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Instruction & Service Manual

**MODEL "ET"
TWO STAGE
ELECTRA-SCREW®
COMPRESSORS**

13-9-605



GARDNER-DENVER COMPANY

QUINCY, ILLINOIS

WARRANTY

Subject to the terms and conditions hereinafter set forth, Gardner-Denver Company (the Company) warrants products and parts sold by it, insofar as they are of its own manufacture, against defects of material and workmanship, under use and service in accordance with Company's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period of three months from the date of initial use, provided that such three month period shall in no case extend beyond one year from the date of shipment by Company. THIS WARRANTY IS LIMITED TO THE REPAIR OR REPLACEMENT, AS COMPANY MAY ELECT, OF ANY DEFECTIVE PARTS, REGARDING WHICH, UPON DISCOVERY OF THE DEFECTS, THE PURCHASER HAS GIVEN IMMEDIATE WRITTEN NOTICE. Installation and transportation costs are not included. Company shall have the option of requiring the return to it of the defective material, transportation prepaid, for inspection. Because of varying conditions of installation and operation, all guarantees of performance are subject to variation of 3%. COMPANY DOES NOT WARRANT THE MERCHANTABILITY OF ITS PRODUCTS AND DOES NOT MAKE ANY WARRANTY, EXPRESS OR IMPLIED, OTHER THAN THE WARRANTY CONTAINED HEREIN. Company has not authorized anybody to make any representation or warranty other than the warranty contained herein.

FOREWORD

Gardner-Denver two-stage ELECTRA-SCREW[®] compressors are a result of advanced engineering and skilled manufacturing. Thousands of satisfying, economical working hours are built into each machine.

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 and maintenance. Careful adherence to these instructions will result in assured economy.

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GENERAL INFORMATION

COMPRESSOR — The Gardner-Denver Model "ET" ELECTRA-SCREW[®] compressor is a two-stage positive displacement rotary machine using helical meshing rotors in two stages to effect compression. Refer to Figure 1. Both rotors are supported between antifriction bearings located outside the cylinder. Single width cylindrical roller bearings are used at the low pressure inlet end of rotors. Two single-row angular contact ball bearings at the high pressure end locate each rotor axially and carry all thrust loads.

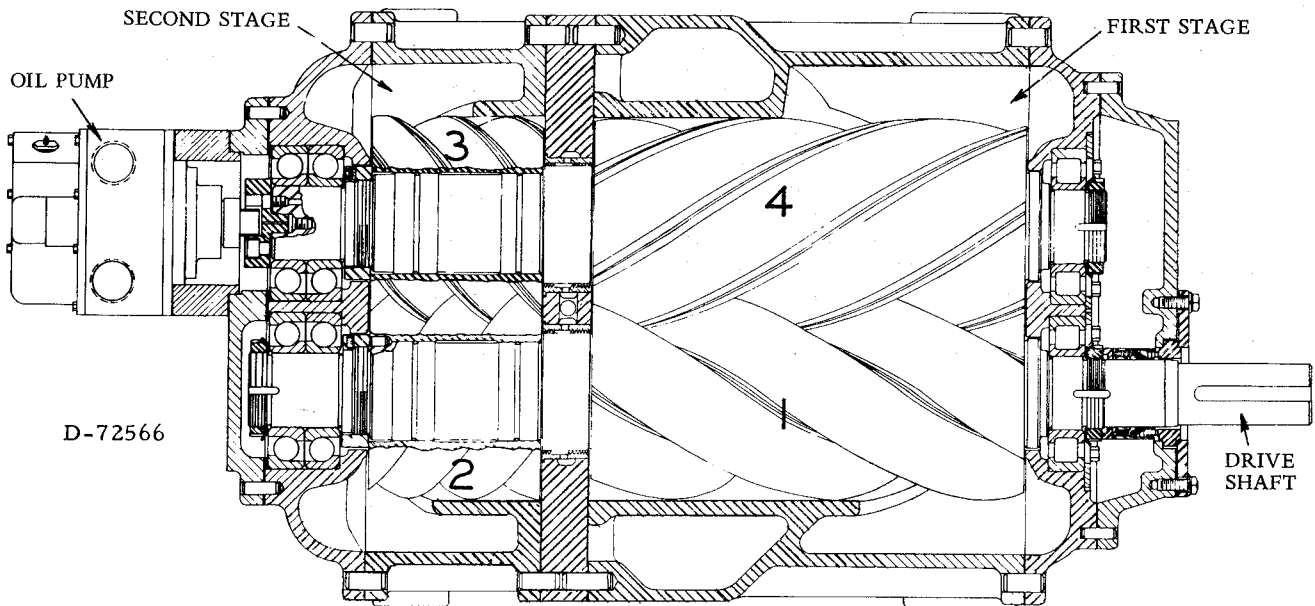


FIGURE 1. — SECTIONAL VIEW OF COMPRESSOR

COMPRESSION PRINCIPLE (Figures 1, 2 & 3) — Compression is accomplished by main and secondary rotors meshing enclosed by the cylinder walls and end plates. The main (driven) rotor has four helical lobes 90° apart. The secondary (idler) rotor has six matching helical grooves 60° apart to allow meshing with main lobes. Air is drawn into the first stage, compressed to approximately 25 PSIG, and travels internally to the second stage where the compression cycle is completed. The first stage rotors and shaft extensions are cast integral; the second stage rotors are a press fit to the shaft extension.

Power from the driver is transmitted through the drive shaft and the first stage main rotor (1) (Figure 1) to the second stage main rotor (2). The second stage main rotor (2) drives both the second stage secondary rotor (3) and the first stage secondary rotor (4). A cushion of air and oil is maintained between rotors at all times.

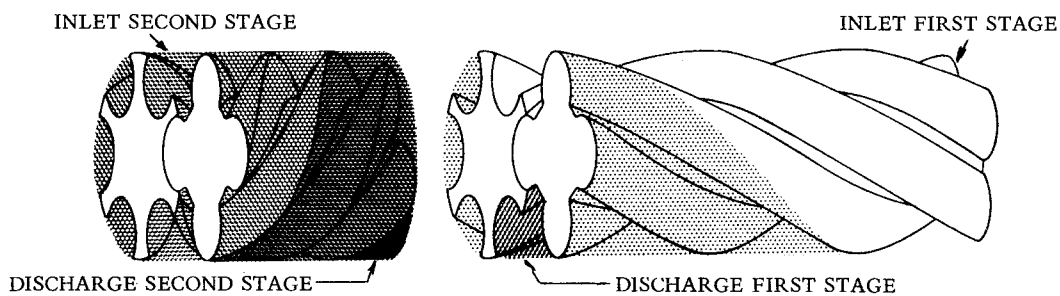


FIGURE 2. — COMPRESSION CYCLE

AIR FLOW (Figure 4) — Compressor air system uses the following components:

- | | |
|-----------------|-----------------------------|
| (a) Air Filter | (d) Discharge Check Valve |
| (b) Inlet Valve | (e) Oil Reservoir-Separator |
| (c) Compressor | (f) Discharge Manifold |

Air admitted through a two-stage dry type air filter passes through the inlet manifold and antiblowback inlet valve to the compressor. At compressor discharge the air-oil mixture passes through discharge check valve into the oil reservoir. Check valve prevents back flow of air and oil.

In the oil reservoir, more than 99% of entrained oil is removed by velocity change and impingement and drops back into reservoir. A multiple element final separator removes balance of oil before the air passes to the discharge manifold.

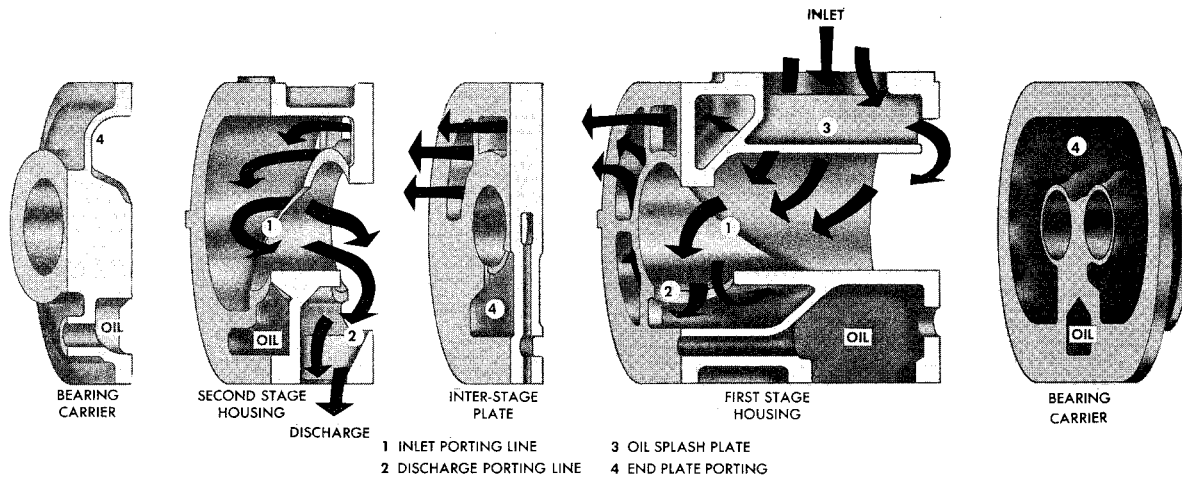


FIGURE 3. — AIR FLOW PATTERN

LUBRICATION, COOLING AND SEALING — A positive displacement internal gear pump, direct connected to the secondary rotor, draws oil from the reservoir through an oil cooler, thermostatic mixing valve (radiator type oil cooler only), 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 seals. The balance of the oil is injected directly into the compression chamber to remove heat of compression, seal internal clearances, and lubricate the rotors. The unit must never be operated below 20 PSIG oil reservoir pressure to avoid oil carry-over.

LOW UNLOADED HORSEPOWER UNITS — Models ET75C, ET100D, ET125D, ET150D, ET200D and ET250D compressor units are equipped with a Low Unloaded Horsepower System. This system consists of a hydraulic unloading valve, a pneumatic unloader pilot and a reservoir blowdown valve. With this system the power requirement while the compressor is running unloaded is much reduced. Models previous to those listed above can have this system added by ordering the required Low Unloaded Horsepower System Parts Kit.

