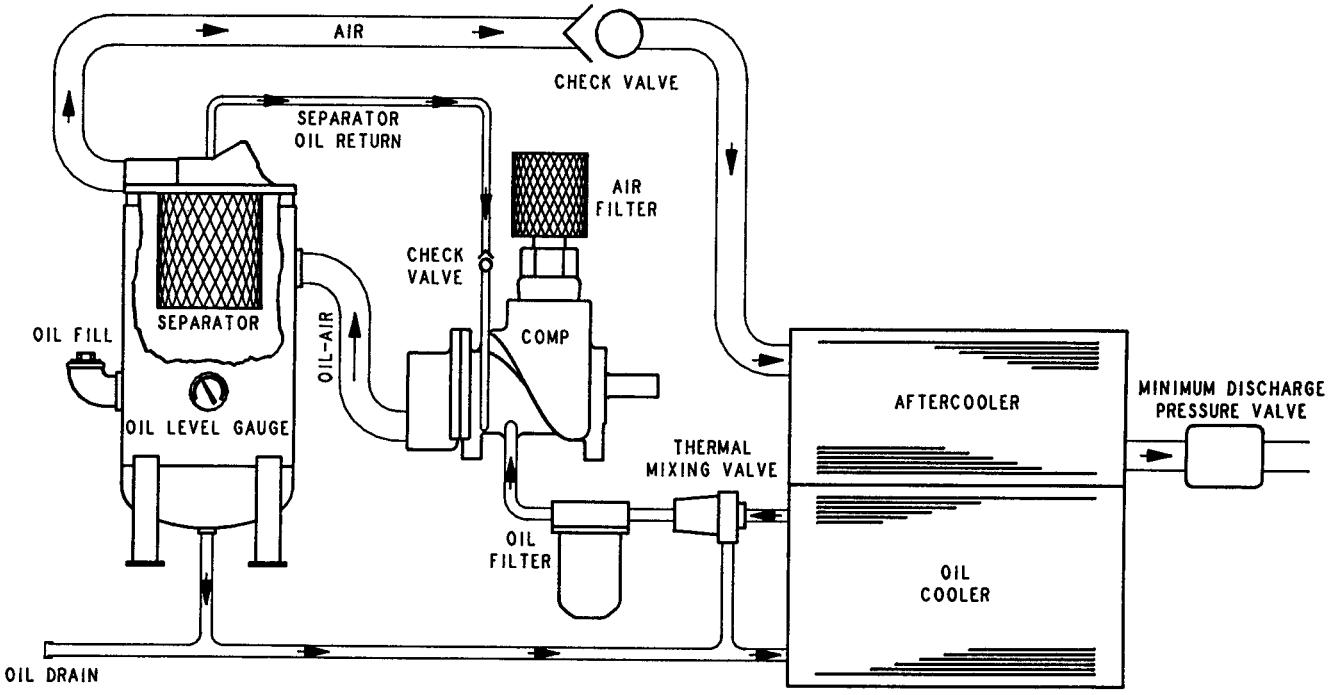


FIGURE 1-5. - FLOW DIAGRAM - AIR-OIL SYSTEMS

COMPRESSOR OIL SYSTEM (Figure 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 separators 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.

OIL SPECIFICATION - The recommended compressor lubricant is Gardner-Denver® GD800 Lubricating Coolant which can be used for year-round operation except as noted in the "High Temperature Operation" paragraph below. GD800 Lubricating Coolant is a superior petroleum base lubricant formulated and containing additives for use in Electra-Screw® compressors.

CAUTION

MIXING OF DIFFERENT TYPES OR THE USE OF INFERIOR LUBRICANTS WILL RESULT IN THE FORMATION OF HEAVY VARNISH AND SLUDGE THROUGHOUT THE SYSTEM.

SYNTHETIC LUBRICANTS - Certain synthetic lubricants, such as synthetic hydrocarbons, diesters or polyesters offer an extended drain interval when used in screw compressors. A superior diester lubricant is available in Gardner-Denver® GD8000 Lubricating Coolant which can extend lubricant change interval from 2 to 4 times that of GD800. A good lubricant analysis program for periodic check of lubricant quality and remaining life can maximize the change interval.

See the instructions on use of GD8000 in systems previously filled with other lubricants under "High Temperature Operation" below.

