GARDNER DENVER®

13-8-619
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May 2, 2006

INTEGRA™
BASE-MOUNTED
COMPRESSORS

MODELS – EFB99A & EFB99F

7.5, 10 & 15 HP

OPERATING AND
SERVICE MANUAL

GARDNER DENVER®

MAINTAIN COMPRESSOR RELIABILITY AND PERFORMANCE WITH GENUINE GARDNER DENVER® COMPRESSOR PARTS AND SUPPORT SERVICES

Gardner Denver Compressor genuine parts, manufactured to design tolerances, are developed for optimum dependability – specifically for Gardner Denver compressor systems. Design and material innovations are the result of years of experience with hundreds of different compressor applications. Reliability in materials and quality assurance are incorporated in our genuine replacement parts.

Your authorized Gardner Denver Compressor distributor offers all the backup you'll need. A worldwide network of authorized distributors provides the finest product support in the air compressor industry. Your local authorized distributor maintains a large inventory of genuine parts and he is backed up for emergency parts by direct access to the Gardner Denver Master Distribution Center (MDC) in Memphis, Tennessee.

Your authorized distributor can support your Gardner Denver air compressor with these services:

1. Trained parts specialists to assist you in selecting the correct replacement parts.
2. Factory warranted new and remanufactured rotary screw airends. Most popular model remanufactured airends are maintained in stock at MDC for purchase on an exchange basis with liberal core credit available for the replacement unit.
3. A full line of factory tested AEON™ compressor lubricants specifically formulated for use in Gardner Denver compressors.
4. Repair and maintenance kits designed with the necessary parts to simplify servicing your compressor.

Authorized distributor service technicians are factory trained and skilled in compressor maintenance and repair. They are ready to respond and assist you by providing fast, expert maintenance and repair services.

For the location of your local authorized Gardner Denver Air Compressor distributor, refer to the yellow pages of your phone directory or contact:

Distribution Center:
Gardner Denver
Master Distribution Center
5585 East Shelby Drive
Memphis, TN 38141
Phone: (901) 542-6100
(800) 245-4946
Fax: (901) 542-6159

Factory:
Gardner Denver
1800 Gardner Expressway
Quincy, IL 62301
Phone: (217) 222-5400
Fax: (217) 224-7814

REMANUFACTURED AIRENDS

Whenever an airend requires replacement or repair, Gardner Denver offers an industry unique, factory remanufactured airend exchange program. From its modern Remanufacturing Center in Indianapolis, IN., Gardner Denver is committed to supplying you with the highest quality, factory remanufactured airends that are guaranteed to save you time, aggravation and money.

Immediately Available
Repair downtime costs you money, which is why the most popular models are in inventory at all times.

Skilled Craftsmen
Our Remanufacturing assembly technicians average over 20 years experience with air compression products.

Precision Remanufacturing
All potentially usable parts are thoroughly cleaned, inspected and analyzed. Only those parts that can be brought back to original factory specifications are remanufactured. Every remanufactured airend receives a new overhaul kit: bearings, gears, seals, sleeves and gaskets.

Extensive Testing
Gardner Denver performs testing that repair houses just don't do. Magnaflux and ultrasonic inspection spot cracked or stressed castings, monochromatic light analysis exposes oil leaks, and coordinate measurement machine inspects to +/- .0001", insuring that all remanufactured airends meet factory performance specifications.

Warranty
Gardner Denver backs up every remanufactured airend with a new warranty…27 months from purchase, 24 months from service. Gardner Denver remanufactured airends deliver *quality without question…year in and year out.*
Call Gardner Denver for information on the airend exchange program and the name of your authorized distributor.

Phone Number: 800-245-4946 or
Fax: 901-542-6159

FOREWORD

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

DANGER

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.

This book covers the following models:

HP	PSI	Air Cooled	Parts List
7.5, 10 & 15	100, 125, 150, 175	EFB99A	13-8-513

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SECTION 1
GENERAL INFORMATION

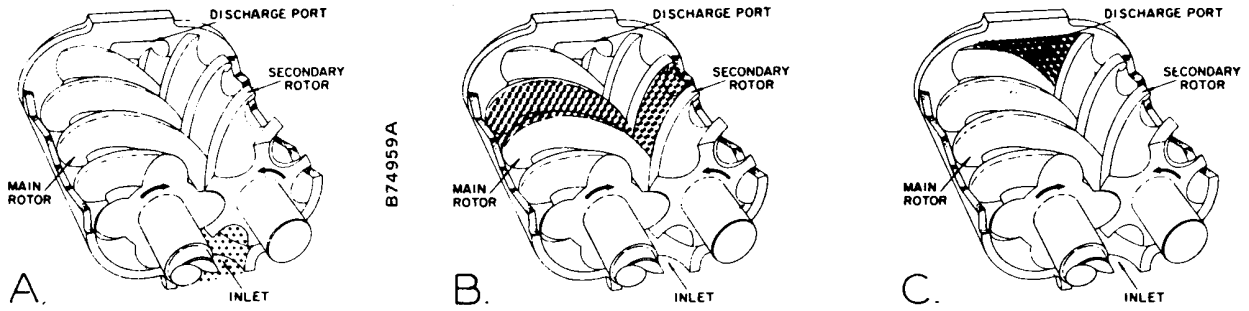


Figure 1-1 – COMPRESSOR CYCLE

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

COMPRESSION PRINCIPLE (Figure 1-1) - Compression is accomplished by the main and secondary rotors synchronously meshing in a one-piece cylinder. The main rotor has five (5) helical lobes 72° 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 the 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 grove, normal volume is reduced and pressure increases.

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

AIR FLOW IN THE COMPRESSOR SYSTEM (Figure 5-4, page 30) - Air enters the air filter and passes through the inlet unloader valve and on into the compression chamber where oil is injected into the air. After compression, the air/oil mixture passes into the oil reservoir where most of the entrained oil is removed by velocity change and impingement and drops back into the reservoir. The air and remaining oil then passes through the air/oil separator. The air then passes through the minimum pressure/check valve, the aftercooler and the moisture separator and into the plant air lines.