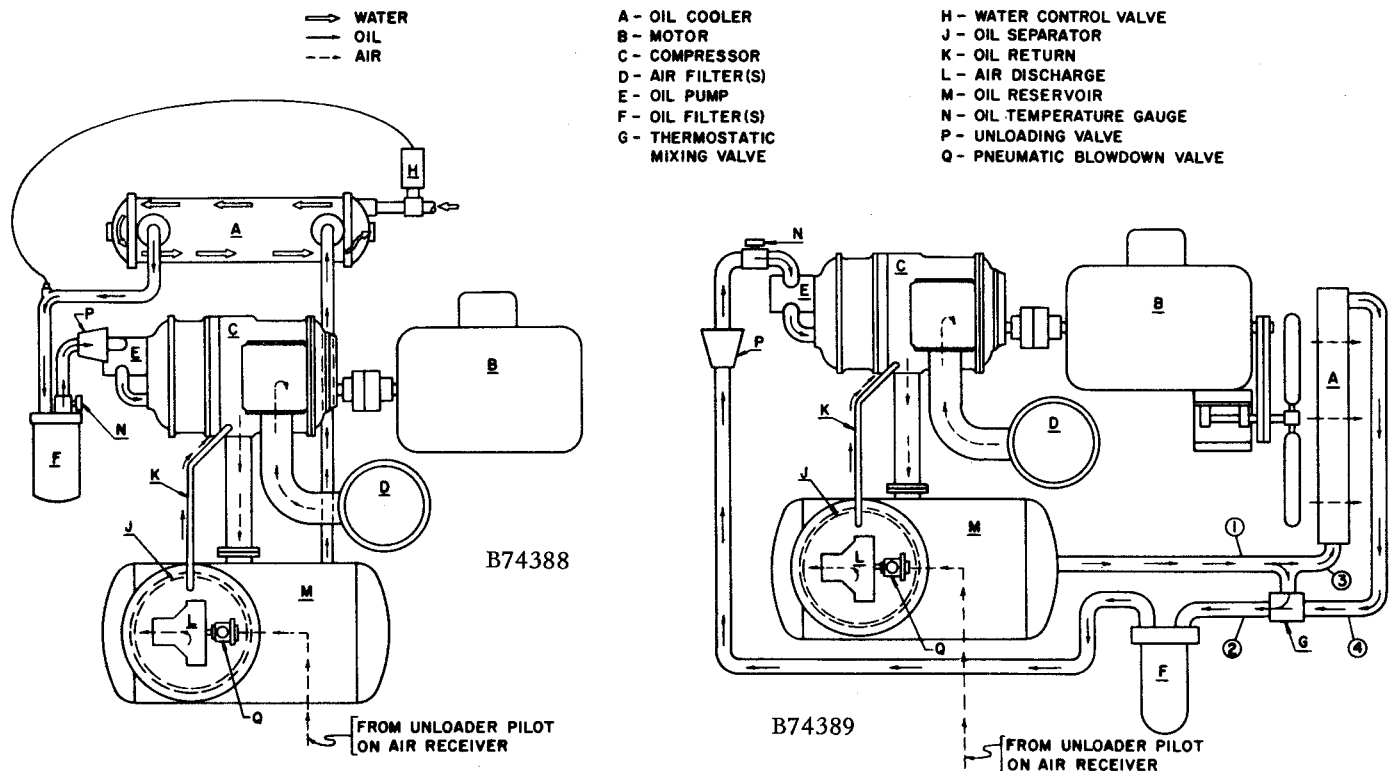
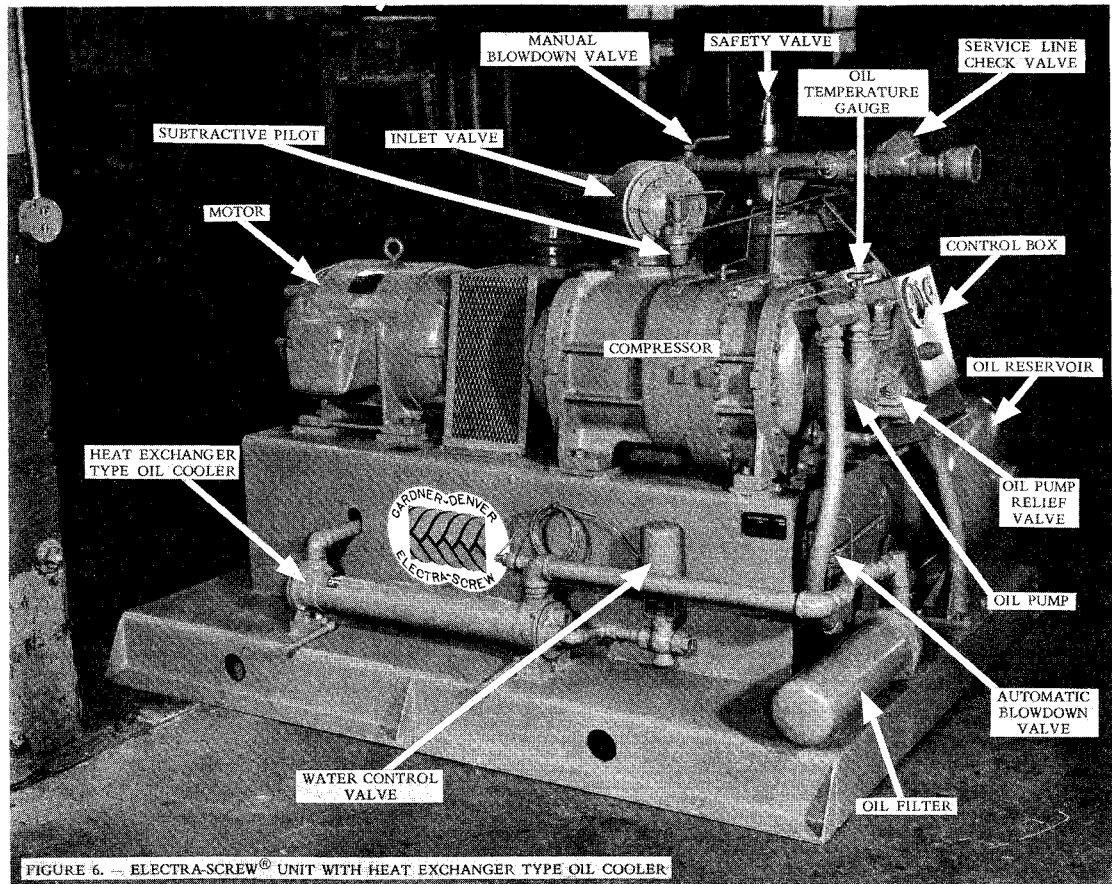
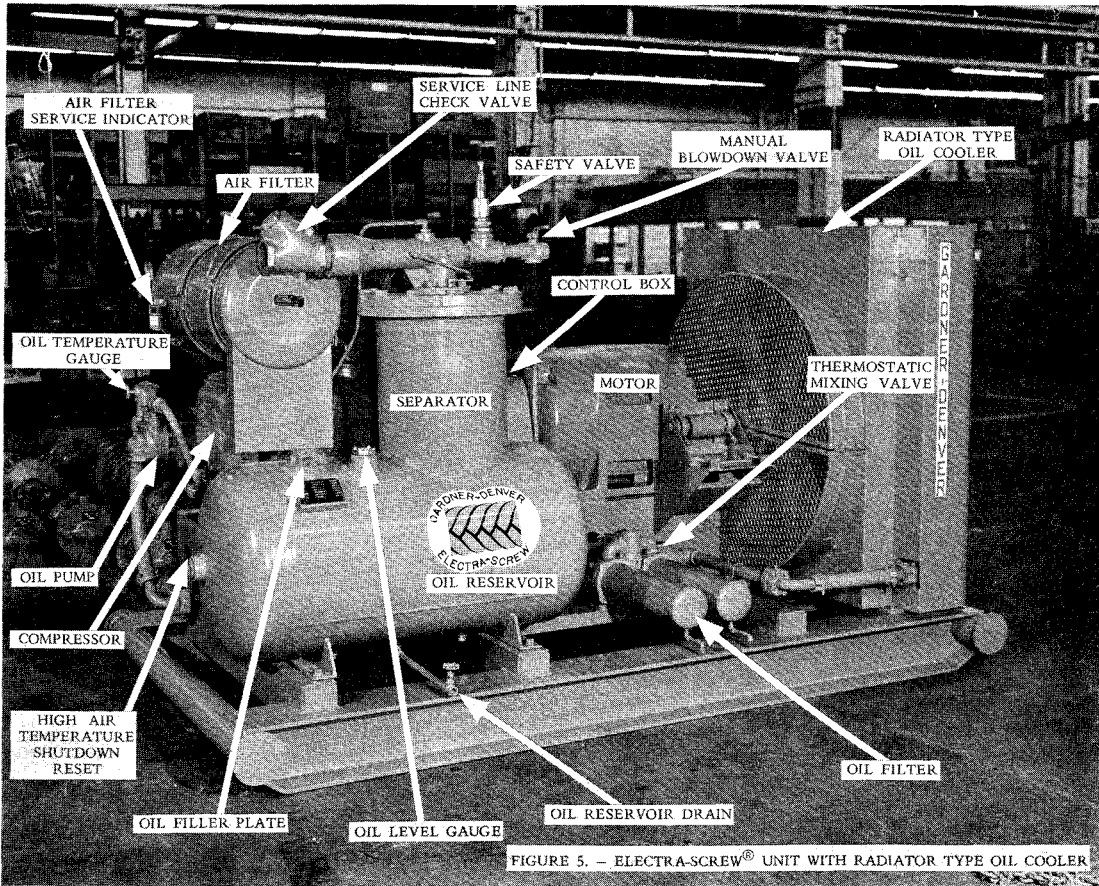


FIGURE 4. — AIR-OIL FLOW DIAGRAMS



INSTALLATION

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

NOTE: Do not electric weld on compressor or base; bearings can be damaged by passage of current.

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 for the inlet filter. In some cases it may be necessary to install air filter at some distance from the compressor to obtain proper air supply.

If unit is to operate in an enclosure, provide the enclosure with adequate inlet and outlet for cooling air. Proper ventilation must be provided for adequate cooling; hot air must be exhausted from the enclosure. A suggested inlet/outlet air flow is shown in Figure 7. Do not block air flow through cooler. Allow a minimum of two feet from cooler to the nearest obstruction.

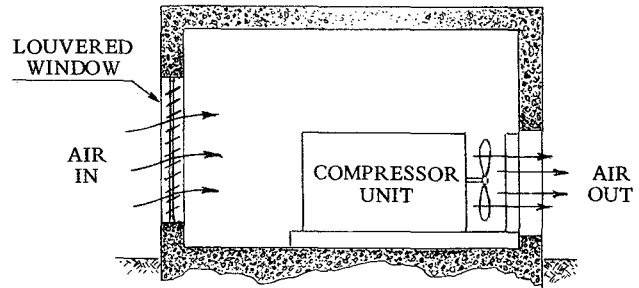


FIGURE 7.

FOUNDATION — The ELECTRA-SCREW[®] compressor requires no special foundation, but should be mounted on a smooth, solid surface. Whenever possible, install unit near level. Temporary installation may be at 15° angle either lengthwise or 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 to the foundation. Be sure compressor base is not pulled in a twist when foundation bolts are tightened.