Recommended Oil	Temperature Range
Gardner-Denver GD800 Lubricating Coolant.....	Year-round Operation At Discharge Temperatures to 200° F
Gardner-Denver GD8000 Lubricating Coolant...	Over Four (4) Hours Sustained Discharge Temperature Between 200-210° F

FIGURE 2-5. - COMPRESSOR LUBRICANT

⚠ WARNING

DO NOT MIX GD800 AND GD8000 LUBRICATING COOLANTS OR OTHER PETROLEUM OR SYNTHETIC LUBRICANTS. MIXING OF LUBRICANTS MAY RESULT IN FORMATION OF VARNISH OR SLUDGE.

⚠ CAUTION

REGARDLESS OF SYNTHETIC LUBRICANT CHANGE INTERVAL USED, OIL FILTER AND OIL SEPARATOR CHANGE INTERVALS REMAIN THE SAME AS FOR GD800 - SEE MAINTENANCE SCHEDULE, SECTION 8.

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 temperatures, use Gardner-Denver GD8000 Lubricating Coolant which is a superior viscosity grade diester synthetic 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 GD800.

When installing GD8000, the original lubricant should be drained completely and the system flushed before filling with GD8000. Complete draining will involve removal of all plugs in the compressor, oil reservoir and oil lines. In some cases, it may be necessary to remove piping to insure complete draining. To insure complete removal of the original lubricant, good practice indicates draining of the original lubricant, refill with GD8000, operation for 100 hours, then draining and final refill.

⚠ WARNING

DO NOT MIX GD800 AND GD8000 LUBRICATING COOLANTS OR OTHER PETROLEUM OR SYNTHETIC LUBRICANTS. MIXING OF LUBRICANTS MAY RESULT IN FORMATION OF VARNISH OR SLUDGE.

⚠ DANGER

DO NOT REMOVE OR DISABLE THE HIGH DISCHARGE AIR TEMPERATURE SWITCH TO COMPENSATE FOR HIGH TEMPERATURE OPERATION. DAMAGE TO EQUIPMENT OR PERSONAL INJURY MAY RESULT.

Use caution when selecting GD8000 lubricant as some downstream air system components such as air line lubricator bowls, gaskets and valve trim may not be compatible. Check with the component supplier for suitability of the part with diester synthetic lubricant. All materials used in Electra-Screw compressor units are compatible with GD8000.

COLD AMBIENT OPERATION - Gardner-Denver® GD800 Lubricating Coolant must be used when the ambient temperature drops to +40° F in the space enclosing the compressor unit. See "Installation for Cold Weather Operation", Section 2.

If a synthetic lubricant is used, a lighter viscosity lubricant than Gardner-Denver GD8000 is necessary in the temperature range of +10° F to -40°F. The lighter viscosity lubricant must have foam depressant, oxidation and corrosion inhibiting characteristics equal to those of GD800 and meet these minimum specifications:

Viscosity at 100° F	140 SUS
Viscosity at 210° F	44 SUS
Pour Point	-60° F

Reservoir Capacity to Top of Green Range	6 U.S. Gallons
System Capacity Reservoir Plus Oil Cooler and Piping	8.5 U.S. Gallons
Green Range Capacity	1 U.S. Gallon

FIGURE 3-5. - OIL SYSTEM CAPACITIES

ADDITION OF OIL BETWEEN CHANGES must be made when level of oil read on the gauge is below the green range as read while the unit is operating. Stop unit and be sure 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 top of the green range as read when the unit is operating. The quantity required to raise the oil level from the bottom to the top of green range is shown in Figure 3-5. Repeated addition of oil between oil changes may indicate excessive oil carry-over and should be investigated.

DANGER

STOP UNIT AND BE SURE NO AIR PRESSURE IS IN THE OIL RESERVOIR. FAILURE TO RELEASE PRESSURE MAY RESULT IN PERSONAL INJURY OR DEATH.

OIL LEVEL GAUGE (Figure 1-5) indicates the amount of oil in the oil reservoir. When the unit is operating the oil level should indicate in the green range. In operation the oil level will fluctuate slightly as the compressor loads and unloads. Add oil only when the oil level gauge indicates in the red range when the compressor is loaded. Drain excess oil (as read in the yellow range when the compressor is loaded); see draining oil system above. Note that the top of the green range on oil level gauge is approximately centerline of filler elbow to prevent overfilling.