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

300EFB797-A
(Ref. Drawing)

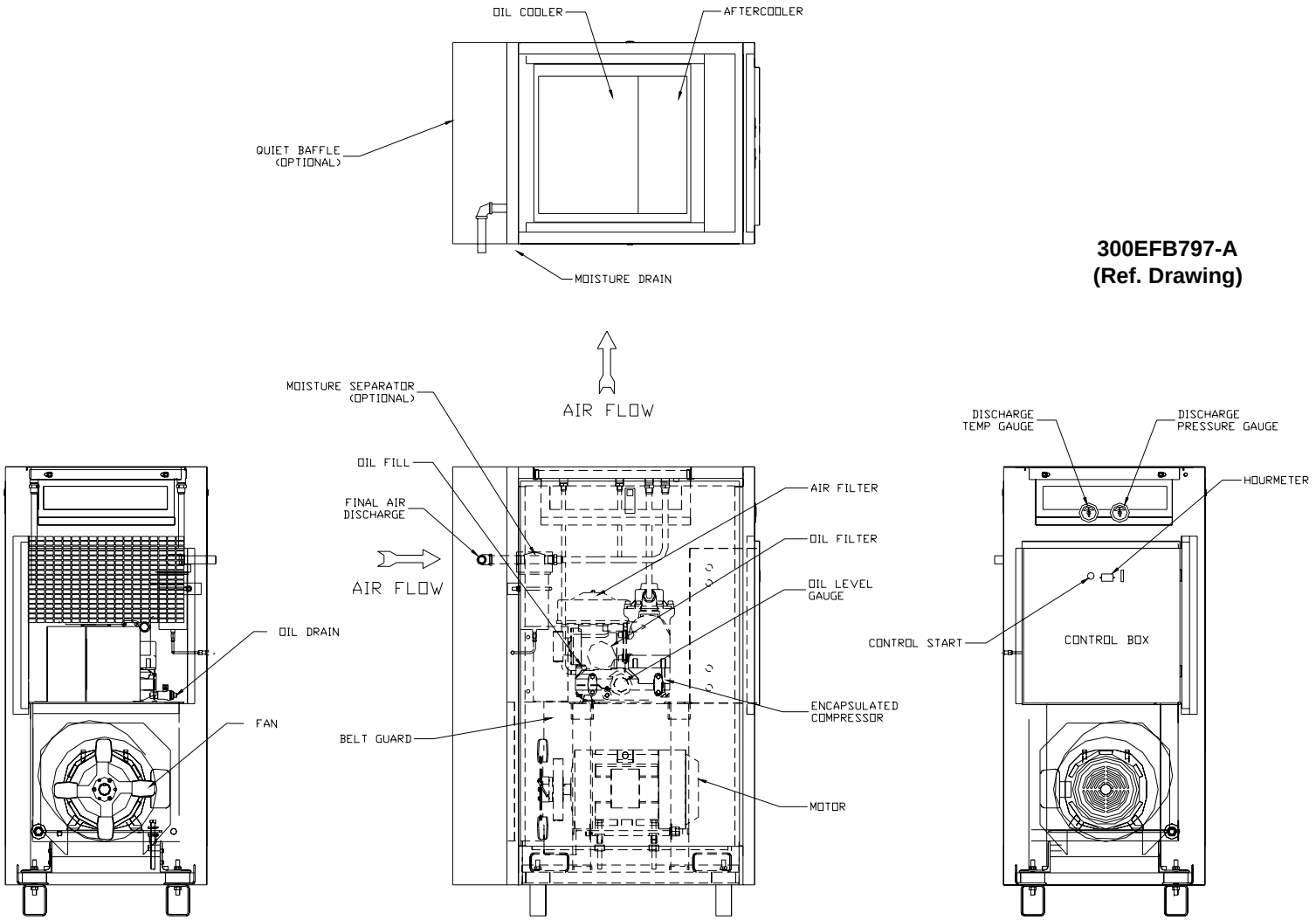


Figure 1-2 – COMPRESSOR ILLUSTRATION

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

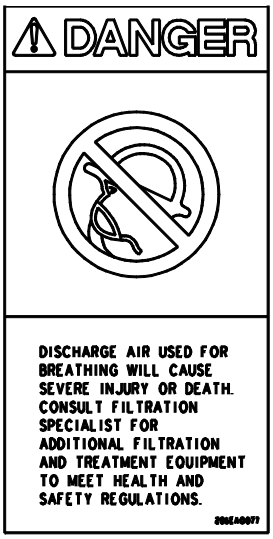
- **Keep fingers and clothing away from revolving fan, drive coupling, etc.**
- **Do not use the air discharge from this unit for breathing – not suitable for human consumption.**
- **Do not loosen or remove the oil filler plug, drain plugs, covers, the thermostatic mixing valve or break any connections, etc., in the compressor air or oil system until the unit is shut down and the air pressure has been relieved.**
- **Electric shock can and may be fatal.**
- **Perform all wiring in accordance with the National Electrical Code (NFPA-70) and any applicable local electrical codes. Wiring and electrical service must be performed only by qualified electricians.**
- **Open the main disconnect switch, lockout and tagout before working on the control.**
- **Disconnect the compressor unit from its power source, lockout and tagout before working on the unit – this machine is automatically controlled and may start at any time.**

⚠ WARNING

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

- **<u>Stop the unit</u> if any repairs or adjustments on or around the compressor are required**
- **<u>Disconnect the compressor</u> unit from its power source, lockout and tagout before working on the unit – this machine is automatically controlled and may start at any time.**
- **<u>An Excess Flow Valve</u> should be on all compressed air supply hoses exceeding 1/2 inch inside diameter. (OSHA Regulation, Section 1926.302, or local regulations)**
- **<u>Do not exceed the rated maximum pressure values</u> shown on the nameplate.**
- **<u>Do not operate unit</u> if safety devices are not operating properly. Check periodically. Never bypass safety devices.**