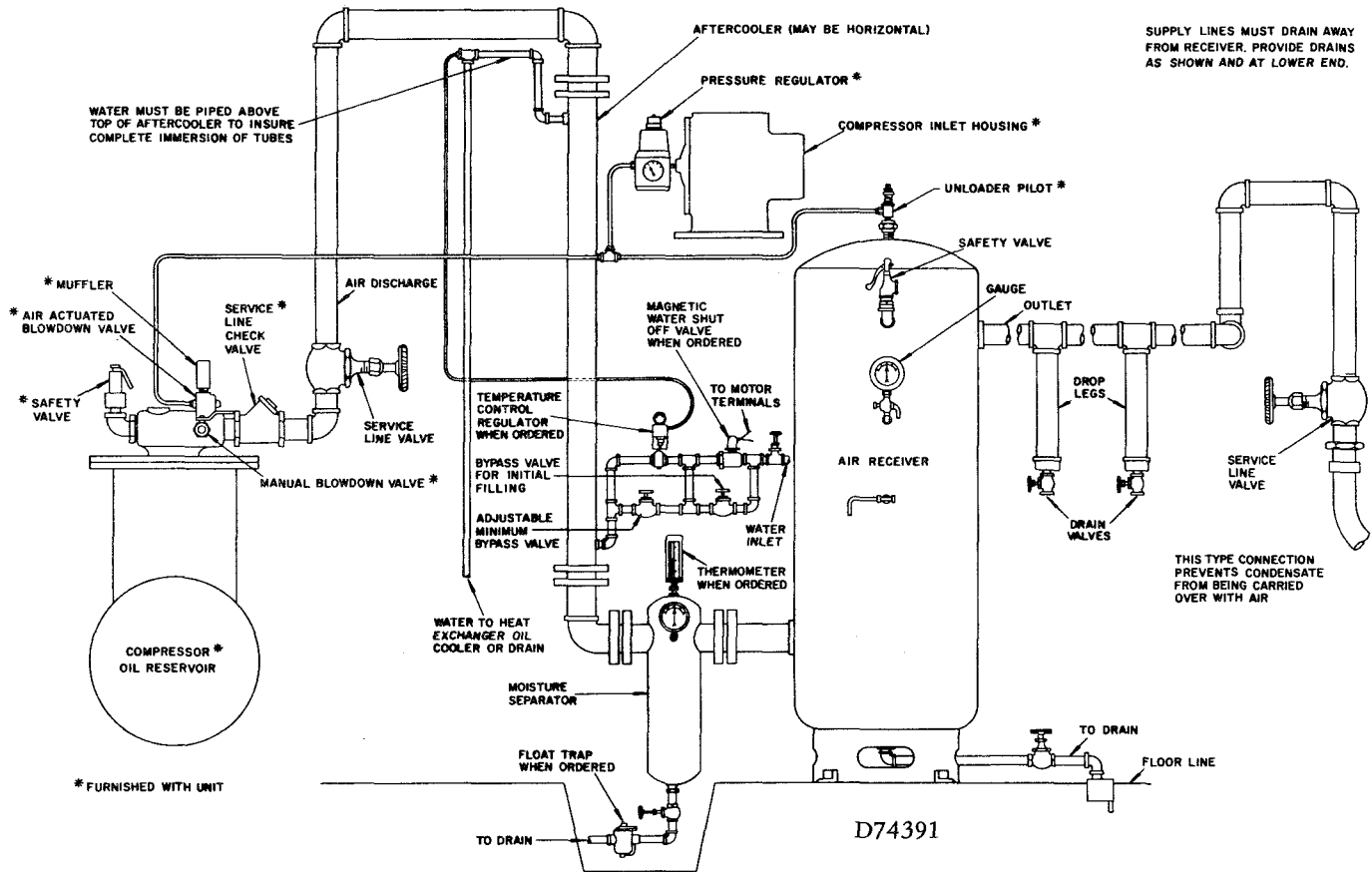


FIGURE 8. — AUXILIARY ACCESSORIES

AUXILIARY AIR RECEIVER – Constant speed systems **without** the Low Unloaded Horsepower System do not normally require an auxiliary air receiver.

Constant speed units **with** Low Unloaded Horsepower System, automatic start and stop units and dual control units require an auxiliary air receiver for air storage, unloader pilot and pressure switch location.

The air receiver should be of adequate size, provided with a relief valve of proper setting, and a means of draining condensate. Refer to Figure 8.

AFTERCOOLER (Figure 8) – An aftercooler is generally not required with the ELECTRA-SCREW® units since the normal discharge temperature is about 180° F.

When an aftercooler is used, it is to be installed between the auxiliary air receiver and compressor discharge. A moisture separator is mounted between the aftercooler and the auxiliary air receiver with a condensate drain provided at bottom.

For complete installation and maintenance instructions, refer to manufacturer's bulletin.

CONTROL PIPING – When a constant speed control system **without** Low Unloaded Horsepower System is provided, no additional pneumatic piping is required.

When a constant speed control system **with** Low Unloaded Horsepower System is provided, an unloader pilot, part number 5AUX525, must be mounted in the top of the auxiliary air receiver. A control line of 1/4" O.D. tube must be installed connecting the unloader pilot and the pressure regulator on the compressor inlet valve. If this line is longer than 25 feet, the tube should be 3/8" O.D.

When start-stop or dual control is furnished, control air must be piped from high point in air receiver to pressure switch opening in control box. The control line size should be 1/2" up to 25 foot length, 3/4" over 25 foot length, and must be free of dirt, scale, thread compound or any other substance which would cause erratic operation of pressure switch. A valve in the line is recommended for shutting off control air when working on controls.

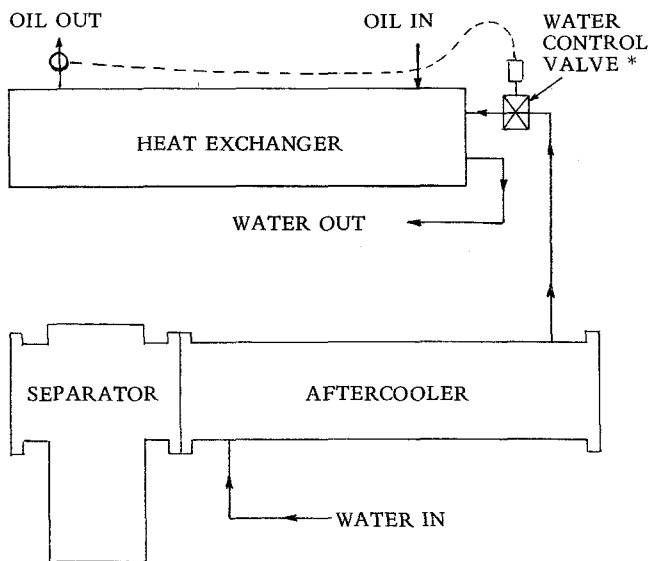
AIR INLET LINE – Where an air inlet line is used between air filter and the compressor, it must be thoroughly cleaned on the inside to prevent dirt or scale from entering the compressor. **If welded construction is used, the line must be shot blasted and cleaned to remove welding scale.** In either case, the inlet line must be coated internally by galvanizing or painting with a moisture and oil-proof sealing lacquer. The inlet line should be the full size of inlet opening on the compressor. If an extra-long line is necessary, the pipe size should be increased accordingly. Following is the recommended size increases:

Length of Inlet Line

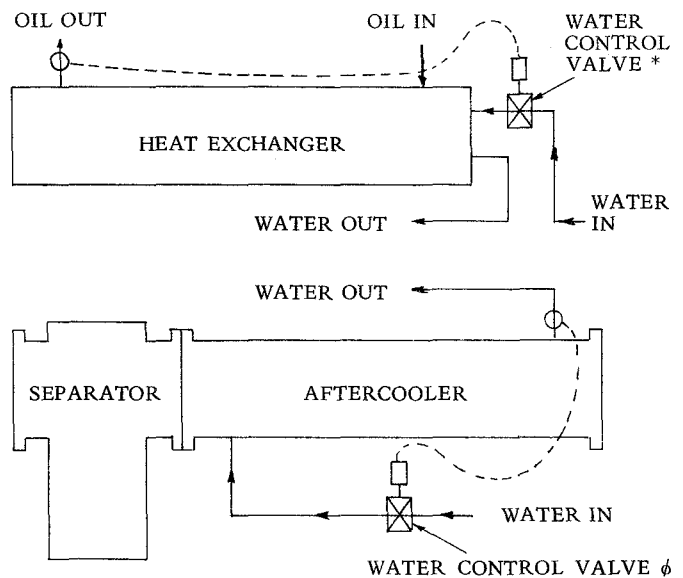
- 0 to 10 Ft.
- 10 to 17 Ft.
- 17 to 38 Ft.

Diameter of Pipe Size

- Same As Compressor Inlet Opening
- One Size Larger Than Inlet Opening
- Two Sizes Larger Than Inlet Opening



SERIES PIPING – WATER FLOW MUST BE THROUGH AFTERCOOLER FIRST FOR EFFECTIVE COOLING OF DISCHARGE AIR.



PARALLEL PIPING – TWO WATER CONTROL VALVES REQUIRED FOR TEMPERATURE CONTROL.

* FURNISHED BY GARDNER-DENVER COMPANY.
 φ MUST BE ORDERED SEPARATELY.

FIGURE 9. – PIPING DIAGRAM FOR AFTERCOOLER AND HEAT EXCHANGER

Accessibility for inlet air filter, servicing must be considered when locating filters.

BLOWDOWN VALVE PIPING – For convenience the automatic blowdown valve for shutdown and the blowdown valve for unloading system, which is furnished with a silencer, may be piped to a drain or to the outside with same size pipe as the valve outlet.

WATER PIPING (Water Cooled Heat Exchanger Models Only) (Figure 9) – When no aftercooler is used in the air discharge line, the only piping connections required are: pipe water inlet to water flow control valve mounted on the heat exchanger, and water outlet on heat exchanger to a sump or drain. Water piping connections when using an aftercooler can be made in either a parallel or series arrangement (see Figure 9).

The water source should be capable of supplying up to 50 gallons of water per minute at 40 PSIG minimum pressure to the inlet of the heat exchanger or aftercooler, if used. Maximum allowable inlet water pressure is 150 PSIG. Maximum allowable inlet water temperature is 100° F.

The following water flow rates are approximate and are a guide to sizing pipe, cooling towers or other water system equipment:

MODEL	Approximate Water Flow (GPM)		
	60° F. Water In 130° F. Oil Out	70° F. Water In 130° F. Oil Out	80° F. Water In 140° F. Oil Out
ET75	8.5	10.0	11.5
ET100	10.0	12.0	14.0
ET125	13.0	16.0	18.0
ET150	16.5	21.5	25.0
ET200	21.0	26.5	30.5
ET250	28.5	35.5	41.0

Water control valve is to be adjusted to maintain oil out of heat exchanger within the 130°-150° F. range regardless of inlet water flow or temperature. See "Maintenance" section for adjustment instructions.

COUPLING ALIGNMENT – Due to handling during transportation and installation of the unit, the coupling may not stay in alignment and must be checked after installation is completed. The compressor is doweled to the base at the factory. The motor is not doweled in the event adjustment is necessary for coupling alignment. Tapered dowels are shipped with the unit.

Be sure there is no strain on the unit due to unsupported piping.

The coupling is of the flexible disc type and compensates for slight variation in parallel and angular misalignment between motor and compressor. If discs are replaced, they must be assembled in coupling exactly as received. Adjacent discs of laminated rings are dialed (turned so grain of steel runs in different directions) to give maximum strength and uniformity. Do not order less than a complete ring. When disassembling, note arrangement of bolts, washers (forged links) and nuts as they must be replaced in the same order. Tie a string or wire through one bolt hole of each laminated ring to retain the dialed position of individual discs. When installing a new coupling, instructions for assembly are included with coupling.

