

13-11-601  
1st Edition

**GARDNER DENVER®**

**TWISTAIR®**

**OIL-FREE**

**EWD**

**ROTARY SCREW**

**COMPRESSOR**

**OPERATING AND  
SERVICE MANUAL**

**Gardner  
Denver**

## **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:

### **DANGER**

**Failure to observe the following will result in injury to or death of personnel.**

- **Do not operate unit if safety devices are not operating properly. check periodically. Never bypass safety devices.**
- **Keep fingers and clothing away from revolving fan, belts, and sheaves.**
- **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, 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 will result in injury or death to personnel. open main disconnect switch before working on the control. Compressor unit must be grounded in accordance with the National Electrical Code.**
- **Disconnect the compressor unit from its power source before working on the unit -- this machine is automatically controlled and may start at any time.**
- **Do not modify unit without written permission from manufacturer's engineering department.**
- **Do not operate compressor in areas where there is a possibility of ingesting flammable or toxic fumes.**

## **WARNING**

**Failure to observe these notices could result in personal injury or 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 value shown on the nameplate.**
- **Bearings can be damaged by passage of current. do not electric weld on the compressor or base.**
- **Inspect the separator tank for fatigue cracks and inspect all pipe and tube connections for looseness or leakage on at least an annual basis.**
- **Compressor initial fill and make-up water must meet the united states environmental protection agency drinking water regulation.**
- **The oil-free compressed air discharged from the unit will be mixed with contaminants that enter the intake of the compressor.**

## FORWARD

Gardner-Denver® 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. The following terminology is used throughout this manual to indicate procedures and operations.

## DANGER

**Danger is used to indicate the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored.**

## WARNING

**Warning is used to indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if the warning is ignored.**

## CAUTION

**Caution is used to indicate the presence of a hazard which will or can cause minor personal injury or property damage if the warning is ignored.**

## NOTICE

**Notice is used to notify people of installation, operation or maintenance information which is important but not hazard-related.**

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For a summary of repair parts itemized by part number, refer to Gardner Denver® EWD Rotary Screw Compressor Parts Book.

## SECTION 1 GENERAL INFORMATION

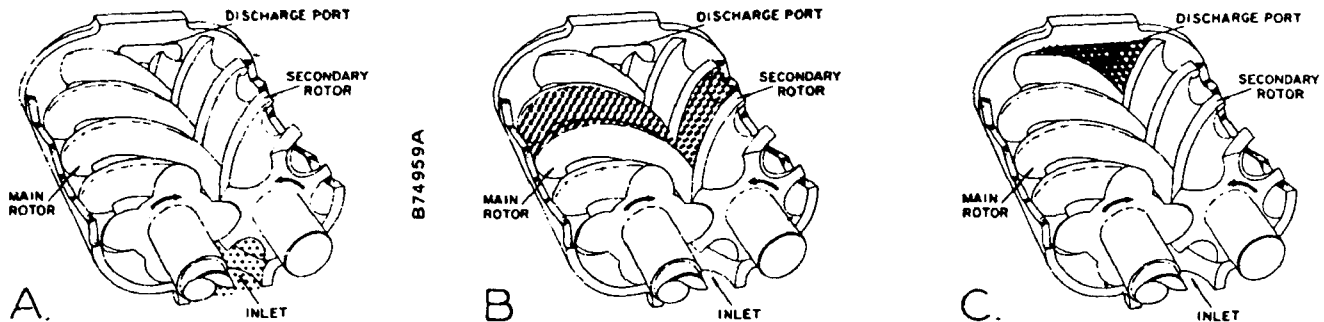


FIGURE 1-1 - COMPRESSION CYCLE

**COMPRESSOR** - The Gardner-Denver® compressor is a single stage, positive displacement rotary machine using helical rotors to effect compression. Both rotors are supported between bearings located outside the compression chamber.

**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. Water is injected into the cylinder to remove the heat of compression and seal internal clearances. Volume reduction and pressure increase continues until the air/water mixture trapped in the interlobe cavity by the rotors passes the discharge port and is released to the 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 1-2) - Air enters the air filter and passes through the inlet unloader valve to the compressor. After compression the entire air/water mixture flows to the heat exchanger and then into the separator tank where the water is removed by velocity change and impingement. Finally the air passes through the minimum pressure/check valve and to the plant air system.

**WATER SYSTEM** (Figure 1-2) - Water is forced by air pressure from the separator tank through the water filter into the compression chamber injection ports. The water removes the heat of compression and seals internal clearances. Seals minimize water leakage out of the compression chamber.

The automatic water management system provides means for the compressor unit to add or drain water to maintain the correct operating levels in the separator vessel. When high humidity air is compressed excess water separates from the air in the separator vessel. This added water is automatically sensed by a water level control which opens the drain solenoid valve. When low humidity air is compressed some of the water in the system is carried out with the discharge air. In this case the water level control opens the fill solenoid valve to add water to the system.

**LUBRICATION SYSTEM** (Figure 1-3) - An oil reservoir is located directly below the compressor to supply oil for lubrication of the compressor bearings and gears. Oil passes through a strainer in the oil reservoir to the pump, oil filter and then into the bearings/gears. Seals between the bearing housings/compression chamber prevent oil from escaping and water from contaminating the oil.