DECALS



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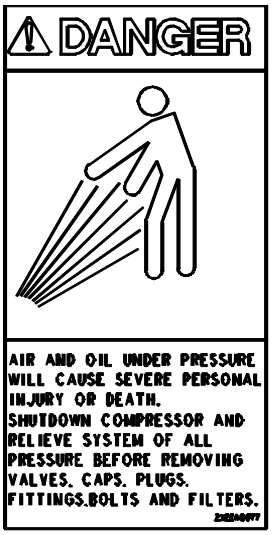

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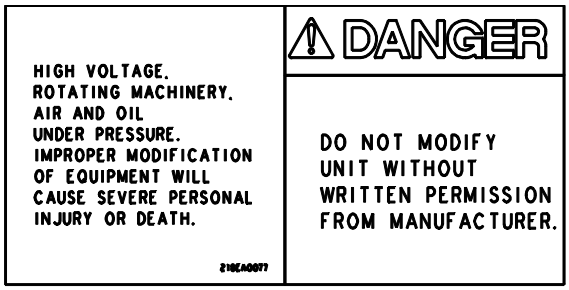

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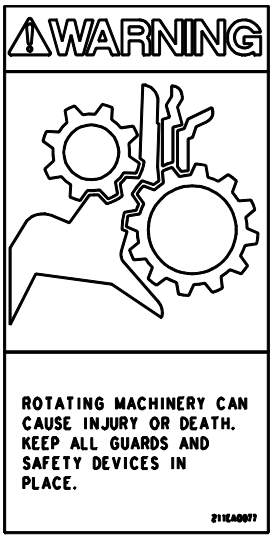

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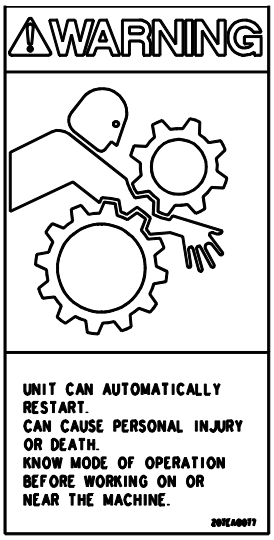

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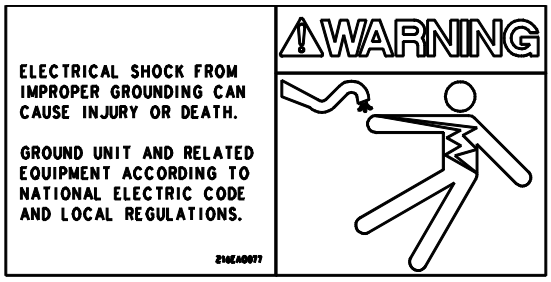

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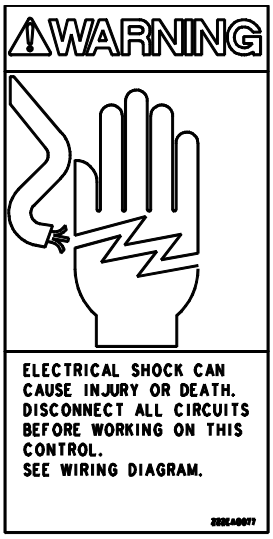

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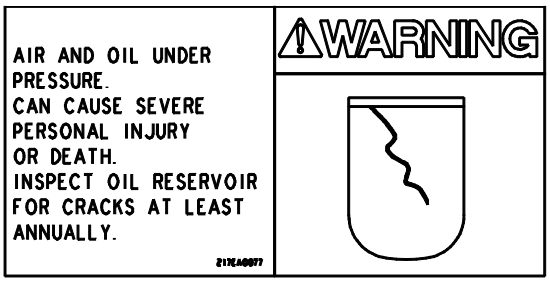

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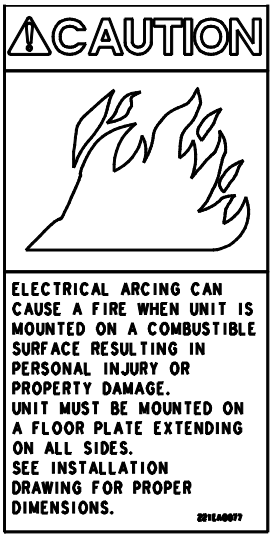

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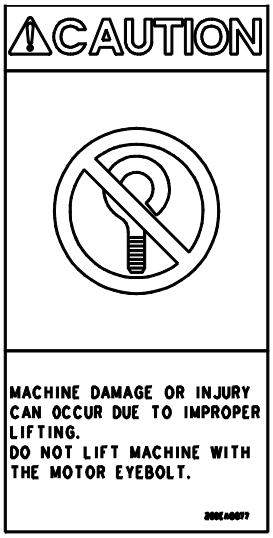

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SECTION 2
INSTALLATION

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

CAUTION

Do not electric weld on the compressor or base; bearings can be damaged by passing of current.

LIFTING UNIT - Proper lifting and/or transporting methods must be used to prevent damage. Unit may be moved into location by lift truck.

CAUTION

Lift compressor unit under base only. Do not use other places such as motor, compressor or discharge manifold piping as lifting points.

DANGER

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

LOCATION (Figure 2-1**,** page 8) - The compressor should be installed where it is protected from rain, snow and freezing temperatures, in a clean, well-lighted, well-ventilated area with ample space all around for maintenance. Select a location that provides a cool, clean, dry source of air. In some cases it may be necessary to install the air filter at some distance from the compressor to obtain proper air supply.