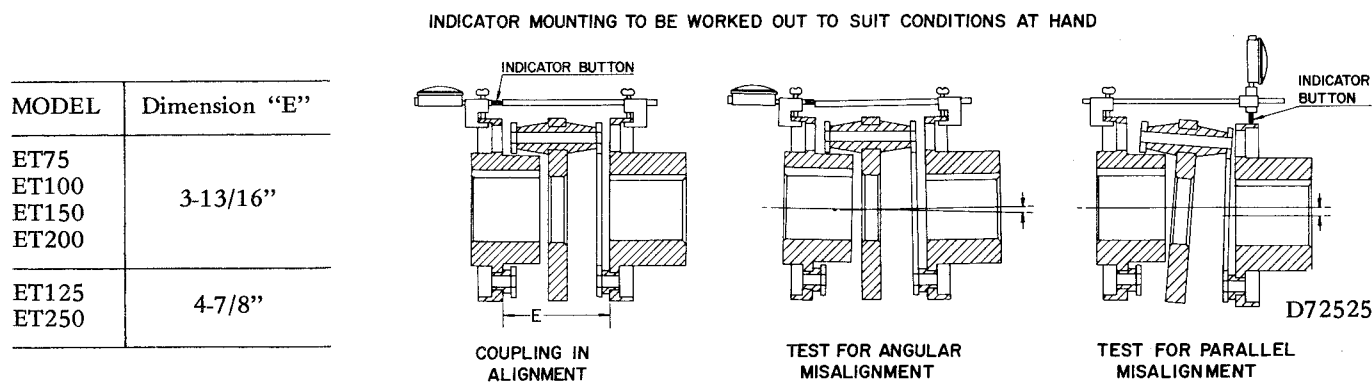


FIGURE 10. – ALIGNMENT OF COUPLING

Figure 10 illustrates one method of attaching an indicator to check the coupling alignment. Other methods may be used to suit indicator equipment at hand. If desirable, the bolts, discs and links may be removed to check alignment. Make sure all parts are marked so they are replaced in the same order, as described above. The maximum run-out, parallel or angular is .002 inches. It may be necessary to adjust shimming under motor feet to achieve alignment.

Distance between coupling flanges shown at "E" in Figure 10 is listed in the table in relation to unit size. This distance must be held to prevent dishing of discs.

Sleeve Bearing Motor Alignment — All of the above instructions apply when aligning sleeve bearing motors, plus the special requirement that the rotor be located at the magnetic center when positioning the motor axially:

Motors with magnetic center nameplate — This plate is attached to the bearing housing at the shaft extension end. The surface of the nameplate should be flush with the shoulder (or with punch or scribe marks) on the shaft extension, thus positioning the rotor on magnetic center. Hold rotor in this position when locating the motor axially.

Motors without magnetic center nameplate — Disconnect electrical leads from motor. Push shaft extension as far as possible toward stator; punch mark or scribe line on shaft using edge of bearing housing as a reference. Pull motor shaft extension as far as possible away from stator; repeat shaft marking. Position motor axially so that rotor is located halfway between shaft marks with edge of bearing housing as reference. This halfway position locates the rotor in the approximate magnetic center.

When alignment is complete, make sure all bolts in coupling, compressor and motor feet are tight.

Dowel two diagonally opposite motor feet with tapered dowel pins supplied. Use a 13/32 drill and a number 8 tapered reamer.

STARTER AND WIRING — Several types of starters can be used depending on local power company restrictions. The proper wiring diagram for each type of starter and control is furnished with unit. All wiring should be adequate for both running and starting current requirements.

STARTING AND OPERATING THE UNIT

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

1. **Compressor Oil** – Check oil level in 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 Dexron (General Motors specification) automatic transmission fluid which is suitable for the first 2000 hours under normal operating conditions. For sustained operation above +90° F. ambient temperature, use SAE 30 MIL-L-2104B or MIL-L-45199 oil. See Figure 11. **REPLACE OIL FILTER ELEMENT EVERY 1000 HOURS.**

Recommended Oils	Temperature Range
Automatic Transmission Fluid – –50° F. Pour Point – Meeting AQ-ATF, Type A, Suffix A, or GM Specification (Dexron), or Ford Specification (M2C33)	Year-round Operation – Except As Noted Below.
SAE 30 – Meeting Specification MIL-L-2104B, or MIL-L-45199 (Series 3)	Above +90° F. – During 8 Or More Hours Of Operation NEVER USE SAE 30 OIL BELOW +40° F.

FIGURE 11. – COMPRESSOR LUBRICANTS

The recommended compressor lubricant is automatic transmission fluid meeting AQ-ATF, Dexron or Ford M2C33 specifications. On fan-cooled radiator models, automatic transmission fluid can be used for all operation up to +90° F. ambient temperatures; when operating ambient exceeds +90° F. for eight (8) hours per day, SAE 30 oil meeting MIL-L-2104B specifications should be used. On water-cooled heat exchanger models, automatic transmission fluid can be used for all operation, provided oil temperature is held 130°-160° F. by adjustment of water flow control valve; if oil temperature will exceed 160° F., SAE 30 oil meeting MIL-L-2104B specification should be used.

The oil must contain the following additives to be suitable for Electra-Screw® compressor use: (1) anticorrosion, (2) antioxidation, and (3) antifoam. Any other additives the above oils may contain as a standard of the refiner are acceptable.

Refer to Figure 11A for oil capacity. On initial fill of new unit or complete draining, the oil capacity will be very nearly that of the complete system. When the cooler, filter and compressor are not drained, the capacity will be very nearly that of the oil reservoir only. The initial fill should bring the pointer of the oil level gauge near the high side of the “Run” range. If the specified quantity and the registration on the gauge do not match, check the gauge for malfunction. The oil level gauge should read in the center of the “Run” range when the oil level is the specified number of inches below reservoir centerline as shown in Figure 11A.

Under no circumstances should the oil level be above the reservoir centerline as oil carry-over may result. On start-up, oil level may fall as system is filled. Add oil if necessary. **ALWAYS STOP UNIT AND BE SURE ALL AIR PRESSURE IS OFF RESERVOIR BEFORE ADDING OIL.** Refer to “Maintenance” section for complete details of compressor oil system.

Model	Oil Capacity – Gallons		Approximate Oil Level (Inches Below Centerline Of Reservoir)
	Complete System	Reservoir Only	
ET250	60	40	5
ET200	50	35	2-1/2
ET150	45	30	3
ET125	33	25	1-1/2
ET100	33	25	1-1/2
ET75	24	18	3/4

FIGURE 11A. – OIL CAPACITY

2. **Air Filter** (Figures 4, 5, 6 & 13) – Inspect air filter to be sure it is clean and tightly assembled. Refer to “Air Filter” in Maintenance Section for complete servicing instructions. Be sure inlet line (if used) is tight and clean.

3. **Alignment** – Check all bolts and cap screws for tightness. Be sure coupling was checked for alignment as outlined in Installation Section.
4. **Fan** – Check belt tension. Refer to Maintenance Section for correct tension.
5. **Piping** – Refer to Installation Section and make sure all piping meets recommendations.
6. **Electrical** – Check wiring diagram furnished with unit to be sure it is properly wired.
7. **Rotation** – Check motor rotation by momentarily starting motor. Compressor rotation is counterclockwise standing at the motor end.

STARTING UNIT – COLD (Below +50° F.) – Close air service valve between main air system and unit discharge manifold and open oil reservoir manual blowdown valve (Figures 5 & 6). If unit is water-cooled heat exchanger model, open manual water inlet valve fully (Figure 6). Start unit. Adjust manual blowdown valve to hold 50 PSIG oil reservoir pressure, and run unit for five minutes to warm up. Close manual blowdown valve and open service valve in discharge line. **DO NOT OPERATE UNIT AT RESERVOIR PRESSURE BELOW 20 PSIG.** See “Minimum Oil Reservoir Pressure” below.

STARTING UNIT – HOT (Above +50° F.) – No warm-up period is required. If unit is water-cooled heat exchanger model, open manual water inlet valve fully. Close service line valve. Start unit and allow reservoir pressure to build up to full unloaded pressure. Open service line valve and put unit on the line. **DO NOT OPERATE UNIT AT RESERVOIR PRESSURE BELOW 20 PSIG.** See “Minimum Oil Reservoir Pressure” below.

MINIMUM OIL RESERVOIR PRESSURE after start-up is 20 PSIG to avoid oil carry-over. When starting up on large system, adjust service line valve in air discharge line to maintain 50 PSIG in oil reservoir during starting period, then adjust valve to maintain 20 PSIG minimum in oil reservoir.

AIR RECEIVER PRESSURE is controlled on constant speed units by adjustment of the unloader pilot; on automatic start-stop units by adjustment of pressure switch setting; and on dual control units by adjusting both the pilot and pressure switch setting. Refer to “Controls” in Maintenance Section for details.

DAILY CHECK – Refer to Service Check List on page 11.

STOPPING UNIT – On constant speed operation, bring the unit up to full unloaded pressure and press “Stop” button. Oil reservoir will automatically blow down as motor stops. On Auto-Start/Stop operation, unit will automatically shut down when full unloaded pressure is reached. Turn On-Off switch to “Off” position. If unit is water-cooled heat exchanger model, shut off water inlet valve.

COMPRESSOR OIL INLET TEMPERATURE

For **Water-Cooled Heat Exchanger Models**, adjust the water flow control valve (Figure 6), on inlet side of heat exchanger, to maintain the temperature of oil into compressor at 130° F. (or as close as possible to this value, up to 160° F. maximum) for automatic transmission fluid. If oil temperature to compressor will exceed 160° F. for more than eight (8) hours of operation, then SAE 30 oil meeting MIL-L-2104B specification should be used. An oil temperature gauge (Figure 6) is mounted in the oil system between the heat exchanger and compressor for checking oil temperature into compressor. Refer to “Water Flow Control Valve” in Maintenance Section for adjustment and other data.

For **Radiator-Fan-Cooled Units**, the oil temperature into compressor is controlled by a thermostatic mixing valve (Figure 5) in the oil system.

LOW UNLOADED HORSEPOWER SYSTEM – Where the unit is equipped with the low unloaded horsepower, the system is entirely automatic, requiring only that the pressure regulator on the compressor inlet valve be set at 20-25 PSIG while the compressor is unloaded. Never set this regulator above 25 PSIG to avoid overpressuring of the inlet valve piston.

MAINTENANCE AND ADJUSTMENT

SERVICE CHECK LIST

Air Filter — Because operating conditions determine air filter service, refer to “Air Filter” on page 12 and plan maintenance accordingly.

Every 8 Hours Operation

1. Check reservoir oil level. Stop unit to check. Add oil if required. Refer to “Compressor Oil Separator” on page 16 for high oil consumption.
2. Observe if unit loads and unloads properly.
3. Drain moisture traps on air receiver and moisture separator (if used).