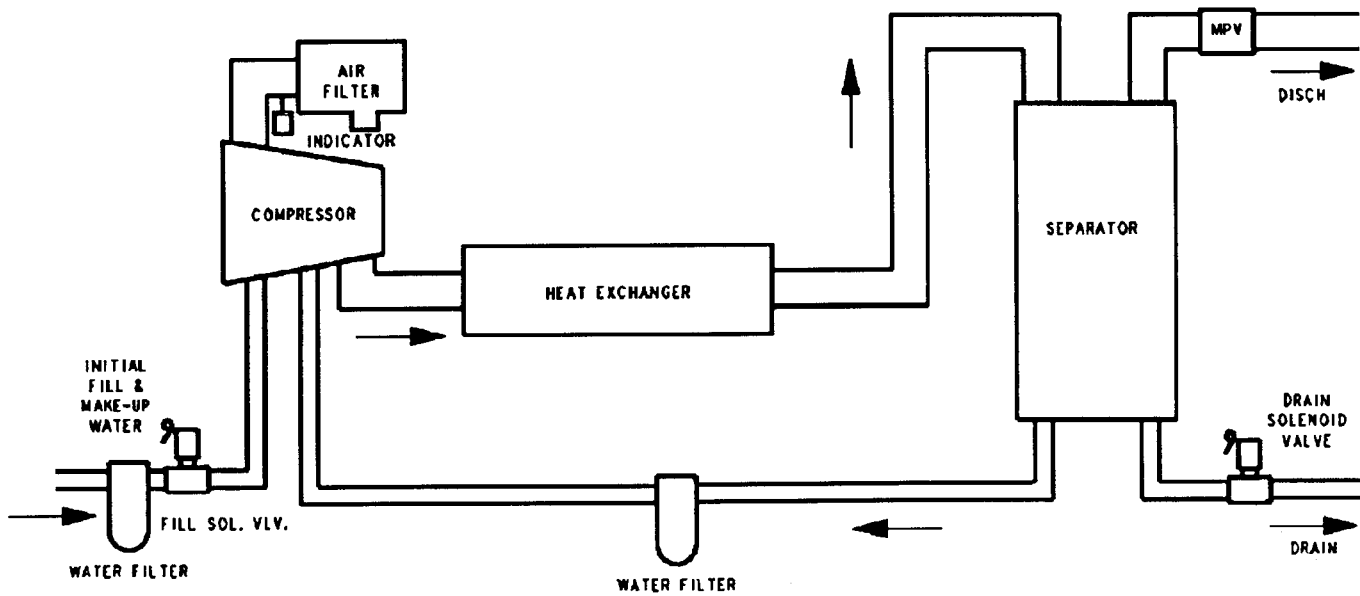


FIGURE 1-2 - AIR/WATER SYSTEM

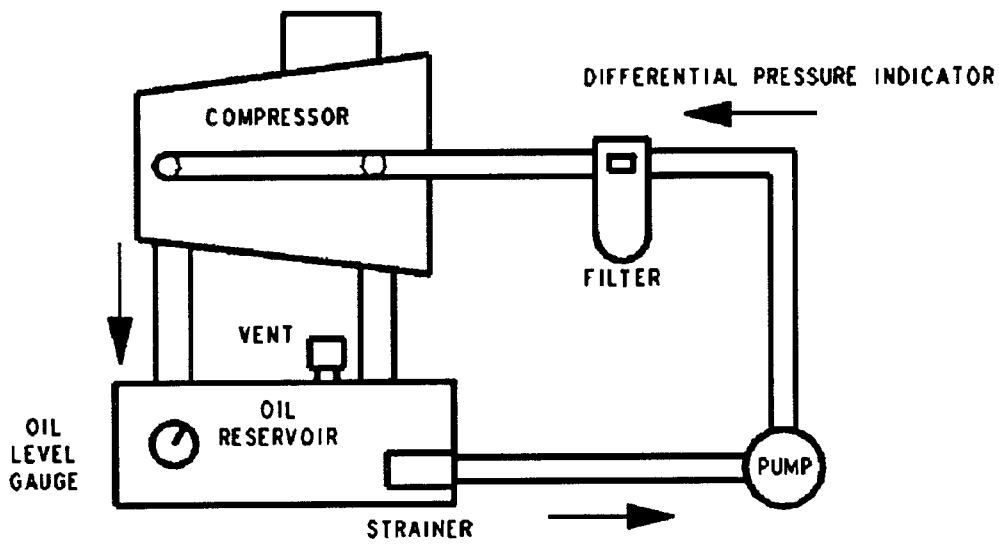


FIGURE 1-3 - LUBRICATION SYSTEM

**GARDNER DENVER® ROTARY SCREW  
EWD ENGINEERING DATA SHEET**

Model (Motor Horsepower)			50	60	75
Service Pressure		PSIG	110	110	110
Inlet Capacity		CFM	200	250	300
Horsepower		BHP	55	66	82
Drive Motor Speed		RPM	1775	1775	1775
Main Rotor Speed		RPM	4332	5300	6605
Comp. Injection Water Flow		GPM	10	10	10
Temperature Rise (Disch. - Inj.)		°F	27	32	40
Approach (Service Temp. - Ambient)		°F	20	24	30
Heat Rejection Water Cooler/Aftercooler		Btu/Min	2100	2520	3130
Radiated Heat		Btu/Min	190	220	280
Cooling Fan Air Cooled:					
Motor Horsepower		Bhp	3	3	3
Capacity		CFM	12,000	12,000	12,000
Vent Fan Water Cooled:					
Motor Horsepower		Bhp	1/4	1/4	1/4
Capacity		CFM	2,000	2,000	2,000
Compressor Potable Injection Water:					
Supply Pressure Range		PSIG	30-100	30-100	30-100
Theoretical Usage	Rel. Hum.	Temp.	**	NOTE 1	
Made (Lost)	20%	40°F		Gal/Hr	0 (0.1)
	20%	70°F		Gal/Hr	0 (0.1) (0.3)
	20%	100°F		Gal/Hr	0 (0.1) (0.5)
	60%	40°F		Gal/Hr	0.2 0.3 0.2
	60%	70°F		Gal/Hr	0.6 0.8 0.7
	60%	100°F		Gal/Hr	1.6 2 2
	100%	40°F		Gal/Hr	0.4 0.6 0.6
	100%	70°F		Gal/Hr	1.3 1.6 1.7
	100%	100°F		Gal/Hr	3.3 4.2 4.6
Cooling Water (Water Cooled):					
Flow Rate	@ 60 °F	**NOTE 2		Gal/Min	5 6 8
	@ 90 °F	**NOTE 2		Gal/Min	13 15 19
Pressure Drop		PSI	0.5-1.0	0.5-1.0	0.5-1.0
Separator Capacity (Water)		Gal	10	10	10
Separator Volume Air above Water		Gal	20	20	20
Oil Reservoir Capacity (Oil)		Gal	5	5	5
Service Connection - Air Discharge		FPT	2	2	2
Ambient Range		F	35-105	35-105	35-105
Service Pressure Full Load Range		PSIG	65-110	65-110	65-110
Sound Level at One Meter:					
Air Cooled		dB(A)	84	84	84
Water Cooled		dB(A)	82	82	82
Shutdown Device Settings:					
High Discharge Temperature		°F	190	190	190
High Oil Temperature		°F	190	190	190
Motor Overload			Based on Motor Nameplate Amps		
Water Filter Press. Drop		PSI	Flash at 30, Shutdown at 40		
Low Oil Pressure		PSI	20	20	20
Overall Unit Dimensions:					
Water Cooled		in	92" L x 54" W x 67.25" H		
Air Cooled		in	92" L x 54" W x 71.12" H		

\*\* NOTE 1 - Does not include loss due to seal leakage if any.

\*\* NOTE 2 - Based on 110 °F cooling water discharge.

## 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.

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

### WARNING

**Personal injury or equipment damage may result when using the motor eye bolts or lugs for lifting the machine. Use the defined machine lifting locations only when moving the machine.**

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

**LOCATION** - The compressor should be installed in a weatherproof, 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. Sufficient air flow, Figure 2-2, for the compressor oil/aftercooling system and for electric motor cooling is required. Do not block the air flow to and from the unit. Allow three (3) feet to the nearest obstruction on both ends and both sides of the unit. Also allow three (3) feet to the nearest obstruction above the enclosure.