AIR-COOLED UNIT - A combination oil/aftercooler is supplied as standard equipment on all air-cooled units. The air-cooled unit with the standard enclosure requires sufficient flow for the compressor oil/aftercooling system and electric motor cooling (Figure 2-1, page 8). Air is drawn into the unit above the motor and discharged through the cooler. Do not block the air flow to and from the unit. Allow three and one half (3-1/2) feet to the nearest obstruction on the control box end of the unit. Allow two (2) feet to the nearest obstruction above and on other sides of unit.

For continuous efficiency, oil cooler cores must be periodically cleaned with either vacuum or compressed air. If wet cleaning is required, shield motor and spray on a mild soap solution and flush with clean water.

⚠ WARNING

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

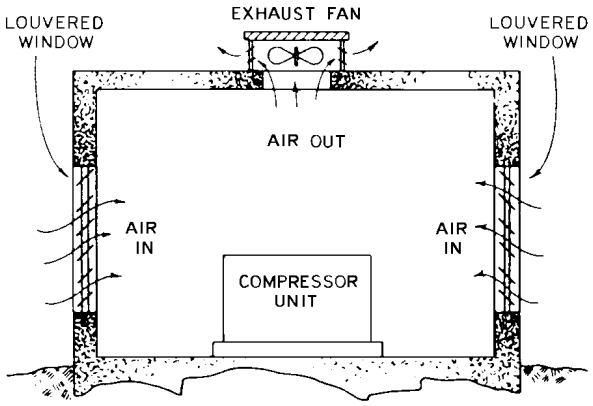


Figure 2-1 – TYPICAL COMPRESSOR ROOM

Minimum Air Flow* For Compressor And Cooling (cubic Feet/Minute)	
	Air Cooled
All Models	3000 cfm

* 80° F Inlet Air

Figure 2-2 – AIR FLOW CHART

FOUNDATION - The rotary screw 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 5° angle lengthwise or 5° sidewise. Mounting bolts are not normally required. However, installation conditions such as piping rigidity, angle of tilt, or danger of shifting from outside vibration or moving vehicles may require the use of mounting bolts and shims to provide uniform support for the base. Belt alignment and tension should be checked after installation. (For information on belt alignment and tension, see SECTION 7, page 35.

OIL RESERVOIR DRAIN - The oil drain is piped from the bottom of the reservoir to the side of the frame. This drain is approximately 20 inches above the floor level.

CAUTION

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

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

Service panels are provided for maintenance access. Be sure to allow enough space around the unit for the doors to be removed. Any of the enclosure panels may be removed by opening the latch and lifting it up slightly.

DANGER

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

CAUTION

The enclosure doors and panels must be closed and latched while the compressor is operating. Failure to close and latch the doors and panels will cause high temperature shutdowns.

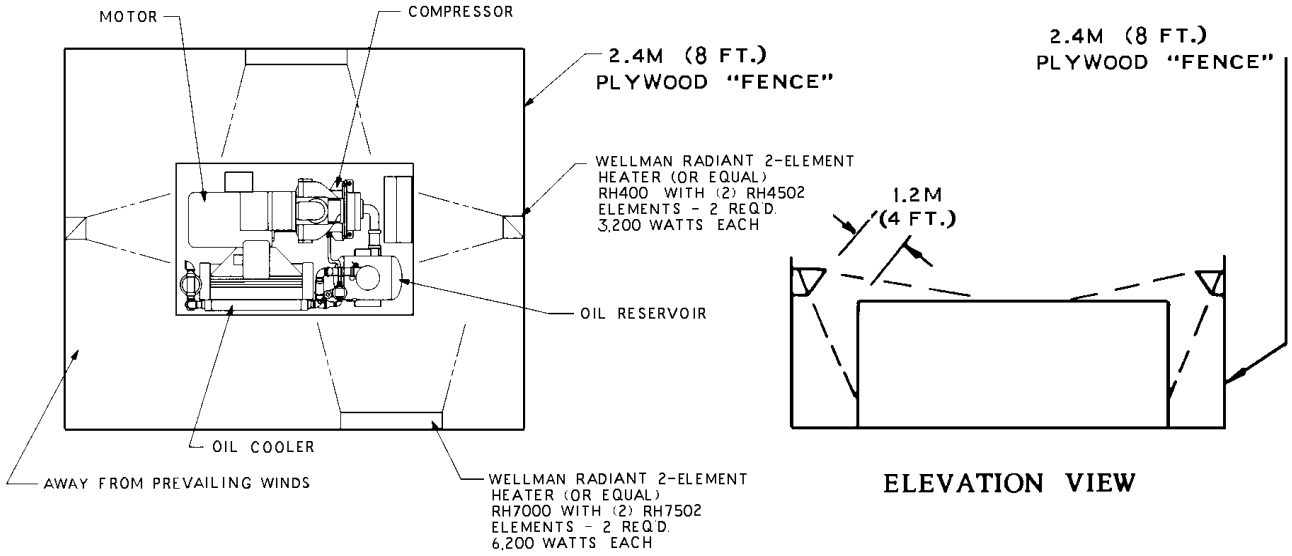


Figure 2-3 – COLD WEATHER INSTALLATION

INSTALLATION FOR COLD WEATHER OPERATION (Figure 2-3, page 9) - It is recommended that the unit be installed inside a shelter that will be heated to temperatures above freezing (32^{o} F, 0^{o} C). This will eliminate many of the problems associated with operating units in cold climates, such as freezing in control lines and downstream of the cooler.

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

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

Cold Weather (Down To $+10^{o}$ F)

1. Be sure all drains, traps, and control lines, including pressure transducer lines are heated to avoid freezing of condensate. Heat tape with thermostat control is generally satisfactory for this purpose and can be obtained at various local plumbing or hardware outlets at nominal cost.

2. Provisions to bypass the aftercooler must be made. Since cold air contains very little moisture, successful operation can be achieved without the aftercooler.