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, or malfunctions of the thermal valve 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 is determined by air filter maintenance, operating conditions and quality of oil. Good practice is to change oil often enough that the drained oil is relatively clean. Under good conditions Gardner-Denver® GD800 may be used up to 2000 hours of operation.

When operating conditions are severe (very dusty, high humidity or high temperature) it will be necessary to change the oil more frequently. Operating conditions and appearance of 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.

DRAINING AND CLEANING THE OIL SYSTEM -

DANGER

STOP UNIT AND BE SURE NO AIR PRESSURE IS IN THE OIL RESERVOIR. FAILURE TO RELEASE PRESSURE MAY RESULT IN PERSONAL INJURY OR DEATH.

Always drain the complete system. Draining when the oil is hot will help to prevent varnish deposits and to 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

STOP THE UNIT AND BE SURE NO AIR PRESSURE IS IN THE OIL RESERVOIR. FAILURE TO RELEASE PRESSURE MAY RESULT IN PERSONAL INJURY OR DEATH.

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. This amount may bring the oil level into the yellow range on the gauge. After a short time of operation, the oil level will drop into the green range as oil fills other parts of the system. Maintain the oil level in the green range. On unloaded operation and after shutdown some oil will drain back into the oil reservoir and the oil level gauge may read in yellow range. 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 carry-over will result. Use only CLEAN containers and funnels so no dirt enters the reservoir. Provide for clean storage of oils. Changing of oil will be of little benefit if done in a slipshod manner.

COMPRESSOR OIL FILTER (Figure 2-1) - 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 15 psi relief valve that opens in the event the element becomes dirty enough to block the flow of oil.

CAUTION
ELEMENT MUST BE REPLACED EVERY 1000 HOURS.

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

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 - The oil 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 two (2) feet clearance around the cooler. Keep both faces of the cooler core clean for efficient cooling of the compressor oil.

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.

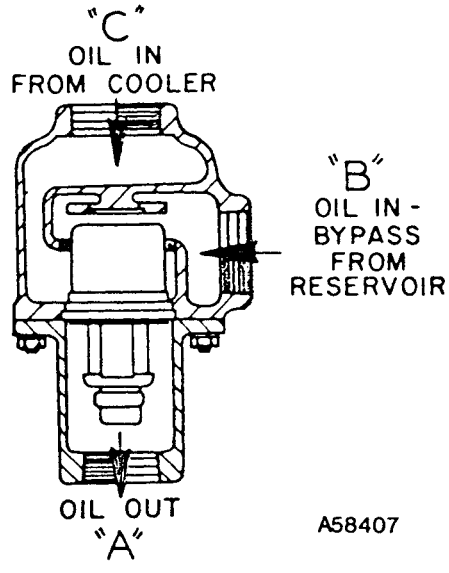


FIGURE 4-5. -
THERMOSTATIC MIXING VALVE

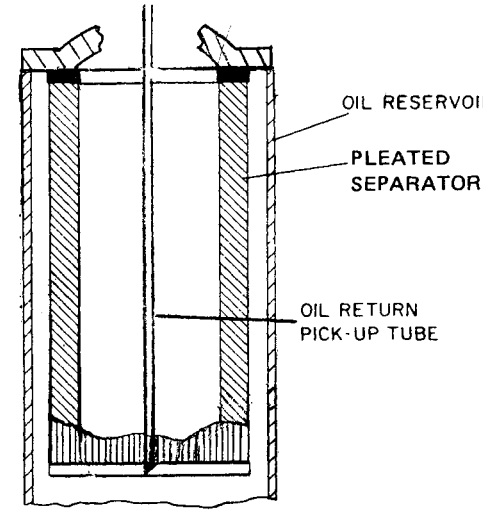


FIGURE 5-5. - OIL SEPARATOR

THERMAL CONTROL (THERMOSTATIC MIXING) VALVE (Figure 4-5) is installed in system as shown in Figure 1-5. This valve is used to control temperature of the oil in air-cooled radiator 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 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 150° F.