### INSTALLATION FOR COLD WEATHER OPERATION

- The unit must be installed inside a shelter that will be heated to temperatures above freezing (35° F, 2° C).

**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 10° angle lengthwise or 10° sidewise.

Mounting bolts are not normally required. However, installation conditions such as piping rigidity, angle of tilt, or danger of shifting from outside vibration or moving vehicles may require the use of mounting bolts and shims to provide uniform support for the base. The belt alignment and tension should be checked after installation.

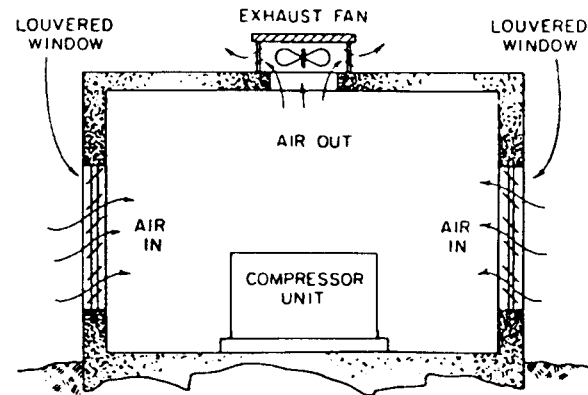
**COMPRESSOR AIR INTAKE** - The air intake can be piped to a remote location, if necessary, to obtain a proper air supply.

### NOTICE

**The oil-free compressed air discharged from the package has been mixed with contaminants that enter the intake of the compressor.**

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. See Figure 2-3 for size information.

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



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FIGURE 2-1 - TYPICAL COMPRESSOR ROOM

### Minimum Air Flow For Compression And Cooling (Cubic Feet/Minute)

All Models (Air Cooled) .....	12000 cfm
All Models (Water Cooled) .....	2000 cfm

FIGURE 2-2

Length of Inlet Line Diameter of Pipe Size	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

FIGURE 2-3 - INLET LINE CHART

**OIL BREATHER** - To prevent oil leakage in shipment the breather vent normally located in the top of the reservoir is replaced by a plug. Before operating unit remove the 1-1/4 inch plug and install the breather.

To prevent introduction of oil fumes from the oil sump vent into the compressor room or compressor inlet, the oil breather may be remote mounted.

**NOTICE**

**When remote mounting the oil breather, be certain there are no low places in the piping where oil could collect and prevent proper venting of the oil sump.**

**OIL RESERVOIR DRAIN** - The oil drain is piped from the bottom of the reservoir to the end of the base. This drain is approximately four (4) 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 during maintenance. Be sure to allow enough space around the unit for the doors to open completely. Any one of the doors may be removed by opening the door and lifting it up slightly to disengage the opposite end. The doors can then be removed.

**WARNING**

**Unit can automatically restart which can cause personal injury or death. Know mode of operation before working on or near the machine.**

**COMPRESSOR WATER SPECIFICATION** - The compressor initial fill and make-up water must meet the United States Environmental Protection Agency National Primary Drinking Water Regulation (See Table at end of this section, Page 4). By requiring potable water fit for human consumption, a quality level is defined which is most generally readily available.

NOTE: Once used the water in the compressor may no longer be potable.

**WARNING**

**Use of compressor initial fill and make-up water not meeting all water specification standards noted may result in contamination of the discharge air stream.**

In addition to the requirements of the National Primary Drinking Water Regulation the following two limits shall not be exceeded:

	<u>Maximum Limit</u>
1) Total Hardness as CaCO <sub>3</sub>	150 parts per million
2) Either Total Dissolved Solids or Specific Conductance	500 parts per million 800 Micromhos/cm

FIGURE 2-4 - ADDITIONAL LIMITATIONS

## **WARNING**

**Use of compressor initial fill and make-up water exceeding these limits could result in excessive scale formation damaging the equipment.**

If a proposed water supply is questionable, the water should be analyzed. If the water does not comply with this specification a water treatment service can recommend equipment to satisfy this specification. Hardness can often be reduced by using a sodium ion exchange water softener.

### **Water Cooled Heat Exchanger Cooling Water:**

The heat exchanger is a multiple pass type with cooling water in the tubes and compressor recirculating water in the shell. The cooling water for the water cooled heat exchanger does not have to meet the compressor recirculating system potable requirement. A separate supply source can be utilized subject to considerations of corrosion, scale formation, and fouling tendency.

**DISCHARGE SERVICE LINE** - When manifolding two or more EWD units on the same line, each unit is isolated by the check valve in the unit discharge line. If an EWD 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 EWD unit and a reciprocating compressor are manifolded together, an air receiver must be located between the two units.

## **DANGER**

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

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

The oil-free air discharging from the EWD package is saturated with water vapor at discharge temperature. An air dryer may be required if the air is used in a moisture sensitive process. In addition, the compressed air has

been mixed with contaminants that entered the intake of the compressor.

**COMPRESSOR WATER DRAIN** - The compressor drain port should be connected to a floor drain. The drain line must slope downward away from the unit to allow excess condensate to flow by gravity. As necessary the automatic water management system will open the drain solenoid valve to drain excess water. Since the compressor may be at operating pressure and temperature when the drain solenoid valve opens, the hot water will spray out of the compressor water drain port at high pressure. It is recommended that the compressor water drain port be hard piped to the floor drain.

## **DANGER**

**Hot water under pressure will cause severe personal injury or death. Do not operate compressor until a water drain line is installed from the compressor water drain port to a floor drain.**

**ELECTRICAL WIRING** - The 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 12 starter and control enclosure. See "Location" paragraph for distance to nearest obstruction on starter/control box side of the unit.

## **WARNING**

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

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

## U.S. EPA National Drinking Water Regulations \*

<u>Primary<sup>1</sup> Constituents</u>	<u>Secondary<sup>2</sup> Constituents</u>	<u>Maximum Contaminant Level Parts Per Million</u>
<b>Inorganic</b>		
Arsenic		0.05
Barium		1
Cadmium		0.01
Chromium		0.05
Fluoride		4
Lead		0.05
Mercury		0.002
Nitrate-Nitrogen		10
Selenium		0.01
Silver		0.05
	Chloride	250
	Copper	1
	Iron	0.3
	Manganese	0.05
	Sulfate	250
	Zinc	5
<b>Organics</b>		
Dischlorophenoxy Acetic Acid (2,4-D)		0.1
Endrin		0.0002
Lindane		0.004
Methoxychlor		0.1
Trichloroxypropionic Acid (2,4,5-Tp Silvex)		0.01
Total Trihalomethanes		0.1
Toxaphene		0.005
<b>Radionuclides</b>		
Radium 226 and 228 combined		5 pCi/L
Alpha Particle		15.0 pCi/l
Beta Particle		4 mRem/year
<b>Biological</b>		
Coliform Bacteria		10/L monthly average
<b>Physical Characteristics</b>		
Turbidity		5 NTU
	Color	15 Color Units
	Corrosivity	Noncorrosive
	Foaming Agents	0.5
	Odor	3 (threshold odor number)
	pH	6.5 to 8.5
	Total Dissolved Solids	500

<sup>1</sup> Primary - Toxic health hazard, enforceable maximum.