Every 125 Hours Operation

1. Check fan belt for proper tension; adjust if required. Refer to “Fan Belt Adjustment” on page 17.
2. Check for dirt accumulation on radiator type oil cooler core faces. Blow off dirt if accumulation is excessive.

Every 1000 Hours Operation

1. Change the oil filter element.
2. Change the compressor oil if using an SAE grade oil. UNDER ADVERSE CONDITIONS, CHANGE MORE FREQUENTLY (refer to “Oil Change Interval”). Flush system if required.

Every 2000 Hours Operation

1. If using automatic transmission fluid, change compressor oil. UNDER ADVERSE CONDITIONS, CHANGE MORE FREQUENTLY (refer to “Oil Change Interval”). Flush system if required.
2. Clean the magnetic plugs in the oil reservoir.

Every 4000 Hours Operation

1. Grease bearings on fan drive.

Agglomerator Element in oil separator should be changed when pressure differential exceeds 8 PSI, as shown by dual hand gauge. Clean screen element.

INSTRUMENTS (Figures 5 & 6) are mounted on the control box cover and include air pressure gauge and hourmeter. The pressure gauge indicates both discharge manifold pressure and oil reservoir pressure (pressure drop across oil separator). Refer to “Agglomerator Element” above and “Oil Separator” on page 16 for function of this gauge. An oil temperature gauge is mounted in oil system between oil cooler and compressor to check oil inlet temperature.

COMPRESSOR CONTROLS — Compressor capacity control is obtained by one of the following systems supplied to the customer's specifications:

(a) Constant Speed, (b) Start-Stop, (c) Dual Control

These controls will be of a suitable voltage and with suitable type enclosure to meet application requirements. Refer to control bulletin furnished with unit for wiring and adjustment of controls.

INLET UNLOADER VALVE (Figures 6, 12 & 12A) — The piston-actuated inlet valve controls the compressor inlet and operates on air pressure from the control system when constant speed or dual control system is used. On compressors that are not equipped with Low Unloaded Horsepower System, the inlet valve is closed when full pressure is on system and changes degree of opening in direct response to system pressure drop. This modulation is controlled by the subtractive pilot which senses air pressure at the air service manifold.

On compressors equipped with Low Unloaded Horsepower System, the subtractive pilot is

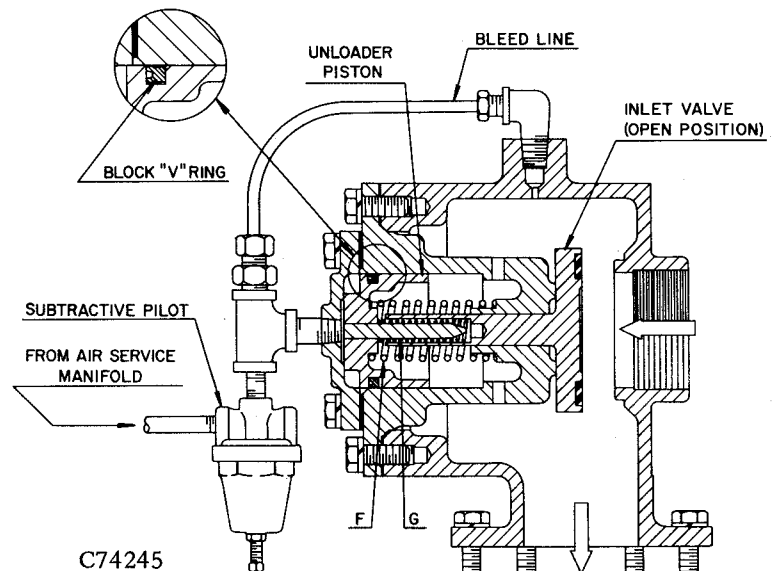


FIGURE 12. — TYPICAL INLET UNLOADER VALVE WITHOUT LOW UNLOADED HP SYSTEM

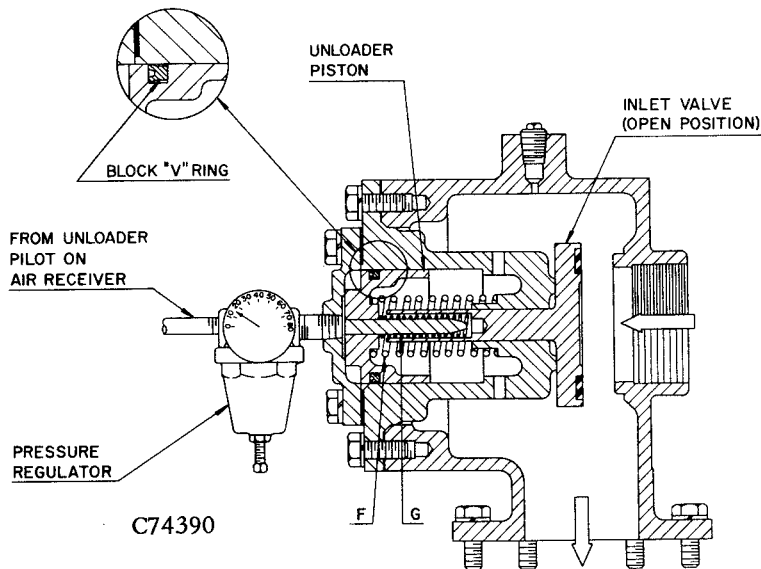


FIGURE 12A. — TYPICAL INLET UNLOADER VALVE WITH LOW UNLOADED HP SYSTEM

replaced with a pressure regulator which reduces the air pressure to operate the piston. No modulation of the inlet valve occurs; the unloader pilot passes pressure through the regulator to close the inlet valve when the air receiver reaches a pre-determined setting, and releases pressure allowing inlet valve to open on decrease in the receiver pressure to the lower limit of the pilot range. The regulator should be set at 25 PSI. Higher pressure setting may cause damage to the inlet valve. On automatic start-stop system, valve closes automatically when compressor stops. Inlet valve contains piston spring "F" which returns piston and allows inlet valve to open as pressure decreases and valve spring "G" which returns valve to closed position on shutdown of compressor to prevent backflow from compressor to air filter.

On some models, a bleed line is piped from the subtractive pilot to the inlet valve housing downstream of the inlet valve to allow a small amount of air to circulate through the compressor and reservoir system and prevent oil logging during unloaded operation. On other models, the bleed is accomplished internally through a 5/32" diameter hole in the inlet unloader piston and vent holes in the piston cylinder.

CHECK VALVE — COMPRESSOR DISCHARGE — A free floating disc type check valve is mounted in the discharge line between compressor and oil reservoir to prevent back flow of air and oil into compressor on unloaded cycle and shutdown.

CHECK VALVE — SERVICE LINE (Figures 5 & 6) — A renewable seat swing type check valve in the discharge manifold prevents backflow of air into compressor air system from the shop line when unit stops under automatic control or is shut down.

AUTOMATIC BLOWDOWN VALVE (Figure 6) — A solenoid valve piped to the compressor discharge manifold ahead of the check valve and wired into electrical system, will blow down compressor air system on motor shutdown. See wiring diagram. On units equipped with Low Unloaded Horsepower System, an additional air actuated blowdown valve is used to release pressure in the oil reservoir during the unloaded cycle.

SAFETY DEVICES

Motor Protection Devices — Overload relays and other protective devices are to be furnished by the customer except when Gardner-Denver furnishes starter on a factory-wired unit. "Guardistor", "Thermotector" or other heat-sensing shutdown devices in motor windings are furnished only when ordered.

High Air Temperature Shutdown (Figure 5) — The compressor is protected from lubrication failure by a high discharge temperature switch in the discharge line between compressor discharge check valve housing and the oil reservoir. This switch is wired into the motor control circuit and will shut down the unit if discharge temperature exceeds $225^{\circ}\text{F.} \pm 5^{\circ}$. This switch will be in a suitable enclosure to meet application requirements. The switch has a maximum rating of 600 volts, is of the manual reset type, and must be reset any time unit is shut down due to high air discharge temperature. Refer to wiring diagram. Normal air discharge temperature is $175^{\circ}\text{-}185^{\circ}\text{F.}$ based on ambient temperature of 80°F. and system in good condition.

Safety Valve (Figures 5 & 6), installed on the discharge manifold, is set at the factory to the proper pressure for protection against overpressure of the oil reservoir. Periodic checks should be made to insure its proper operation. Never operate the unit without proper safety valve setting.

NEVER DISCONNECT SAFETY DEVICES THAT PROTECT THE UNIT.

AIR FILTER SERVICE INDICATOR (Figure 5) signals time to change or service air filter. The flag in the window gradually rises as the filter element loads with dirt. When air pressure drop across filter reaches the equivalent of 20" water suction, the flag reaches the top and locks in position, thus indicating need for filter servicing. After servicing, reset indicator by pushing reset button all the way in firmly, then release.

CAUTION — The air filter service indicator is an effective device so long as system vacuum is maintained. If the vacuum is broken because of a defective filter gasket or ruptured cartridge, the indicator WILL NOT function. It is wise, therefore, to periodically inspect the air filter for excessive dust buildup as discussed in "Air Filter" below.

AIR FILTER (Figures 4, 5, 6, 13 & 14) is dry type two-stage design. Early models used air filter type shown in Figure 13. Later models use type shown in Figure 14. Air filter must receive proper maintenance if maximum service is to be obtained from unit. Establishing adequate and timely filter service is MOST IMPORTANT. Local dust conditions are the determining

factor for servicing the air filter. The following instructions give a wide range of operating hours and should be considered only as a guide for servicing filters. Experience only can determine the proper time element.

For air filters as shown in Figure 13, instructions are given in four sections:

- (a) Dust Cup
- (b) Lower Body and Tube Assembly
- (c) Filter Cartridge
- (d) Cartridge Life

For air filters as shown in Figure 14, instructions are given in three sections:

- (a) Dust Cup
- (c) Filter Cartridge
- (d) Cartridge Life

NOTE: There is no lower body and tube assembly on filters as shown in Figure 14.

Dust Cup – Empty every 4 to 120 operating hours depending on dust conditions. **DAILY INSPECTION IS RECOMMENDED.**

- (a) Stop unit (never remove dust cup with unit running).
- (b) Loosen clamps and lower cup from body.
- (c) Dump out dust and wipe cup and/or tray clean with dry cloth.
- (d) Inspect and wipe gasket clean. Replace dust cup.

Do not bend edge of cup by striking on hard surface. **DO NOT USE OIL, GASOLINE OR OILY WASTE TO CLEAN.** Replace gasket if damaged or worn. Keep several gaskets on hand to assure tight seal and minimum down time. Horizontally mounted filters equipped with dust cup tray must have the tray pointed downward for proper filter action.

NOTE: Air filter will not function properly if dust deposit builds up past a 2" level in the cup or above top of tray. This greatly overloads and reduces life of second stage cartridge with danger of dirt entering the unit.