OIL RESERVOIR - The oil reservoir-separator combines two (2) functions into one vessel. The lower half is the oil reservoir, providing oil storage capacity for the system. The upper half contains the final oil separator with the discharge manifold service line mounted on the upper flange. The reservoir also provides limited air storage for control and gauge actuation.

COMPRESSOR 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 5-5).

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

Oil carry-over through the service lines may be caused by a faulty oil separator, faulty minimum pressure valve, overfilling of the oil reservoir, oil that foams, or oil return line malfunction. If oil carry-over occurs, inspect the separator only after it is determined that the oil level is not too high, the oil is not foaming excessively, the oil return line from the discharge manifold to the compressor cylinder is not clogged or pinched off, and the return tube inside the separator is not loose or broken and is inserted to within 1/4"-1/2" of the separator bottom.

Oil carry-over malfunctions of the oil separator are usually due to using elements too long, heavy dirt or varnish deposit 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 carry-over.

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 (Figure 3-1) - The discharge air pressure gauge located on the instrument panel is also used to determine the pressure differential across the oil separator during all conditions of operation. To check pressure differential across the oil separator, be sure the unit is loaded at operating pressure. Differential cannot be measured if unit is unloaded.

1. Note discharge air pressure gauge reading.

2. Press and hold "Push to Test" pushbutton and note new air pressure reading.

3. Subtract reading 1 from reading 2 for differential pressure.

The separator should be changed when the pressure differential reading reaches 10 psi with the unit on load at 100 psig air discharge pressure.

NOTE:
PRESSURE DIFFERENTIAL ON NEW ELEMENTS IS APPROXIMATELY 1-2 PSI. AS THE SEPARATOR RETAINS DIRT, DIFFERENTIAL WILL RISE. A SUDDEN DROP TO ZERO DIFFERENTIAL OR A SUDDEN HEAVY OIL CARRY-OVER MAY INDICATE A RUPTURED SEPARATOR.

CAUTION
USING AN OIL SEPARATOR AT DIFFERENTIAL PRESSURE EXCEEDING 10 PSI RISKS INCREASING OIL CARRY-OVER AND COLLAPSE OF THE SEPARATOR. NEVER USE AN OIL SEPARATOR AT A PRESSURE DIFFERENTIAL OVER 15 PSI.

Inspection - After removal of the separator use a drop 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
STOP UNIT AND BE SURE NO AIR PRESSURE IS IN THE OIL RESERVOIR. FAILURE TO RELEASE PRESSURE MAY RESULT IN PERSONAL INJURY OR DEATH.

1. Disconnect oil return to 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 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 1/4″-1/2″ from bottom of separator.
12. Reconnect compressor oil return tube to tube elbow.

COMPRESSOR OIL SYSTEM CHECK - The following readings are based on ambient temperature of 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 - 170° to 200° F - Read at thermometer on the instrument panel or check with a thermometer at the discharge housing.

Compressor Oil Inlet Temperature - 150° to 160° F - Check with thermometer at tee out of oil filter.

Oil Inlet Pressure - Check at the fitting in the line near the compressor oil inlet. With air receiver pressure at 100 psi, oil inlet pressure should be 65-75 psig.

SECTION 6
AIR FILTERS

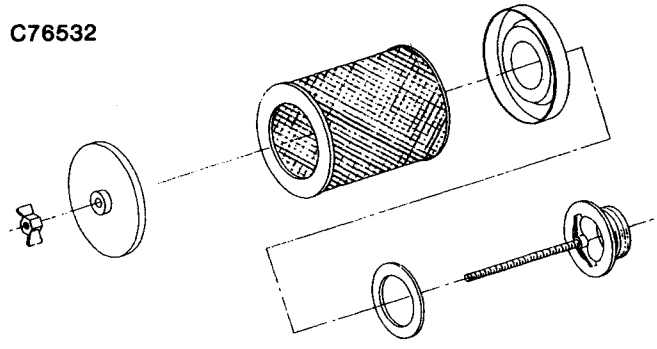


FIGURE 1-6. - DRY TYPE AIR FILTER

AIR FILTER (Figure 1-6) furnished as standard equipment is a washable element dry type 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. When the outside surface of the element appears to be evenly coated with dirt, it should be cleaned as follows:

1. Remove the wing bolt, lift off the filter element.

2. Vibrate or blow heavy dirt accumulations from the element. Direct air blast at slight inward angle and parallel to the element pleats; do not point directly at the element.