<sup>2</sup> Secondary - Aesthetic characteristics, desirable goals not enforceable.

\* For general information only - refer to the U.S. EPA for current requirements, additional regulations may be in effect.

## 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 reservoir oil level. Oil level must be within the operating range. Add or drain oil to correct level using the same type of oil. Check to ensure the vent is installed in the top of the oil reservoir and is open to allow free passage of air.

### DANGER

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

### CAUTION

Use of improper lubricants will cause damage to equipment. Do not mix different types of lubricants or use inferior lubricants. See Section 5 for lubricant recommendations.

2. **Air Filter** - Inspect the air filter to be sure it is clean and tightly assembled. Be sure the inlet line, if used, is tight and clean.
3. **Alignment** - Check all bolts and cap screws for tightness.
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 2 for installation instructions.
6. **Enclosure** - Check for damaged panels or doors. Check all screws and latches for tightness. Be sure doors are in place.
7. **Operating Mode** - Refer to Section 4 for detailed information on the control system.
8. **Rotation** - Check to ensure correct compressor rotation. An arrow on the compressor/motor cou-

pling housing shows correct rotation is counterclockwise facing opposite the drive end of the compressor.

### WARNING

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

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

### WARNING

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

### 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. Start the unit by pushing either the "CONSTANT RUN" button or one of the "AUTO" buttons. Run for approximately one minute and then open the air service valve.

**Unit Hot** - No warm-up period is required. Close the air service valve. Start the unit by pushing either the "CONSTANT RUN" button or one of the "AUTO" buttons. Open the air service valve.

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

**STOPPING THE UNIT** - Close the air service valve, allow the unit to build up to full unload pressure and unload. Press the "STOP-RESET" button. Open the air service valve.

## SECTION 4 CONTROLS & INSTRUMENTATION

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

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

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

**Water Filter Differential Pressure** - The water filter differential pressure is continually monitored by the microprocessor controller. At a differential of approximately 30 PSI, the "CHANGE SEPARATOR" LED located on the control keypad is flashed indicating required maintenance. If the warning is ignored, and the separator differential continues to increase, the microprocessor controller will stop the unit and the LED will remain on steady. See "Control System Operation" in this section for further information on operation of the microprocessor controller.

**High Discharge Air Temperature** - The compressor is protected from high discharge temperature by a thermistor probe.

**High Oil Temperature** - The compressor is protected from high oil temperature by a thermistor probe.

The microprocessor controller will shut the compressor down if the temperature sensed at either location exceeds 190° F. See "Control System Operation."

### CAUTION

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

**Low Oil Pressure** - The oil pressure is monitored and if the pressure falls below 20 PSIG the controller will shut the compressor down.

**Relief Valve** - Pressure relief valves are installed between the compressor discharge and the aftercooler and in the separator. The valves are set at the factory for protection against overpressure. Periodic checks should be made to insure their proper operation.

The relief valves should be tested for proper operation at least once every year. To test the relief valve, raise the

system operating pressure to 75% of the relief valve set pressure and manually open the valve with the hand lever. Hold the valve open for a few seconds and allow it to snap shut.

### WARNING

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

### CAUTION

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

### WARNING

**Operation of unit with improper relief valve setting can result in severe personal injury or machine damage.**

**Insure properly set valves are installed and maintained.**

**Blowdown Valve** (Figure 2-1) - The blowdown valve releases pressure from the separator. See description under "Air Control Components" in this section for construction and operation information.

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

**Oil Sight Gauges** (Figure 1-3) - This gauge indicates the level of the oil in the reservoir.

**Compressor Air Inlet Filter** (Figure 1-2) - An air filter differential pressure indicator shows the air filter pressure drop.

All other instruments are a part of the microprocessor controller. See "Control System Operation."

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

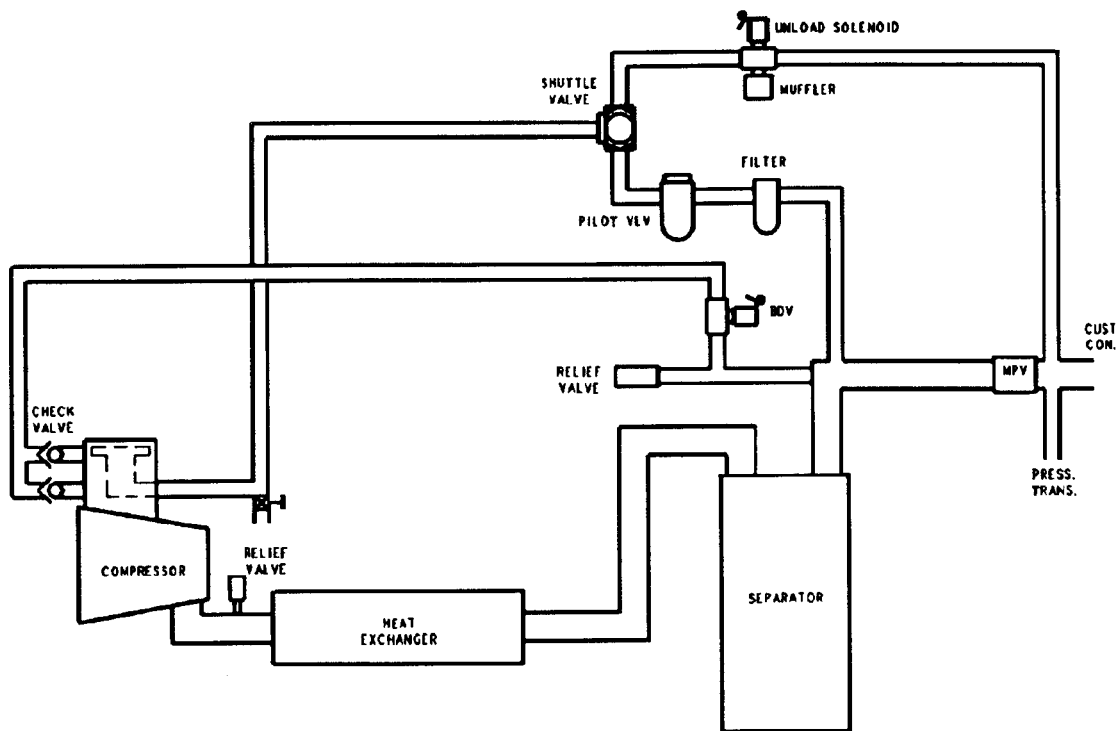


FIGURE 4-1 - CONTROL SCHEMATIC

**Inlet Valve** (Figure 4-2) - 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. Modulating control feature: when the control pressure is less than 18 psig, the inlet valve will modulate to match compressor capacity to system demand.