3. Provide at least some simple shelter such as a plywood windbreak to protect against drifting snow.

4. Use only Gardner Denver AEON 9000 SP lubricant.

5. Monitor unit carefully during start-up and operation to be sure it is functioning normally.

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

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

OPTIONAL MOISTURE SEPARATOR/TRAP - The unit is equipped with a built-in aftercooler, a combination moisture separator and trap is furnished as an option to the unit. This should be piped into the system down stream of the aftercooler.

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

INLET LINE - Where an inlet line is used between the air filter and the compressor, it must be thoroughly cleaned on the inside to prevent dirt or scale from entering the compressor. If welded construction is used, the line must be shot blasted and cleaned to remove welding scale. In either case, the inlet line must be coated internally by galvanizing or painting with a moisture and oil-proof sealing lacquer. Up to 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 according to “Inlet Line Length Chart” below.

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

INLET LINE LENGTHS

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

DISCHARGE SERVICE LINE - The discharge service line connection is made at the right hand corner of the package when viewed from the control box end, viewed from the oil cooler side. A hand operated valve, (air service valve) must be installed between the unit and the customer's air system. If a fast operating valve such as a ball valve is used, it must be closed slowly to give the intake valve time to shut and keep the discharge pressure from spiking. When manifolding two or more rotary screw units on the same line, each unit is isolated by the check valve in the unit discharge line. If a rotary screw unit is manifolded to another compressor, be sure the other compressor has a check valve in the line between the machine and the manifold. If a rotary screw 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.

ELECTRICAL WIRING - All of the electrical connections and controls are factory wired for the voltage specified on the order. Verify that the available voltage source matches that shown on the compressor package nameplate before installing the compressor package. It is necessary only to connect the package to the supply and ground of the branch circuit. The connections to the compressor package are made with the electrical controls box, accessible by opening the cover of the box.

The 24CA4820 Control Transformer (Cutler-Hammer C0250G6U) is connectable for a variety of input voltages. Ensure that it is properly connected prior to applying power to the package. Recommended connections are:

Line Voltage	Primary Connect	Secondary Connect
200-208	H1 & H2	X1 & X4
230-240	H1 & H2	X1 & X3
380-416	H1 & H3	X1 & X3
460-480	H1 & H4	X1 & X3
575-600	H1 & H5	X1 & X3

WARNING

Electrical shock can cause injury or death. Open main disconnect switch, lockout and tagout before working on control box.

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

⚠ WARNING

Failure to properly ground the compressor package could result in injury or death. Install ground wiring in accordance with the National Electrical Code and any applicable local codes.

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

⚠ WARNING

Rotating machinery can cause injury or death. Open main disconnect, lockout and tagout power supply to starter before working on the electric motor.

ELECTRIC MOTOR GREASE RECOMMENDATIONS (-30° TO 50° C)

MANUFACTURER	TRADE NAME
CHEVRON	SRI #2
SHELL	DOLIUM R
EXXON	UNIREX #2
EXXON	POLYREX

ELECTRIC MOTOR REGREASING INTERVAL

Type of Service	Typical	Rating	Relubrication Interval
Standard	One or Two Shift Operation	Up to 150 HP (112 KW)	18 Months
		Above 150 HP (112 KW)	12 Months
Severe	Continuous Operation	Up to 150 HP (112 KW)	9 Months
		Above 150 HP (112 KW)	6 Months
Very Severe	Dirty Locations, High Ambient Temperature	Up to 150 HP (112 KW)	4 Months
		Above 150 HP (112 KW)	2 Months

SECTION 3
STARTING & OPERATING PROCEDURES

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

1. **Compressor Oil** - The oil must be checked before starting the unit and every 8 hours of operation. For instructions on checking the oil and the proper oil level, refer to "Compressor Oil Filter", SECTION 5, page 29.

   Do not mix different type oils. Unit is shipped filled with Gardner Denver AEON 4000 Lubricating Coolant which is suitable for the first 4000 hours under normal operating conditions. AEON 9000 SP is also available. Check the decal on the reservoir to be sure which lubricant is in the machine.

   REPLACE OIL FILTER EVERY 1000 HOURS.

NOTICE
Regular maintenance and replacement at required intervals of the oil filter, air filter and air/oil separator is necessary to achieve maximum service and extended drain intervals of AEON 4000 lubricant. Use only genuine Gardner Denver filters designed and specified for this compressor.

DANGER
Always stop the unit and release air pressure before removing oil filler plug. Failure to release pressure may result in personal injury or death.

2. **Air Filter** - Inspect the air filter to be sure it is clean and tightly assembled. Refer to SECTION 6, page 34 for complete servicing instructions. Be sure the inlet line, if used, is tight and clean.

3. **Piping** – Refer SECTION 2, page 11 "Discharge Service Line" and make sure all piping meets all recommendations.

4. **Electrical** - Check the wiring diagrams furnished with the unit to be sure it is properly wired. See Figure 4-3, page 23 for general wiring diagrams and SECTION 2, page 11 for "Electrical Wiring".

5. **Grounding** - Unit must be properly grounded according to Section 250 of the National Electrical Code.

WARNING
Failure to properly ground the compressor package could result in controller malfunction.

6. **Rotation** - Check for correct motor rotation by bumping the starter using the ON/OFF switch. Compressor drive shaft rotation must be counterclockwise facing the compressor sheave.

⚠ WARNING

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

7. **System Pressure** - The discharge pressure of the unit is set at the factory. To change the discharge pressure, set the controls to the desired load pressure. DO NOT EXCEED THE MAXIMUM OPERATING PRESSURE ON THE COMPRESSOR NAMEPLATE. See SECTION 4", Setting the Load/Unload Pressure Setpoints," , page 20 for procedure.

⚠ WARNING

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

8. **Operating Mode** - Refer to SECTION 4, page 17 for detailed information on the control system.