3. If required, wash element with a nonsudsing household detergent and water; rinse with clear water. Allow to dry before reinstalling.

⚠ 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.

Replace the filter element with genuine replacement parts whenever needed. Good judgment should be used in establishing the replacement interval. Do not attempt to overextend the element life; the small savings involved do not justify the risk.

⚠ 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.

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

SECTION 7
DRIVE

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. Best tension is just enough tension to keep belts from "squealing" on start-up.

⚠WARNING
DO NOT OVERTENSION AS PERMANENT DAMAGE TO COMPRESSOR AND MOTOR BEARINGS AND SHAFTS CAN RESULT.

Belts can be changed when necessary by removing belt guard and fan orifice mounting screws. Use adjusting screws in motor base to loosen belt tension. Move fan orifice toward motor and remove belts over fan.

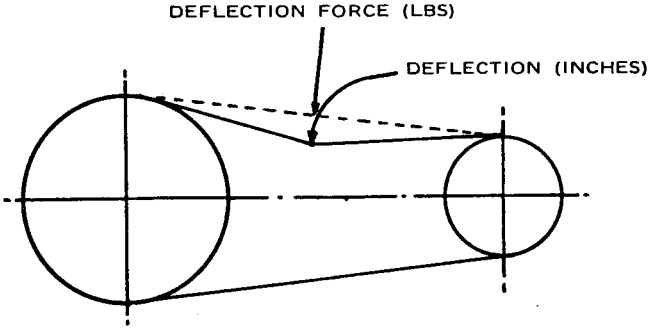
To install new belts, reverse this procedure - DO NOT OVERTIGHTEN (see note below). New belts will stretch after several hours operation and should be checked.

Be certain to tighten belts before mounting fan orifice. Adjust fan orifice for even clearance around fan after belts are tensioned.

⚠WARNING
CONFIRM FAN ORIFICE HAS EVEN CLEARANCE AROUND FAN BEFORE STARTING UNIT.

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

NOTE:
WHEN A NEW SET OF BELTS IS INSTALLED ON A DRIVE, THE INITIAL DEFLECTION FORCE SHOULD BE 1/3 GREATER THAN SHOWN IN TABLE. RECHECK TENSION FREQUENTLY DURING THE FIRST 24 HOURS OF OPERATION. ALWAYS BE SURE TO LOOSEN FAN ORIFICE BEFORE ADJUSTING BELT TENSION, THEN READJUST AND TIGHTEN FAN ORIFICE AFTER ADJUSTING BELT TENSION.



BELT TENSION 5VX BELTS

Motor H.P.	No. Of Belts	Deflection Force Pounds	Deflection In Inches
40	4	6.0- 8.5	3/8
50	4	7.0-10.0	3/8

SECTION 8
MAINTENANCE SCHEDULE

SERVICE CHECK LIST -

Air Filter - Operating conditions determine frequency of service, refer to Section 6, "Air Filters", and plan maintenance accordingly.

Oil Separator - The unit is equipped with pressure differential gauging. Change the oil separator element when the pressure differential reaches 10 psi.

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

Motor Lubrication - Refer to Section 2.

Every 8 Hours Operation

1. Check the reservoir oil level - add oil if required. See Section 5.

2. Observe if the unit loads and unloads properly.

3. Drain the moisture trap in the control system. See Section 4.

Every 125 Hours Operation

1. Check for dirt accumulation on oil cooler and aftercooler core faces and the cooling fan. If cleaning is required, clean the exterior fin surfaces of the cores by blowing compressed air 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", Section 5). Flush system if required.

Every 4000 Hours Operation

1. Check the oil separator element.

Every Year

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

SECTION 9
TROUBLESHOOTING

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. Malfunctioning low reservoir pressure switch.	5. Replace switch.
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 subtractive pilot or piloted unloader valve.	1. Refer to Section 4 and adjust valve.
	2. Air leak in control lines.	2. Determine source of leak and correct.
	3. Restricted control line.	3. Clean control lines - regularly drain moisture.
	4. Subtractive pilot or piloted unloader 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.
	3. Piloted unloader valve differential setting too low.	3. Adjust valve. See Section 4.
	4. Subtractive pilot setting too high.	4. Adjust valve. See Section 4.
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. Subtractive pilot or piloted unloader valve adjusted too low.	3. Adjust valve. 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.