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

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

**STARTER/CONTROL BOX** - 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.

**SOLID STATE ELECTRONIC CONTROLLER** - Instant on, permanent memory, solid state electronic controls are just a few of the state-of-the-art features standard on the EWD compressor package. The controller has built-in digital and LED lamp test and self diagnostic capability every time the controller is energized. The membrane touch pad panel offers an unequalled number of operating modes as well as assurance displays.

Panel mounted digital readouts provide discharge air and separator operating pressures and temperatures. Selection of an operating mode is as simple as pushing a button on the panel mounted touch pad. The ease of operation, together with the number of standard operating modes allows our customers the flexibility to meet their compressed air demands. An illuminated LED indicates the operating mode selected.

Control system operating modes include:

- **STOP/RESET button with LED** - This button is used for normal stop function, reset any operating function or reset assurance/service functions after correcting shutdown conditions. In addition, this button is used in the procedure to adjust load and unload operating pressures.

If the unit is running loaded when the STOP/RESET button is pressed the compressor will run 40 seconds, unloaded, before stopping. This provides time for the separator tank to blowdown to zero pressure.

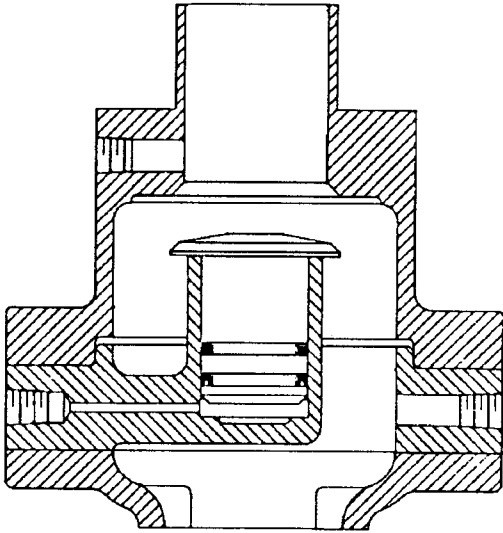


FIGURE 4-2 - INLET VALVE

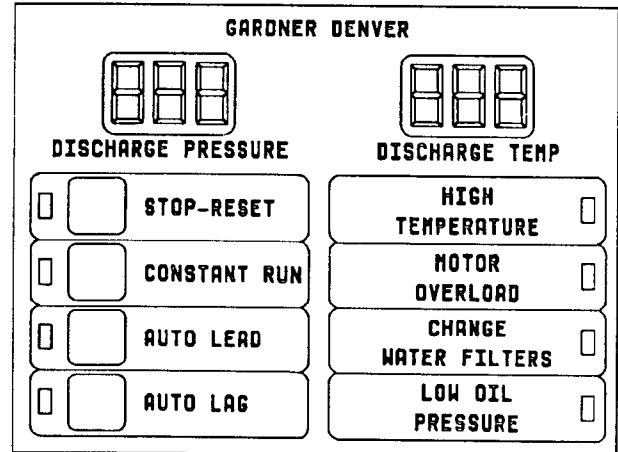


FIGURE 4-3 - TOUCH PAD

- **CONSTANT RUN button with LED** - This button is used to operate the unit in the constant run capacity control mode. In this mode the compressor runs continuously, loading and unloading in response to air demand. With modulating control this mode then allows modulating capacity control where the inlet valve will open or close to match system demand within 20% to 100% of compressor capacity.
- **AUTO LEAD button with LED** - This button is used to operate the unit in the "auto-start/timed-stop" mode, either by itself or as the lead compressor in a lead/lag sequence arrangement. Loading and unloading or optional modulating occurs as in the constant run mode. However, if the compressor runs unloaded for a period of 10 minutes, the unit will stop. The compressor will remain in the auto lead mode and will restart when system pressure reaches the programmed load set point.
- **AUTO LAG button with LED** - This button selects the lag unit in a lead-lag sequence arrangement. Operation is identical to auto lead except the load and unload pressure set points are automatically 5 PSI lower than programmed.

The auto lead and auto lag sequence control of two EWD units does not require any external wiring. All that is necessary is that both units are piped into the same header.

In addition to these operating functions, this electronic controller provides the following assurance and service functions that ensure the compressor is properly maintained.

- **HIGH AIR TEMPERATURE LED** - The compressor is protected from high discharge temperature by two independent thermistor probes. One

probe is located in the compressor discharge housing to sense compressor discharge air temperature. The second probe is located in the oil line and senses the temperature of the oil.

The microprocessor controller will shut the compressor down if the temperature sensed at either location exceeds 190°F.

At the time of a high temperature shutdown, the LED is illuminated and the temperature digital readout is locked to "Air" or "Oil". Pressing "Stop/Reset" will extinguish the LED (if the temperature has lowered below 190°F) and revert the digital readout to displaying actual discharge temperature.

- **MOTOR OVERLOAD LED** - This LED indicates that the motor starter overload heaters have tripped the motor overload relay and shut down the motor.
  - **CHANGE WATER-FILTER LED** - This LED will flash when the differential pressure across the filter reaches approximately 30 PSI. At this point, the filter element should be scheduled for service at the earliest opportunity.
- Should the condition be ignored and allowed to further deteriorate, the compressor will be shutdown and the LED illuminated steadily when the differential pressure reaches 40 PSI.
- **LOW OIL PRESSURE LED** - This LED indicates that the oil pressure switch is open. The oil pressure switch contacts open if oil pressure drops below 20 PSIG. Pressing "Stop/Reset" will extinguish the LED. The microprocessor controller allows the compressor to run 15 seconds on start-up giving the pump time to increase oil pressure above 20 PSIG.

## CAUTION

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

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

The digital readouts are also used to display error messages. These error messages correspond to various indications concerning condition of the pressure and temperature sensors and EMERGENCY STOP condition. See Figure 4-4 below for definitions of error messages.

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

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

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

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

## WARNING

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

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

## NOTE

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

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

Pressure: the current unload setpoint

Temperature: **U l d** indicating that the pressure value is the "unload" value.

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

## WARNING

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

Pressure Readout		Temperature Readout	
Error #	Meaning	Error #	Meaning
E01	Failure of final disch. sensor	E01	Failure of compressor sensor
E02	Failure of water injection sensor	E02	Failure of oil sensor
E03	Failure of both sensors	E03	Failure of both sensors
E04	EMERGENCY STOP		

FIGURE 4-4 - DEFINITIONS OF ERROR MESSAGES

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

Pressure: the current load setpoint

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

Step 6: Raise or lower the load setpoint in the same manner as the unload setpoint in Step 4. NOTE: The load setpoint cannot be set within 8 PSI of the unload setpoint.