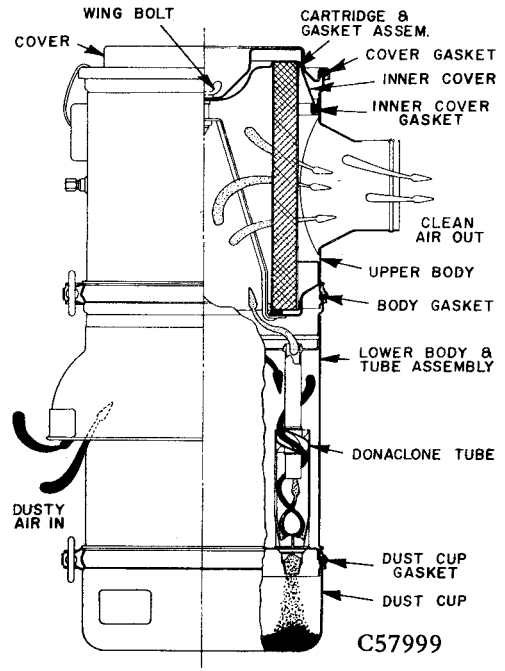


FIGURE 13. – AIR FILTER

Lower Body and Tube Assembly – Inspect tubes each time dust cup is serviced and clean if accumulation of dirt is found. Service as follows:

- (a) Loosen clamps near center of filter. Remove lower body and tube assembly.
- (b) Thoroughly clean by pushing round bottle brush through each tube and blow off all loose dirt.
- (c) Clean inlet screen inside of body.
- (d) Clean and inspect all gaskets. Replace if damaged or worn.
- (e) Replace lower body and dust cup making sure all clamps are tight.

Filter Cartridge – Clean every 50 to 250 operating hours depending on dust conditions. Loss of compressor delivery may indicate need for servicing cartridge. To service:

- (a) Stop unit.
- (b) Wipe dirt and grease from cover and filter body. Loosen clamps and remove cover.
- (c) Remove wing bolt, remove inner cover and lift cartridge from filter body.
- (d) Slap side or bottom rim of cartridge with palm of hand to remove loose dirt. **DO NOT STRIKE ON HARD SURFACE** as dents will affect seal of gaskets.

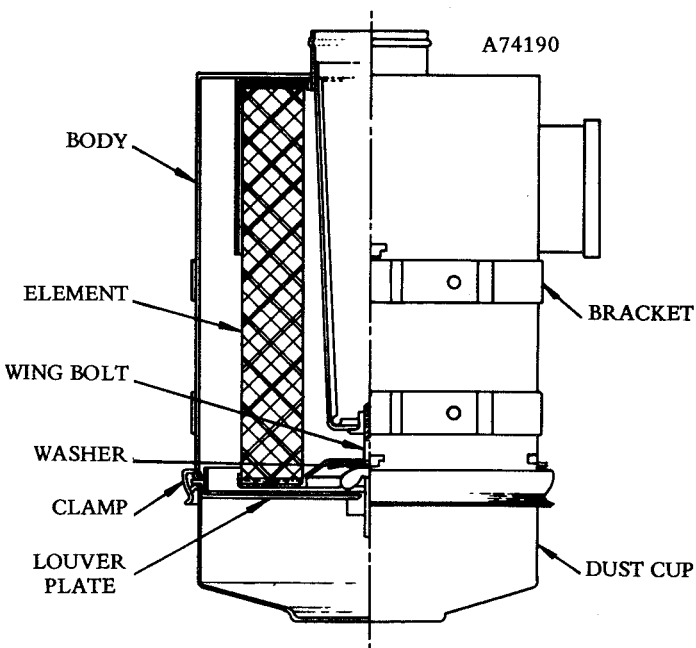


FIGURE 14. – AIR FILTER

- (e) If clean dry air is available (not to exceed 100 PSI) direct air along complete length of each pleat on clean air side. An even, bright pattern of light can be seen through clean cartridge when light is held inside. Cartridge can also be washed with water and nonfoaming household detergent. After washing, flush with gentle stream of water until drain water is clean. Inspect for rupture or damage. Air dry thoroughly before using.

- (f) Thoroughly clean upper body. If accumulation of dirt is found in upper body or air ducts to compressor, determine cause and correct before continuing to operate unit.
- (g) Make certain all gaskets, clamps, etc. in air duct are air tight.
- (h) Inspect replaceable gaskets for possible damage.

CAUTION: Keep spare cartridges and gaskets on hand to reduce down time.

- (i) Reassemble filter. Make sure wing nuts holding cartridge are tight, and that clamps are not worn allowing loose assembly.

Filter Cartridge Life — Replace filter cartridge with genuine replacement parts every 600 hours of operation, or less under adverse conditions. While cartridge may function safely for a longer period of time, the small savings involved do not justify the risk.

CAUTION: Do not run unit with damaged filter or filter parts. Always handle filter parts with care.

Causes of short cartridge life are: severe dust conditions; dust cup service not frequent enough; accumulation of dirt in tubes; leaking gaskets or seals; or improper cleaning.

COMPRESSOR OIL SYSTEM (Figure 4) cools compressor, lubricates moving parts and seals internal clearances in compression chamber.

The oil pump suction line is connected near bottom of oil reservoir. Oil is drawn from reservoir through oil cooler, thermostatic mixing valve and oil filter by the oil pump and is discharged into the compressor main oil gallery. Oil passes through internal passages for lubrication, cooling and sealing during the compression cycle. The air-oil mixture is then discharged to the oil reservoir where impingement and velocity change remove more than 99% of the oil from the air. The remaining oil is removed by the oil separator in the separator section of the reservoir. Never operate unit below 20 PSIG oil reservoir pressure to avoid oil carry-over.

OIL SPECIFICATIONS — Refer to Compressor Lubricants (Figure 11) under “Starting and Operating the Unit” for a listing of recommended oils. Automatic transmission fluid, with -50° F. pour point, is recommended for year-round use except where periods of operation exceeding eight (8) hours with ambient temperatures above $+90^{\circ}$ F. are encountered. In this case, SAE 30 oil meeting the specifications listed in Figure 11 is recommended. NEVER USE SAE 30 OIL BELOW $+40^{\circ}$ F. The SAE 30 motor oil must be corrosion, oxidation and foam inhibited. Mixing of different types, or the use of lubricants without sufficient oxidation inhibitor will result in formation of heavy varnish and sludge deposits throughout the system.

OIL QUALITY — There are many brands of lubricating oils which are represented by the suppliers as meeting one or more of the specifications listed under Compressor Lubricants (Figure 11). The ability of an oil to meet the minimum performance level of a specification is determined by the supplier. Therefore, the responsibility for the QUALITY of the oil and its PERFORMANCE IN SERVICE rests with the oil supplier.

COLD AMBIENT OPERATION — If an SAE grade oil is used, the oil should be changed to automatic transmission fluid when the ambient temperature drops to $+40^{\circ}$ F. in the space enclosing the compressor unit or if the unit operates out of doors. Experience clearly indicates that an oil with a pour point above the ambient temperature may chill in the oil cooler and block oil flow to the compressor. The loss of oil circulation causes excessive discharge air temperature and may result in compressor damage and/or a flash fire in the oil reservoir. This rise of discharge air temperature occurs very rapidly, and without oil as a wetting agent surrounding the sensing bulb of the high air temperature shutdown switch, damage generally results before the device can actuate to stop the unit.

ADDITION OF OIL BETWEEN OIL CHANGES must be made when oil level gauge (Figure 5) reads below “Run” range. Be certain unit is stopped and no air pressure is in oil reservoir when checking oil level. Wipe away all dirt before removing oil filler plate or plug (Figure 5) in top of reservoir. Repeated addition of oil between oil changes may indicate excessive oil carry-over and should be investigated.

OIL CHANGE INTERVAL is determined by air filter maintenance, operating conditions and quality of oil. Good practice is to change oil often enough that drained oil is relatively clean. Under good operating conditions automatic transmission fluid can be used up to 2000 hours of operation and SAE 30 oil up to 1000 hours. When operating conditions are severe (very dusty, high humidity or high temperature) it may be necessary to change oil more frequently. Operating conditions and appearance of drained oil must be surveyed and oil change intervals planned accordingly by the user. Refer to Compressor Oil Filter for filter element replacement.

DRAINING AND CLEANING OIL SYSTEM — Always drain complete system. Drain when oil is hot to help prevent varnish deposits and to carry away impurities. STOP UNIT. Be sure no air pressure is in reservoir. To drain system, use one of the following methods:

If unit is not elevated high enough to use oil reservoir drain openings to drain oil, a small hand-, electric- or air-operated pump should be used to drain reservoir. Remove compressor sump drain, oil cooler drain (2) and oil filter plugs. After oil reservoir is emptied, remove oil reservoir magnetic plug.

If unit is elevated so that oil reservoir drain openings can be used, remove following plugs: oil reservoir drain, oil reservoir magnetic, compressor sump drain, oil cooler drain (2), and filter.

Clean all magnetic plugs to maintain effectiveness. If drained oil and oil filter element are contaminated with dirt, flush entire oil system: reservoir, cooler, pump, mixing valve and lines. Inspect oil separator element for dirt accumulation; replace if necessary. If varnish deposit exists, contact oil supplier for recommendations for removal of deposit and prevention of recurrence.

FILLING OIL RESERVOIR – Wipe away all dirt before removing oil filler plate or plug in top of oil reservoir (Figure 5). Refer to Compressor Lubricants (Figure 11) and Oil Capacity (Figure 11A) for oil quantity and type required to fill compressor oil reservoir. This amount brings pointer of oil level gauge to high side of “Run” range. After a few minutes of operation, oil drops to center of “Run” range as some oil is retained in other parts of system. Maintain oil level in “Run” range. **DO NOT OVERFILL** as oil carry-over will result. Use only **CLEAN** containers and funnels so no dirt enters reservoir. Provide for clean storage of oils. Changing oil will be of little benefit if done in a slipshod manner.

COMPRESSOR OIL FILTER (Figures 4, 5, 6 & 15) is a vital part in maintaining a trouble-free compressor, since it removes dirt and abrasives from circulated oil. Filter is a replaceable cloth bag element type and is equipped with a relief valve that opens in event elements become dirty enough to block flow of oil. **Elements must be replaced every 1000 hours**; more frequent changes improve system reliability and are recommended. Use only replacement element shown on filter tag, or refer to parts list for part number. Models ET75, ET100 and ET150 use a single element filter. Models ET125, ET200 and ET250 use two single element filters connected in parallel through the oil filter cover (see Figure 15). Use the following procedure to replace filter element. (Do not disturb piping.)

1. Dismantle filters, clean all parts and replace gasket on filter head.
2. Slide new element over spool and slip spring and plate assembly over end of tube.
3. Place reassembled element and spool into the shell with relief valve and spring down (away from the filter head).
4. Bolt assembly to filter head.