SECTION 10
REBUILDING DATA

SSEBB REBUILDING DATA

CYLINDER

DIAMETERS

MAIN ROTOR BORE	4.741/4.744
MAIN ROTOR AIR SEAL DIA	2.599/2.604
MAIN ROTOR BEARING DIA	4.3307/4.3321
SECONDARY ROTOR BORE	4.741/4.744
SECONDARY ROTOR AIR SEAL DIA	1.850/1.845
SECONDARY ROTOR BEARING DIA	2.4409/2.4421

LENGTHS

CENTER DISTANCE BETWEEN MAIN AND SECONDARY BORES	3.671/3.669
DEPTH OF MAIN AND SECONDARY ROTOR BORES	8.303/8.313
MAIN AND SECONDARY BEARING SHOULDERS TO INLET FACE OF CYLINDER	2.831/2.835

DISCHARGE BEARING HOUSING

DIAMETERS

MAIN ROTOR AIR SEAL DIA	2.130/2.131
MAIN ROTOR BEARING DIA	4.123/4.124
SECONDARY ROTOR AIR SEAL DIA	2.130/2.131
SECONDARY ROTOR BEARING DIA	2.5645/2.5655

LENGTHS

CENTER DISTANCE BETWEEN MAIN AND SECONDARY BORES	3.671/3.669
MAIN AND SECONDARY BEARING SHOULDERS TO CYLINDER SIDE FACE OF BEARING HOUSING	1.000/.995

SSEBB REBUILDING DATA

MAIN ROTOR

DIAMETERS

BODY	4.736/4.735
INLET AIR SEAL DIA	2.590/2.589
INLET BEARING DIA	1.9695/1.9689
DISCHARGE AIR SEAL & BEARING DIA	2.1265/2.1260
COUPLING DIA	1.750/1.749

LENGTHS

BODY	8.291/8.289
INLET BEARING SHOULDER TO INLET FACE OF ROTOR BODY	.776/.774
DISCHARGE END OF SHAFT TO DISCHARGE FACE OF ROTOR BODY	2.175/2.170

SECONDARY ROTOR

DIAMETERS

BODY O.D.	4.736/4.735
INLET AIR SEAL DIA	1.836/1.835
DISCHARGE AIR SEAL DIA	2.1265/2.1260
INLET BEARING DIA	1.1818/1.1814
DISCHARGE BEARING DIA	1.3765/1.3760

LENGTHS

BODY	8.291/8.289
INLET BEARING SHOULDER TO INLET FACE OF ROTOR BODY	.776/.774
DISCHARGE BEARING SHOULDER TO DISCHARGE FACE OF ROTOR BODY	.973/.963

SSEBB REBUILDING DATA

BEARING FITS

MAIN ROTOR INLET

INNER RACE TO SHAFT	.004T/.0015T
OUTER RACE TO HOUSING	.000/.002L

MAIN ROTOR DISCHARGE

INNER RACE TO SHAFT	.0005T/.0015T
OUTER RACE TO HOUSING	.001T/.003T

SECONDARY ROTOR INLET

INNER RACE TO SHAFT	.003T/.0011T
OUTER RACE TO HOUSING	.000/.0017L

SECONDARY ROTOR DISCHARGE

INNER RACE TO SHAFT	.0005T/.0015T
OUTER RACE TO HOUSING	.001L/.003L

.UNNING CLEARANCE

DIAMETRAL

MAIN ROTOR BODY TO CYLINDER	.005/.009
MAIN ROTOR INLET AIR SEAL	.009/.015
MAIN ROTOR DISCHARGE AIR SEAL	.0035/.005
SECONDARY ROTOR BODY TO CYLINDER	.005/.009
SECONDARY ROTOR INLET AIR SEAL	.009/.015
SECONDARY ROTOR DISCHARGE AIR SEAL	.0035/.005

AXIAL

ROTOR BODY TO INLET END PLATE	.009/.022
ROTOR BODY TO DISCHARGE END PLATE	.002/.003

6C-4-89

INDUSTRIAL MACHINERY

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