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

#### LEAD-LAG OPERATION OF TWO COMPRESSORS -

The microprocessor controller provides the capability of true lead-lag operation without the need to purchase any additional equipment and without complicated interconnecting wiring.

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

Step 1: Program the load and unload pressure setpoint on both units to the same value. For example: Compressor "A" load at 92 PSI; unload at 100 PSI. Compressor "B" load at 92 PSI; unload at 100 PSI.

### WARNING

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

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

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

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

equalizing machine wear and minimizing maintenance costs.

**Pneumatic Control System Operation** (Figure 4-1) - In the "CONSTANT RUN" mode the motor runs continuously as the compressor loads or unloads to meet air demand. As the demand for compressed air decreases, the system air pressure increases.

When system air pressure exceeds the programmed unload setpoint, the unloader and blowdown valves open and air is directed to three (3) separate locations:

1. Pressurized air is directed 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 rotary screw compressors when unloaded.
3. Pressurized air is exhausted to the atmosphere to blow down the separator.

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 programmed load setpoint, the unload and blowdown valves will close, allowing the compressor to load.

In either "AUTO" mode, the motor will stop after the compressor has run unloaded for 10 minutes. When stopped the separator will blow down to atmospheric pressure as the compressor is not operating. The starting of the motor is also subject to a delay by the controller which prevents starting if there is more than 5 psig pressure in the separator.

### WARNING

Unit can automatically restart causing personal injury.

Know operating mode before working on or near machine.

**MODULATING CONTROL SYSTEM:** - This system consists of subtractive pilot valve in addition to the standard control system. The difference in operation, whether in "CONSTANT RUN" or either "AUTO" mode, is that the subtractive pilot valve allows reservoir air pressure to open or close (modulate) the inlet valve to match system demand.

This modulation occurs before the compressor is unloaded by the microprocessor controller.

Thus the number of load/unload or start/stop cycles is often reduced, and the unit responds more quickly to changes in system air demand. This modulating feature is in effect when system air demand is approximately between 20% to 100% of compressor capacity.

**Subtractive Pilot** - The subtractive pilot is an adjustable, spring-loaded diaphragm valve that controls pressure in

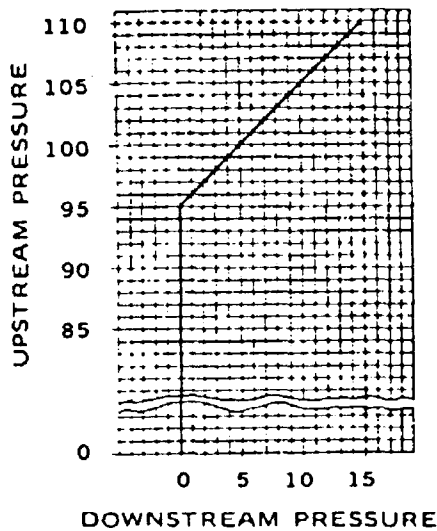


FIGURE 4-5

relation to the upstream (discharge) pressure.

The downstream pressure is maintained equal to the upstream pressure minus a constant which is adjustable. In the example shown in Figure 4-5, 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 the downstream pressure is vented below 95 psig.

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

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

**Operating Air Pressure Adjustment** - The microprocessor controller load and unload pressure setpoints should already be programmed.

**WARNING**

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

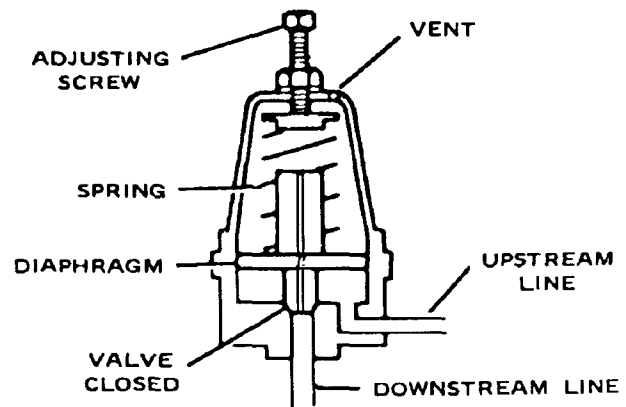


FIGURE 4-6 - SUBTRACTIVE PILOT (Closed)

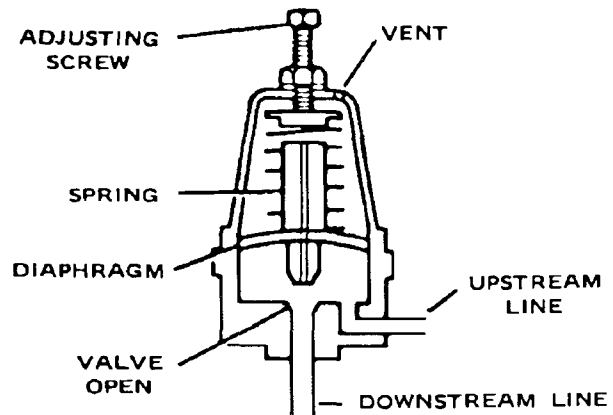


FIGURE 4-7 - SUBTRACTIVE PILOT (Opened)

To adjust the subtractive pilot:

1. With the unit off, loosen the locknut and back out the adjusting screw several turns so the subtractive pilot will fully unload the compressor before the unload pressure setpoint of the microprocessor controller is reached.
2. Close the air service valve and start the unit in the "CONSTANT RUN" mode. Allow the unit to reach the pressure at which the subtractive pilot fully unloads the compressor.
3. Turn-in the adjusting screw until the unload pressure setpoint is reached and the microprocessor

controller allows the unit to blow down.

4. Turn-in the adjusting screw an additional one-eighth (1/8) turn and tighten the locknut. As a result, the subtractive pilot will not fully unload the compressor before the microprocessor controller's un-

load pressure setpoint is reached.

5. Using the air service valve, cycle the unit between load and unload several times to be certain that the unit will reach the microprocessor controller's unload pressure setpoint and blow down.

NAMEPLATE FULL LOAD OPERATING PRESSURE	STANDARD CONTROL SYSTEM	
	LOAD	UNLOAD
110	110	120

**NOTE**

**Load setpoint cannot be set within 8 PSI of the unload setpoint.  
Minimum operating pressure is 65 PSIG.**

**FIGURE 4-8 - MAXIMUM SETPOINTS FOR MICROPROCESSOR CONTROLLER, PSIG**

**SECTION 5  
LUBRICATION**

**COMPRESSOR OIL SYSTEM** - The oil reservoir is filled with oil at the factory before shipment. A tag on the reservoir fill cap indicates the type of oil in the reservoir as it left the factory.