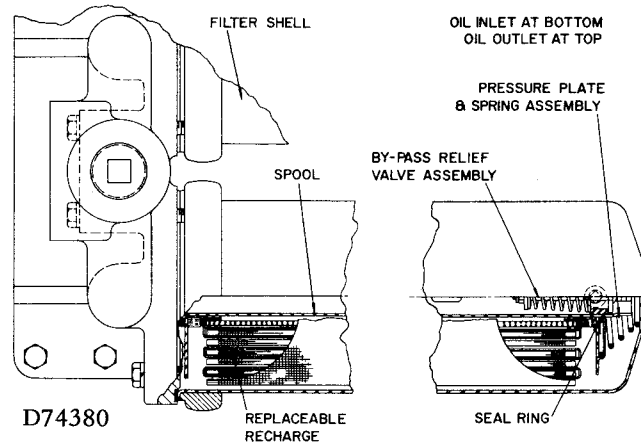


FIGURE 15. – COMPRESSOR OIL FILTER

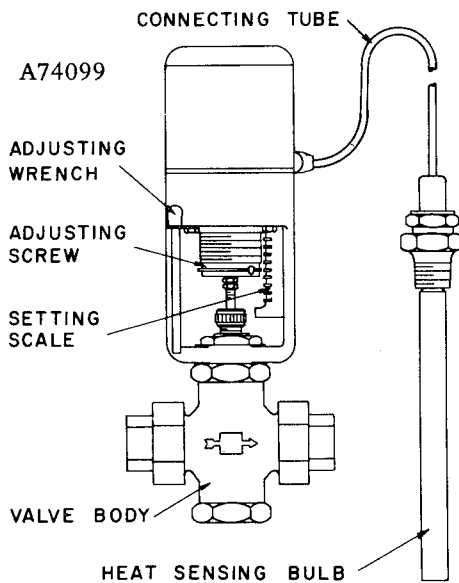


FIGURE 16. – WATER CONTROL VALVE

COMPRESSOR OIL COOLER – RADIATOR TYPE (Figures 4 & 5) – The fan exhausts air through oil cooler away from the unit. Keep face of oil cooler core clean for efficient cooling of compressor oil. If heating persists it may be necessary to remove cooler for thorough cleaning of fins and tubes.

COMPRESSOR OIL COOLER – WATER COOLED HEAT EXCHANGER (Figures 4 & 6) – The optional heat exchanger type oil cooler is the multiple pass type, with water in tubes and oil in shell. The water flow is controlled by an automatic valve designed to hold temperature of cooled oil at 130° F. The valve temperature sensing bulb, in the cooler discharge oil line, directs the valve to decrease or increase water flow to the heat exchanger on oil temperature change. Use water free of scale forming minerals and silt.

WATER CONTROL VALVE FOR HEAT EXCHANGER (Figures 6 & 16) – The water control valve is adjustable to compensate for varying inlet water temperatures. To decrease water flow (increase oil temperature) insert adjusting rod into one of the holes in the adjusting screw and move from left to right, increasing spring tension. To increase water flow (decrease oil temperature) turn screw in the opposite direction. The rib through the adjusting screw wrench holes is an index line for use with the index scale 0 to 8 in obtaining a desired setting.

Care must be used when handling the capillary tube; a kink or break in the tubing or connections will make the valve inoperative. Never attempt to change capillary length.

If a leak develops through the packing, tighten the packing gland nut firmly with a wrench to reseat packing around valve stem, then back off nut until loose, and finally retighten nut finger tight. Tightening packing nut too tight may cause erratic operation. An occasional drop of oil on the valve stem at the packing nut will prolong packing life.

If valve malfunctions, check for foreign material in valve, erosion or thermal system (capillary) failure.

THERMOSTATIC MIXING VALVE (Figures 5 & 17) (used only on units equipped with radiator type oil cooler) is installed in the system as shown in the flow diagram (Figure 4). On start-up, with unit cold, the thermostat in the valve is open to the bypass line, allowing oil to circulate directly from oil reservoir to compressor during warm-up period. As the oil warms up, the thermostat gradually opens to allow oil from the cooler to mix with oil from bypass line. After unit is warmed up, the mixing valve maintains oil injected into compressor at a minimum of 130° F. This system provides proper compressor warm-up and prevents moisture contamination of the oil.

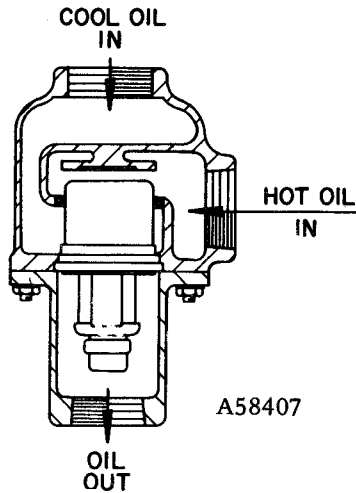


FIGURE 17. —
THERMOSTATIC
MIXING VALVE

To check thermostat, heat in oil — it should be wide open at 130° F. If unit shuts down due to high air discharge temperature, the cause may be that thermostat is stuck open in bypass position blocking cooler out of the system, in which case oil lines 1 and 2 (Figure 4) will be hot to the touch and lines 3 and 4 much cooler. When flushing oil system, remove mixing valve and clean all parts thoroughly. NOTE: Units with water cooled heat exchanger do not use mixing valve.

COMPRESSOR OIL SEPARATOR (Figures 4, 5 & 18) located in tower section of oil reservoir consists of a renewable cartridge type agglomerator element and a screen element, and provides final removal of oil from air stream. Oil from inside separator is returned through tubing to compressor cylinder. Oil carry-over through service lines may be due to malfunction of oil separator caused by blown gaskets and/or ruptured elements. This, in turn, may be due to using elements too long, or heavy dirt or varnish deposit caused by inadequate air filter service, use of improper oil or using oil too long. Collapsed separator elements are usually due to heavy dirt and varnish build-up in the filtering material.

Oil carry-over may also be caused by the oil return line inside the separator being too far off bottom, loose or broken connections, or by oil which foams excessively. When oil carry-over occurs, inspect separator only after it is determined that the 3/16" oil return line from discharge manifold to cylinder is not clogged.

The air pressure gauge mounted on instrument panel registers both the oil reservoir air pressure and service line pressure. When pressure differential between the two hands exceeds 8 PSI, change the agglomerator element as follows:

1. Disconnect all tubing, remove discharge manifold and lift separator from unit.
2. Remove bottom plate and elements.
3. Inspect and clean screen element and oil return tube. The screen element can be used for an indefinite period of time, provided it is cleaned at each agglomerator change. Usually, the only causes for replacement are physical damage or collection of large amounts of varnish so that it cannot be thoroughly cleaned.
4. Inspect (replace if necessary) screen element gasket on top cover (no gasket on bottom).
5. Inspect agglomerator element and gaskets bonded to each end. Replace if damaged or fouled with dirt.
6. Reassemble separator, being careful to center elements for effective seal. Make sure the return tube is positioned so the end practically touches the bottom plate. This can be checked with a straight edge across the element. Tighten bottom plate to hold elements securely.
7. When reinstalling assembly in reservoir tower, be sure oil return aligns with hole in manifold so oil will return to system through tubing. Handle elements carefully to prevent damage.

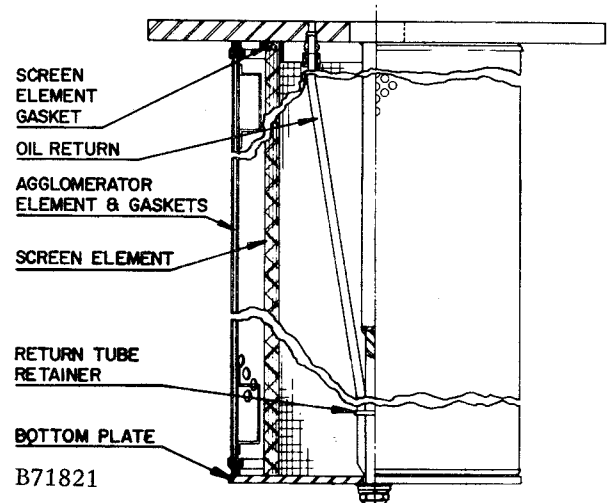


FIGURE 18. — OIL SEPARATOR

OIL PUMP (Figures 5 & 6) is positive displacement internal gear type and delivers correct pressure and volume. Pump discharge pressure will vary greatly with oil viscosity and air discharge pressure.

Oil pump pressure is checked at the tapped hole provided in the oil inlet boss on compressor end plate just below pump. Refer to "Compressor Oil System Check" below. A high pressure relief valve built into oil pump protects system from over-pressure.

The **Oil Pump Relief Valve** (Figures 6 & 19) contains a close fitting steel plunger, spring loaded for correct relief pressure. Relief valve may be disassembled as follows after removing pump from compressor:

1. Remove cover from pump and remove valve plug (1) from cover.
2. Normally, valve screw (2) should not be loosened or removed since it is factory set to correct relief pressure. If maintenance is necessary, remove valve screw (2), adjusting spring (8) and ball (9). DO NOT CHANGE NUMBER OR THICKNESS OF COPPER GASKETS (7) UNDER VALVE SCREW WHEN REASSEMBLING.

3. Remove plunger spring (3) and plunger (4).
4. Inspect cross-drilled hole in plunger bore. If edges of hole are not rounded, burr and clean thoroughly.
5. Inspect bottom edge of plunger bore "A". If edges are sharp, break edge and clean thoroughly.
6. Install plunger and spring. Plunger is close fit in bore — do not cock or force into bore. Spring must fit freely over plunger stem.
7. Inspect plug O-rings. Plug must have larger diameter ring (5) in top groove and smaller diameter ring (6) in bottom groove. Replace any damaged O-rings.
8. Replace plug. Watch O-ring as it threads past cross-drilled hole; it must turn past hole without damage. If O-ring is cut, remove plug, reburrr hole and replace with new O-ring.
9. Replace cover. Be sure plastic gaskets are in place between cover and pump body. REPLACE ANY DAMAGED PLASTIC GASKETS WITH IDENTICAL THICKNESS.
10. Replace pump on compressor. Check oil pump pressure at normal operating temperatures and discharge air pressure.

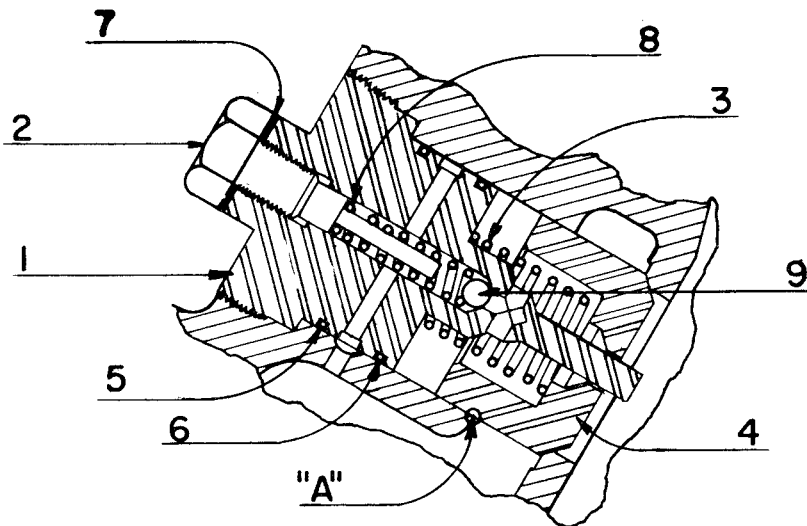


FIGURE 19. — OIL PUMP RELIEF VALVE

COMPRESSOR OIL SYSTEM CHECK — An oil temperature gauge (Figures 5 & 6) is furnished on the filter outlet (pump inlet) for checking oil inlet temperature to units. Expected temperatures using a water cooled heat exchanger are shown in table (following Figure 9) in "Installation" section. The following table shows temperatures that may be expected with a radiator type cooler under various ambient conditions:

AMBIENT TEMPERATURE	OIL INLET TEMPERATURE
Up to 80° F.	130°-135° F.
90° F.	140°-145° F.
100° F.	150°-155° F.
110° F.	160°-165° F.
120° F. Max.	170°-175° F.