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

STARTING THE UNIT - Observe the following starting procedures:

Unit Cold:

1. Open the air service valve (customer furnished) between the main air system and the check valve on the package.

2. Place the operating switch in the OFF position. Turn on power to the compressor package. To start the package, place the switch in the ON position.

3. Run for approximately five minutes or until the temperature stabilizes.

   The unit is equipped with a minimum (45 psig) pressure/check valve. No special procedure is required to maintain the unit reservoir pressure.

Unit Hot (No warm-up period is required):

1. Open the air service valve (customer furnished) between the main air system and the check valve on the package.

2. Place the operating switch in the OFF position. Turn on power to the compressor package. To start the package, place the switch in the ON position.

3. Run for approximately one minute. The unit is equipped with a minimum (45 psig) pressure/check valve, no special procedure to maintain the unit reservoir pressure is required.

DAILY CHECK - Refer to “Maintenance Schedule,” SECTION 8 page 38.

STOPPING THE UNIT:

1. To stop compressor operation, place the switch in the OFF position. The oil reservoir will automatically blow down as the motor stops.

2. Close the air service valve.

SECTION 4
CONTROLS & INSTRUMENTATION

GENERAL - The electrical controls on the compressor package are prewired and require only connection to the building wiring. The standard package has all of the necessary controls for protection and fully automatic operation.

OPERATION - The switch on the control box has an OFF position and an ON position. For normal operation, leave the power connected to the compressor continuously, and use this selector switch. To run the compressor, turn the switch to its ON position. To stop operation, turn the switch to its OFF position. The OFF position also resets the controls after a power failure or other protective shutdowns.

When in the automatic mode, the controls operate the compressor. When air is used, the pressure in the plant drops, and the compressor will start. After the compressor builds up the pressure, the compressor unloads, and the motor runs at light load. If the plant calls again for more air, the compressor reloads. If there is no demand, the motor stops after a time delay is completed.

The compressor drive motor and wiring are protected from overload by a thermal overload relay inside of the control box. The control system features thermal protection for the compressor and oil separator, and will stop the compressor if high temperatures or defective sensors are detected.

CAUTION

Damage will occur to the machine if it is repeatedly restarted after high temperature stops operation. Find and correct the malfunction before resuming operation.

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

WARNING

When the 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 the unit with improper relief valve setting can result in severe personal injury or machine damage. Ensure properly set valves are installed and maintained.

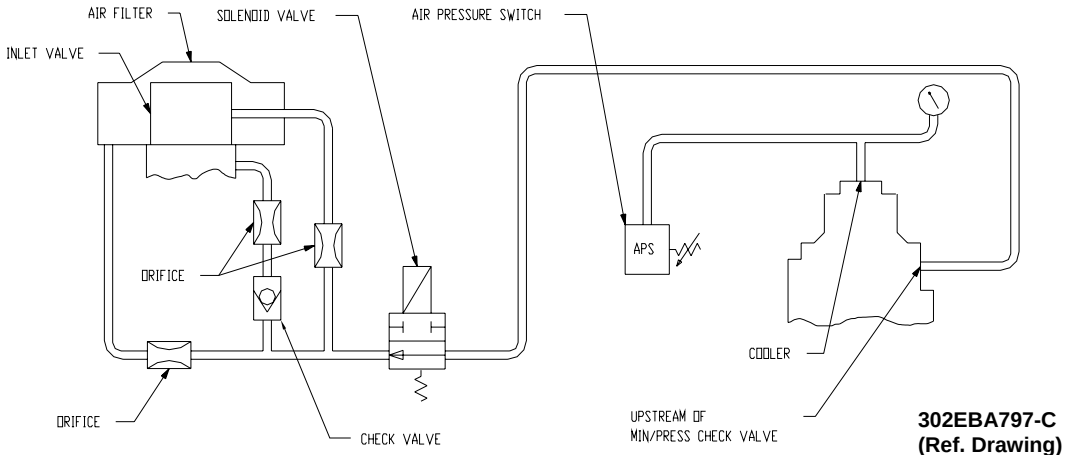


Figure 4-1 – CONTROL SCHEMATIC

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

Inlet Valve - The inlet valve is a normally opened, pneumatically closed valve. The inlet valve is controlled by a solenoid valve, which in turn is controlled by the AutoSentry T controller, The inlet valve closes to unload the compressor and opens to load the compressor. At shutdown the inlet valve closes to function as a check valve and to prevent the backflow of air and oil. The seals will need to be replaced periodically. The interval will depend on the environment and the operating conditions.

Solenoid Valve (

Figure 4-1) - The solenoid valve is operated by the controller. When energized, the valve closes, the inlet valve opens and the package starts compressing air. When the solenoid valve is de-energized, it closes the inlet valve and relieves the pressure in the reservoir.

Minimum Pressure/Check Valve (Figure 5-4, page 30) - An internal spring-loaded minimum pressure valve is installed prior to the aftercooler to maintain a positive pressure on the oil system even when the air service valve is fully open. This valve senses upstream pressure. If demand for air exceeds the compressor capacity, the valve throttles the flow to maintain a minimum pressure on the upstream (oil reservoir) side of the valve. When pressure rises above the minimum pressure (standard setting 40 to 45 PSIG) the valve reaches the full open position.

A check valve incorporated in the minimum pressure valve prevents backflow of air from the shop air line when the unit stops, unloads or is shut down.

Changing Minimum Pressure/Check Valve Seals

1. Be sure the unit is completely off and that no air pressure is in the oil reservoir.
2. Disconnect, lockout and tagout the power supply to the starter.
3. Tighten the nut down on the minimum pressure/check valve cover.
4. Remove the 6 bolts holding the cover onto the separator housing.
5. Remove the snap ring in the cover.
6. Remove the components and replace the seals in the minimum pressure/check valve.
7. Re-assemble valve, including the snap ring.
8. Tighten the cover down to the separator housing.
9. Loosen the nut on top of the minimum pressure/check valve .05 to .08 inches.
10. Run the unit and check for leaks.