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

**OIL SPECIFICATIONS** - This compressor is factory filled with AEON™ 9000 lubricating coolant. AEON 9000 is a synthetic extended life lubricant which can extend lubricant change intervals 4 to 10 times that of a petroleum based lubricant. A lubricant analysis program for a periodic check of lubricant quality and remaining life can maximize the change interval.

tained discharge temperature up to 210°F when unusually high ambient air temperature is encountered.

**DANGER**

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

**WARNING**

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

**CAUTION**

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

**CAUTION**

**Improper equipment maintenance with use of synthetic lubricants will damage equipment. Oil filter and oil change intervals must be rigidly adhered to for maximum compressor protection and efficiency. See Maintenance Schedule, Section 8.**

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

**OIL CHANGE INTERVAL** - Recommended oil change interval is 8000 hours or one year, whichever comes first, based on normal operating conditions. Severe operating conditions may require shorter intervals. A good lubricant analysis program is helpful in planning the change interval. The oil filter element should always be changed when the oil is replaced.

**OIL FILTER ELEMENT** - Normally the replaceable element only needs to be changed when the oil is changed every 1000 hours or 1 year, whichever comes first. The oil filter is equipped with a differential pressure indicator. If the indicator shows in the red zone the element must be replaced. If a dirty element is not replaced the unit may shut down on low oil pressure.

**High Temperature Operation** - Gardner-Denver® AEON 9000 lubricating coolant will operate at a sus-

	Standard Service	High Temperature
Work 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

FIGURE 5-1 - GREASE RECOMMENDATIONS

**BREATHER** - The breather for the reservoir should be cleaned once a year or when changing the oil filter. To service remove the breather, unscrew the wing nut and remove the element. Clean the element in solvent and dry it completely.

**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.

**WARNING**

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

6. Stop the unit. Replace the relief plug.
7. Restart the unit.

**GREASE RECOMMENDATIONS** - Refer to Figure 5-1 on page 1 of this section.

**REGREASING INTERVAL** - Refer to Figure 5-2 below.

Type of Service	Type of 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

**FIGURE 5-2 - REGREASING INTERVAL**

## SECTION 6 AIR FILTERS

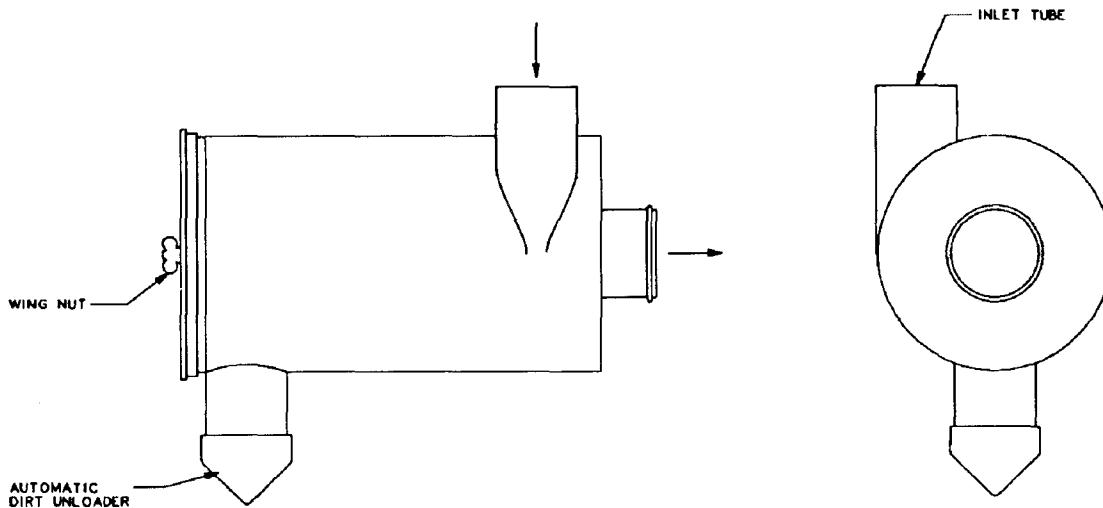


FIGURE 6-1 - AIR FILTER

**AIR FILTER** (Figure 6-1) 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. Improperly maintained air filter can cause a loss of compressor air delivery.

Service the air filter when the air filter indicator is red. To service or change the air filter element, proceed as follows:

1. Unscrew wing nut and remove element. Visually inspect for dirt accumulation.
2. If cleaning is required, the element may be cleaned by water or air flow.

To clean by air flow, use a reversing flow of compressed air not exceeding 30 PSIG to blow out dirt.

To wash with water, first soak for 15 minutes in warm water with a mild household detergent. Rinse thoroughly with clean water. A hose may be used if water pressure does not exceed 30 PSIG. Allow to air dry COMPLETELY. Do not expose to heat over 150° F.

### CAUTION

**Improper cleaning can damage element. Use only water and a mild household detergent when washing element.**

3. Inspect the element for ruptures or cracks in the media; replace it if any are found. Also inspect

gaskets.

4. Inspect the inlet screen and tube for dirt accumulation. Clean the tube by ramming a clean dry cloth through the tube. Wipe the inside of the filter body to remove any dirt.
5. Install element in the filter body and fasten securely with the wing nut.
6. Reset air filter indicator by pressing button on the bottom.

### WARNING

**Operating the unit without the element or with a dirty element can cause damage to equipment. Always use a clean element maintained per instructions in this section.**

**Filter Element Life** - The air filter element should be changed after six (6) cleanings, or if:

1. Visual inspection indicates a rupture, crack or pin hole in the media. Inspection should be made by placing a bright light inside the element.
2. With a freshly cleaned element, the air filter indicator quickly turns red.

Do not attempt to overextend the element life; the small savings involved do not justify the risk.

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

## SECTION 7 COUPLING

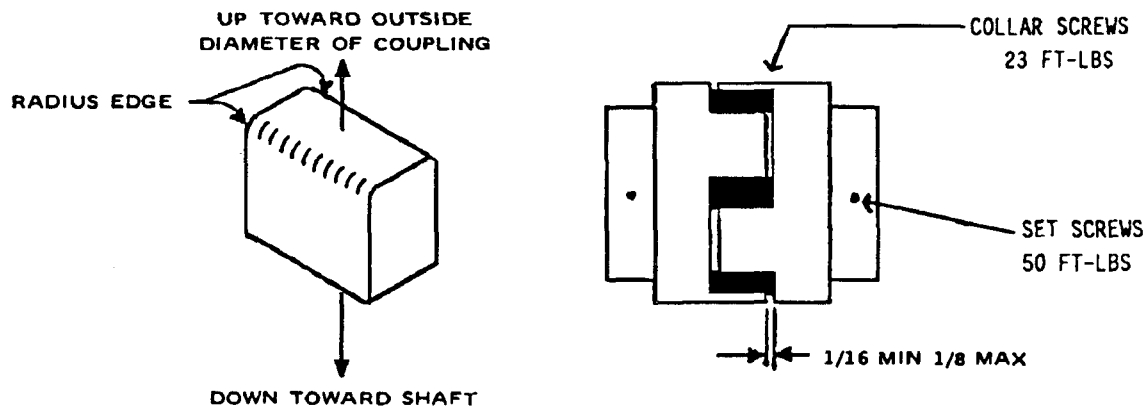


FIGURE 7-1 - INSTALLATION OF COUPLING CUSHIONS

### DANGER

Rotating machinery can cause personal injury or death. Turn unit completely off and open main disconnect before servicing coupling.