Air and oil discharge temperature will be about 45° higher than oil inlet on Models ET150, ET200 and ET250 (3600 RPM units) and about 25° higher on Models ET75, ET100 and ET125 (1800 RPM units) if oil system is functioning normally at 100 PSIG. Oil pump pressure into the compressor with 90 PSI oil reservoir pressure should be 85-95 PSI.

FAN — Grease pillow block bearings once every 4000 hours or every six months with high quality ball bearing grease.

FAN BELT ADJUSTMENT — Check belt tension frequently. Loose belts cause slippage resulting in overheating, pulley wear and excessive belt wear. Overtight belts cause wear of bearings and shortened belt life. Belts are properly adjusted when belts deflect 1/4" midway between pulleys under a minimum force of 3-1/2 pounds and a maximum of 5-1/4 pounds. There will be a rapid drop of tension in a new drive during the "run-in" period. Tension new drives to 1/4" deflection under a 7-pound force and check tension frequently during the first eight hours of operation.

LOW UNLOADED HORSEPOWER SYSTEM (Figures 4 & 8) — This system incorporates an automatic hydraulic unloading valve (Figure 4) in the oil pump inlet line, an unloader pilot (Figure 8) mounted at the high point of the air receiver, a pressure regulator (Figure 8) mounted on the compressor inlet valve and an air-actuated blowdown valve with silencer mounted on the oil reservoir discharge manifold.

The unloader pilot is set at the factory to maintain the maximum and minimum required air receiver pressure. The range of this setting is 10% of the system's maximum working pressure. When the air receiver reaches this preset maximum pressure, the unloader pilot closes the compressor inlet valve and opens the blowdown valve releasing the pressure in the oil reservoir. Without pressure in the oil reservoir the hydraulic unloading valve in the pump inlet line closes allowing only a predetermined amount of oil for lubrication to pass into the compressor. The compressor then runs unloaded until the preset minimum air receiver pressure is reached. The unloader pilot then opens the compressor inlet valve and closes the blowdown valve allowing pressure to build up in the oil reservoir, the increase in pressure opens the hydraulic unloading valves allowing full oil flow to the compressor, and the compressor is again running at full load.

No adjustments other than the setting of the unloader pilot to the desired air receiver pressure, and the pressure regulator on inlet valve to 20 to 25 PSIG, are necessary.

TROUBLE SHOOTING

IF UNIT FAILS TO START check wiring system for wrong lead connections. Check manual reset on high air temperature shutdown switch.

UNIT STARTS BUT STOPS AFTER SHORT RUN, check for: high air discharge temperature caused by low compressor oil level, clogged oil cooler or oil filter, thermostatic mixing valve stuck, dirt on oil cooler core face, unit operating in area with poor ventilation, defective oil pump, fan belt slipping, oil pump relief valve stuck open, air temperature switch setting too low. Check manual reset on air temperature switch. Check for motor overload. Check unit for free rotation. If unit does not turn freely by hand, internal contact is indicated. Check at discharge port opening for possible scoring. Check oil pump for internal contact. On water cooled heat exchanger models – check for: water not turned on, low water supply, cooling water too hot, water tubes in heat exchanger fouled, oil side of heat exchanger fouled.

ACCELERATION TIME TOO LONG (in the case of manual starter) check for correct transformer tap. Check leads for adequate capacity for starting current. Check for low voltage. Check unit for proper oil viscosity.

COMPRESSOR DOES NOT UNLOAD, check for control malfunction, control lines from air receiver or discharge manifold for restriction. Check for air leaks in control system; inlet valve stuck or piston rings worn; pilot adjustment; pilot for dirt, leaky diaphragm or clogged bleed hole.

COMPRESSOR UNLOADS, BUT CONTINUES TO BUILD UP PRESSURE, check: inlet valve piston for binding or defective block vee ring or piston ring; inlet valve for binding or wear on seat, inlet housing gaskets for leaks.

COMPRESSOR UNLOADS CONTINUOUSLY – On units with Low Unloaded Horsepower System, check unloader pilot on air receiver for proper setting. Also check pressure regulator on inlet unloader valve for proper setting.

On units without Low Unloaded Horsepower System, check subtractive pilot for proper setting, ruptured diaphragm or broken springs.

UNIT FAILS TO SHUT DOWN ON START-STOP SYSTEM, check for control malfunction. Check: control lines from air receiver for restriction or leaks; pressure switch for dirt, leaky diaphragm, wiring to switch.

SOLENOID BLOWDOWN VALVE CONTINUES TO PASS AIR, check for loose leads. If wiring is correct, check for coil failure. Operation may continue by plugging valve outlet and blowing down reservoir with manual blowdown valves until solenoid valve can be replaced.

RESERVOIR PNEUMATIC BLOWDOWN VALVE CONTINUES TO PASS AIR, check for dirt in unloader pilot; loose connections in air line from unloader pilot to blowdown valve; defective blowdown valve.

EXCESSIVE OIL CONSUMPTION, check for: oil carry-over through discharge line caused by overfilling reservoir; clogged oil return line; return line inside separator loose at top connection or too far off bottom; bottom plate holding elements blocking end of return line; defective oil separator elements, gaskets or loose assembly; incorrect oil causing foam; operation below minimum reservoir pressure. Check all fittings and gaskets for oil leaks.

COMPRESSOR LOW ON DELIVERY AND PRESSURE, check for: clogged air filter; closed inlet valve caused by subtractive pilot not in adjustment; broken inlet valve spring; binding inlet valve piston; incorrect motor speed. Insufficient oil circulation due to: fouled oil system; oil filter element in backwards; oil pump defective.

NOTE: For explanation and adjustment of Controls, refer to Control Bulletin.

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GRAND JUNCTION, COLORADO - 81501
2909 North Avenue
HARTFORD (BLOOMFIELD), CONNECTICUT - 06002
81 Old Windsor Road
HIALEAH, FLORIDA - 33013
3630 East 10th Court
HOUSTON, TEXAS - 77027
3325 South Rice Avenue
INDIANAPOLIS, INDIANA - 46203
2228 Shelby Street

KANSAS CITY (SHAWNEE MISSION), KANSAS - 66201
9101 Bond Street
KNOXVILLE, TENNESSEE - 37917
709 North Fifth Avenue
LAFAYETTE, LOUISIANA - 70501
200 Vanway Street
LOS ANGELES (WHITTIER), CALIFORNIA - 90601
2555 Pellissier Place
LOUISVILLE, KENTUCKY - 40207
4050 Westport Road
MILWAUKEE, WISCONSIN - 53209
5148 North Teutonia Avenue
MINNEAPOLIS, MINNESOTA - 55431
1701 West 80th Street
NEW ORLEANS (HARVEY), LOUISIANA - 70058
1100 Destrehan Avenue
NEW YORK DOMESTIC (MAHWAH, NEW JERSEY) - 07430
386 State Highway No. 17
ODESSA, TEXAS - 79760
East Highway 80
OKLAHOMA CITY, OKLAHOMA - 73129
2200 South Prospect Avenue
PHILADELPHIA (HORSHAM) PENNSYLVANIA - 19044
406 Caredean Drive
PHOENIX, ARIZONA - 85009
2020 N. Black Canyon Highway
PITTSBURGH, PENNSYLVANIA - 15205
Parkway West - 4499 Campbells Run Road
QUINCY, ILLINOIS - 62301
Gardner Expressway
ST. LOUIS (HAZELWOOD), MISSOURI - 63042
6011 N. Lindbergh Blvd.
SALT LAKE CITY, UTAH - 84115
35 West Louise Avenue
SAN DIEGO, CALIFORNIA - 92123
5345 Overland Avenue
SAN FRANCISCO (SOUTH SAN FRANCISCO), CALIFORNIA - 94080
144 West Harris Avenue
SEATTLE, WASHINGTON - 98104
623 Eighth Avenue, South
SHREVEPORT, LOUISIANA - 71107
1025 Joseph Street
TOLEDO, OHIO - 43614
2415 S. Byrne Road
TULSA, OKLAHOMA - 74145
4259 So. 76th East Avenue
WALLACE, IDAHO - 83873
502 Bank Street
MEXICO 1, D.F. MEXICO
Apartado 575

CANADA

GARDNER-DENVER COMPANY (CANADA), LIMITED

EDMONTON, ALBERTA - 9835 - 42 Ave.
MONCTON, NEW BRUNSWICK - East Main St.
MONTREAL 28, QUEBEC - 6825 St. James St. West
NELSON, BRITISH COLUMBIA - 608 Railway St.
NORTH BAY, ONTARIO - 693 Cassells St.

SUDBURY, ONTARIO - 1868 LaSalle Blvd., East
TORONTO (SCARBOROUGH), ONTARIO -
1500 Ellesmere Road
VANCOUVER 9, BRITISH COLUMBIA - 1775 Pine St.
WINNIPEG 21, MANITOBA - 1380 Sargent Ave.

INTERNATIONAL

GARDNER-DENVER INTERNATIONAL -- QUINCY, ILLINOIS GARDNER-DENVER INTERNATIONAL -- 233 Broadway, New York, N. Y.

ARGENTINA -- BUENOS AIRES
AUSTRALIA -- SYDNEY, MELBOURNE, HOBART, BRISBANE,
ADELAIDE, PERTH, KALGOORLIE
BELGIUM -- BRUSSELS
BRAZIL -- BELO HORIZONTE, RIO DE JANEIRO,
SAO PAULO
CHILE -- SANTIAGO
COLUMBIA -- BARRANQUILLA
ENGLAND -- LONDON
HOLLAND -- SCHIPHOL

ITALY -- MILAN
LEBANON -- BEIRUT
NEW ZEALAND -- OTARA (AUCKLAND)
PERU -- LIMA
SINGAPORE -- SINGAPORE
SOUTH AFRICA -- JOHANNESBURG
SWEDEN -- STOCKHOLM
VENEZUELA -- CARACAS
ZAMBIA -- NDOLA

FACTORIES

DALLAS, TEXAS
DENVER, COLORADO
GRAND HAVEN, MICHIGAN
GREEN BAY, WISCONSIN
LA GRANGE, MISSOURI
QUINCY, ILLINOIS

REED CITY, MICHIGAN
YORK, PENNSYLVANIA
JOHANNESBURG, S. AFRICA
RIO DE JANEIRO, BRAZIL
WOODSTOCK, ONTARIO, CANADA
WESTHAUSEN, GERMANY



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