DANGER

Air/oil under pressure will cause severe personal injury or death. Shut down compressor, relieve system of all pressure, disconnect, lockout and tagout power supply to the starter before removing valves, caps, plugs, fittings, bolts and filters.

STARTER/CONTROL BOX (Figure 1-2, page 2) - 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.

CONTROL BOX AND CONTROLLER - Most of the electrical controls are mounted within the control box mounted on the compressor package. If service is required, disconnect and lock out the power to the compressor.

The starter within the enclosure runs and stops the compressor motor. The contactor is controlled by the electronic controller.

The control transformer steps the voltage down from the compressor line voltage to 120 volts for the control circuits. Control circuit fuses are located within the enclosure. These protect the control transformer, wiring and other control components from damage due to short circuits.

The manual switch is used to enable and disable compressor operation. In the OFF position, it removes power from the electronic controller outputs, and resets the controller. When in the ON position, it enables the electronic controller to operate the compressor.

The pressure switch starts and stops the compressor while in the automatic mode. The pressure input to this switch is the plant pressure, measured within the package. The switch is wired to an input of the electronic controller.

Thermistors are located in the air system directly after the compressor and after the separator. These sense the temperature at these two locations, and are wired back to the electronic controller.

The electronic controller takes these inputs above and controls two output devices. The first is the coil of the starter, which starts and stops the compressor in response to the pressure switch. The second output is wired directly to a solenoid valve which loads the compressor. The indicator lights on the controller aid in servicing the compressor. Refer to SECTION 9, page 42, "Troubleshooting the AutoSentry T Electronic Controller" for detailed information.

#1	Red	Compressor temperature fault indicator
#2	Red	Separator temperature fault indicator
#3	Yellow	High/low temperature warning
#4	Green	Automatic mode indicator
#5	Green	Power-on indicator

CAUTION

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

SETTING THE LOAD/UNLOAD PRESSURE SETPOINTS

WARNING

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

Compressor start and stop pressures are controlled by the pressure switch mounted at the compressor control box. To change the settings, disconnect and lock out power to the compressor, relieve all pressure from the receiver tank. Connect an accurate gauge to the tank, and remove the cover from the switch. Read directions on the switch for details on locations of the adjusting screws.

DANGER

Air/oil under pressure will cause severe personal injury or death. Shut down compressor, relieve system of all pressure, disconnect, lockout and tagout power supply to the starter before removing valves, caps, plugs, fittings, bolts and filters.

The first adjustment, the load pressure, controls the pressure at which the compressor will start, see Figure 4-2). This is often referred to as the cut-in or reset pressure, and will be the minimum pressure while in automatic operation. For the most economical operation, set this as low as tolerable for the equipment operating from the compressed air.

The second adjustment, the unload pressure, controls the difference between the cut-in and cut-out pressure, see Figure 4-2). Wide differentials run the compressor for fewer, longer cycles, but will raise the maximum pressure in the plant. Narrow differentials reduce maximum pressure, but load and unload the compressor more frequently. This should be set so that the cut-out pressure does not exceed that maximum allowable pressure of equipment connected to the compressed air system. Do not set above the rated pressure of the compressor package.

NOTICE
The unload setpoint cannot be set above the pressure listed in Figure 4-2.

Once the adjustments are completed, disconnect and lock out power, replace the switch cover, and remove the test gauge.

NAMEPLATE FULL LOAD OPERATING PRESSURE	CONTROL SYSTEM PRESSURE (PSI)	
	LOAD	UNLOAD
100	85	100
125	110	125
150	135	150
175	160	175

Figure 4-2 – MAXIMUM SETPOINT FOR NEMA 4 PRESSURE SWITCH

⚠ **WARNING**
Electrical shock can cause injury or death. Open main disconnect and any other circuits, lockout and tagout before working inside the control box.

The electronic controller has three selections which affect its behavior. Disconnect and lock out power to the compressor, and open the control enclosure. Locate the three pairs of pins on the circuit board. To change the operation, add or remove a jumper onto the pair of pins as indicated below. This can be done with small jumper connectors commonly used on PC boards, and sold in electronics and computer stores. Restore power and start the compressor.

Auto Time - This jumper is located on the pair of pins closest to the edge of the control board. It controls the time that the motor will run unloaded before stopping. This is normally jumpered, and sets the automatic time for 10 minutes. With the jumper removed, this time is set to 5 minutes.

Automatic Restart - The jumper located in the center controls automatic restart after power interruptions. This is normally not jumpered, and the control will not start compressor operation when power is resumed. Manually reset the compressor by switching to the OFF position, then place it in the ON position to start operation.

Install a jumper on the center pair of pins when it is necessary to have the compressor automatically restart after a power interruption. There will be a brief delay, then the controller will resume operation if the selector switch is in its ON position. This feature should only be enabled when the owner determines that it is safe to do so. It is recommended that compressor access be limited to only trained service personnel when this feature is used. The controller recalls any temperature shutdown or advisory conditions which were in effect prior to the power interruption. Put the switch into the OFF position to reset the controller.

Regardless of the jumper, if the switch is in the OFF position, the controller will be stopped and ready when power is applied. Turn the switch to ON to start operation.