**COUPLING** - The motor and compressor are direct connected by a resilient type flexible coupling, Figure 7-1. Coupling does not require lubrication.

If maintenance on mating parts is required, reassemble coupling as follows:

#### Flexible Coupling Design (Figure 7-1)

1. Slide coupling halves over shaft extensions. Be sure collar is installed on shaft behind one coupling body.
2. Assemble motor on compressor.
3. Working through coupling guard opening, center

coupling over gap between shafts, maintaining gap as shown in Figure 7-1 between the ends of the jaws on one coupling body and the flange on the opposite coupling body. Tighten set screws in each coupling body.

4. Insert cushion as shown in Figure 7-1 and slide collar over cushions and secure with cap screws. Reinstall the coupling guard.

### DANGER

Rotating machinery can cause personal injury or death. Do not operate unit with either the coupling guard or the collar removed. All bolts and screws must be properly tightened.

**Alignment** - The coupling is permanently aligned by the flanges on the compressor and motor.

## SECTION 8 MAINTENANCE SCHEDULE

### Daily or every 8 hours of operation

1. Control Panel - check compressor discharge pressure and temperature, oil temperature and water filter L.E.D. Always change both water filters - make-up and recirculating.
2. Check the reservoir oil level.
3. Check air filter and oil filter indicators.
4. Drain condensate from control line filter and control line inlet valve.

the cooling fan air flow.

### Annually or every 8000 hours of operation

1. Change the compressor lubricant and oil filter element. UNDER ADVERSE CONDITIONS, CHANGE MORE FREQUENTLY.
2. Check relief valves for proper operation.
3. Clean oil reservoir breather.

### Weekly or every 150 hours of operation

1. Aircooled: Check for dirt accumulation on the water/aftercooler core face. If cleaning is required, clean the exterior fin surfaces of the cores by blowing compressed air in a direction opposite that of

### 18 months

1. Grease the electric motor bearings. UNDER SEVERE CONDITIONS LUBRICATE MORE FREQUENTLY.

### MAINTENANCE SCHEDULE (See detail notes above)

Maintenance Action	As Indicated By Panel LED	Every 8 Hours Operation	Every 150 Hours Operation	Every 1000 Hours Operation	Every 4000 Hours Operation	Every 8000* Hours Operation	Every Year
Change Air Filter	●						
Check Reservoir Oil Level		●					
Check For Proper Load/Unload		●					
Check Discharge Pressure/Temp.		●					
Check Dirt Accumulation on Cooler			●				
Change Oil Filter Element				●			
Change Compressor Lubricant						●	
Check Relief Valve							●

\* Or every year, whichever comes first.

## SECTION 9 TROUBLESHOOTING

---

Symptom	Possible Cause	Remedy
Compressor fails to start.	<ol style="list-style-type: none"> <li>1. Wrong lead connections.</li> <li>2. Blown fuses in control box.</li> <li>3. Motor starter overload heaters tripped.</li> <li>4. Pressure in reservoir and muffler.</li> <li>5. Read error message on control panel. See Section 4.</li> </ol>	<ol style="list-style-type: none"> <li>1. Change leads.</li> <li>2. Replace fuse.</li> <li>3. Reset and investigate cause of overload.</li> <li>4. Inspect blowdown valve</li> <li>5. Investigate accordingly.</li> </ol>
Compressor starts but stops after a short time.	<ol style="list-style-type: none"> <li>1. High discharge temperature.</li> <li>2. Blown fuse in starter/control box. (continue to blow).</li> <li>3. Motor starter overload heaters trip.</li> <li>4. Read error message on control panel. See Section 4.</li> </ol>	<ol style="list-style-type: none"> <li>1. See "High Discharge Air Temperature" in this section.</li> <li>2. Replace fuse (investigate if fuses</li> <li>3. Reset and investigate cause of overload.</li> <li>4. Investigate accordingly.</li> </ol>
Compressor does not unload (or load).	<ol style="list-style-type: none"> <li>1. Improperly adjusted subtractive pilot valve.</li> <li>2. Air leak in control lines.</li> <li>3. Restricted control line.</li> <li>4. Subtractive pilot or blowdown valve malfunction.</li> </ol>	<ol style="list-style-type: none"> <li>1. Refer to Section 4 and adjust valve.</li> <li>2. Determine source of leak and correct.</li> <li>3. Clean control lines.</li> <li>4. Repair, clean or replace valve.</li> </ol>
Compressor cycles from load to unload excessively.	<ol style="list-style-type: none"> <li>1. Insufficient receiver capacity.</li> <li>2. Restriction in control tubing.</li> <li>3. Subtractive pilot setting too high.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase receiver size.</li> <li>2. Inspect and clean control tubing.</li> <li>3. Adjust valve. See Section 4.</li> </ol>

Symptom	Possible Cause	Remedy
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 unload pressure adjusted too low.	3. Adjust valve or unload pressure. See Section 4.
	4. Minimum pressure valve stuck closed.	4. Disassemble and clean valve.
High discharge air temperature.	1. Dirty or clogged cooler face.	1. Clean cooler.
	2. Insufficient cooling air flow.	2. Provide unrestricted supply of cooling air.
	3. Clogged water filter or cooler (interior).	3. Replace filter or clean cooler.
	4. Clogged make-up water filter.	4. Replace filter element.
	5. Make-up water valve failed.	5. Repair/replace valve.
Motor Overload	1. Full load pressure set above maximum.	1. Reset controller unload & load pressures. Adjust subtractive pilot valve.
	2. Defective motor.	2. Repair motor.
	3. Clogged water/after-cooler (interior).	3. Clean/replace cooler.
	4. Low voltage.	4. Repair
	5. Heaters setting too low.	5. Reset heaters.
	6. Heaters not mounted tight in overload relay.	6. Tighten heaters.
Excessive water in discharge air line.	1. Level switch defective.	1. Repair/replace switch.
	2. Make-up water valve stuck open.	2. Repair/replace valve.
	3. Drain water valve will not open.	3. Repair/replace valve.
	4. Control relay defective.	4. Replace relay.



# **Gardner** --- **Denver**

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