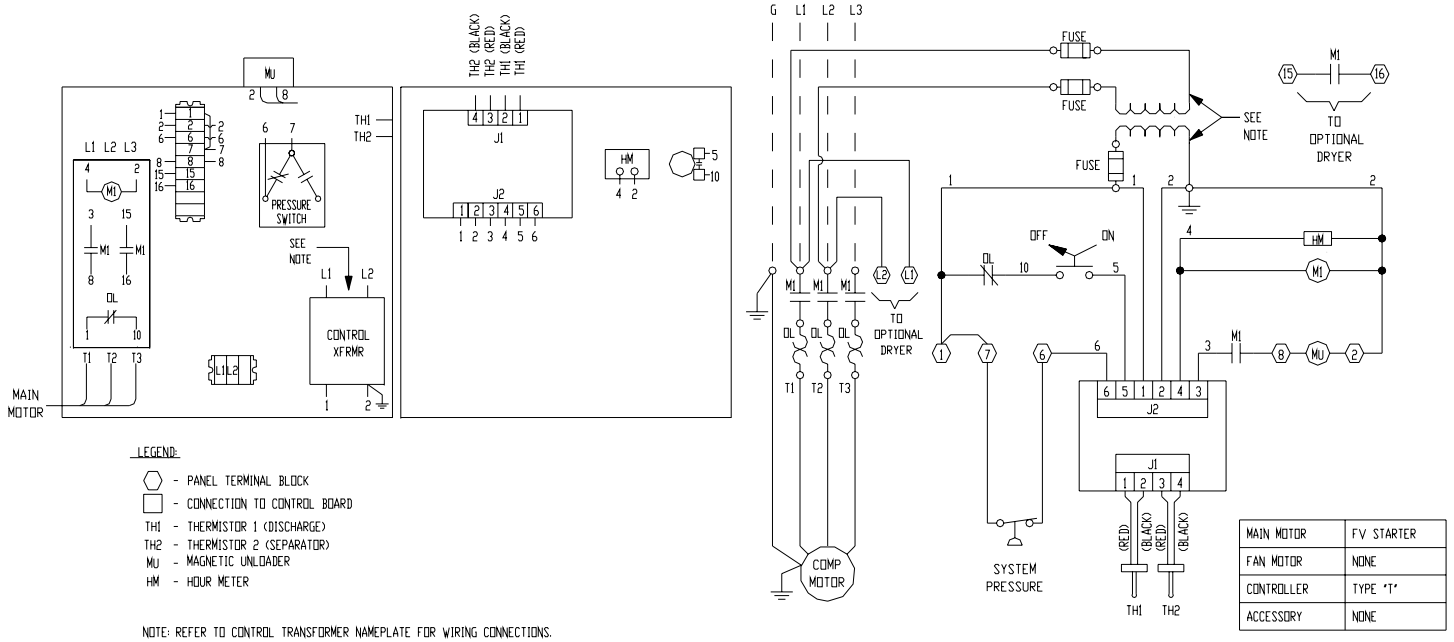
Temperature Shutdown - For test purposes, the high temperature shutdown may be set lower. Install a jumper on the pair of pins furthest from the edge of the controller. The shutdown will occur prior to the compressor reaching its normal operating temperature. Disconnect power, remove the jumper, and close up the control box.

CONNECTION TO EXTERNAL CONTROLS

Remote on-off control of the compressor requires only a simple two-wire control, with an isolated contact suitable for 120 volts, 1 amp. This may be a switch, a timer contact, or a PLC output. To connect, simply run the two wires to the control box, remove the jumper between terminal 1 and terminal 7 and connect the two wires to terminal 1 and terminal 7.

The compressor will operate normally whenever this contact is closed. Note that the switch on the compressor is always the master control; the compressor will not operate unless the control is reset and the switch is in the ON position.

When the remote contact is opened, the compressor will immediately unload, run for its programmed auto time, and stop. If it was already unloaded or stopped, it will simply continue. The compressor will remain stopped until the remote contact is closed to resume automatic operation.



300EFB542-C
(Ref. Drawing)

Figure 4-3 – WIRING DIAGRAM

SECTION 5
LUBRICATION
OIL COOLER, OIL FILTER & SEPARATOR

COMPRESSOR OIL SYSTEM - The compressor oil system cools the compressor, lubricates moving parts and seals internal clearances in the compression chamber.

Air pressure in the oil reservoir forces oil through the oil cooler, thermostatic mixing valve, oil filter and into the compressor main oil gallery.

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

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

OIL SPECIFICATIONS - The recommended compressor lubricant is Gardner Denver AEON 4000 Lubricating Coolant which can be used for year-round operation except as noted in the "High Temperature Operation" (this section) or low temperature, see "Installation for Cold Weather," Section 2, page 10. AEON 4000 Lubricating Coolant is a superior petroleum base lubricant formulated and containing additives for use in Gardner Denver compressors.

CAUTION

Specific AEON lubricants are recommended for use in this equipment. Other lubricants may cause excessive carryover or compressor damage. Do not mix different types of lubricants or use inferior lubricants.

Check the decal on the oil reservoir for lubricating coolant specification.

HIGH TEMPERATURE OPERATION - If the discharge temperature is sustained between 200-210° F for a period of more than four (4) hours due to continuing high ambient air temperature, use Gardner Denver AEON 9000 SP Lubricating Coolant which is a superior synthetic lubricant. Short periods of up to four (4) hours of sustained discharge temperatures up to 210° F do not require a change from the recommended year-round lubricant AEON 4000.

COLD AMBIENT OPERATION - See "Installation for Cold Weather Operation", Section 2, page 10 and FIGURE 2-3, page 9.

PROCEDURE FOR CHECKING OIL LEVEL - Check the oil level when the compressor is shutdown and the oil/air mixture has separated. The oil should be visible in the oil site gage (Figure 5-3, page 29).

ADDITION OF OIL BETWEEN CHANGES – Oil must be added when the oil level is not visible in the oil site gage, as read when the unit is shutdown and the air/oil mixture has settled out to air and oil.

To add oil, follow these steps:

1. Be sure the unit is completely off and that no air pressure is in the oil reservoir.
2. Disconnect, lockout and tagout the power supply to the starter.
3. Wipe away all dirt around the oil filler plug. It is located by the oil filter. See Figure 1-2, page 2.
4. Remove the oil filler plug and add oil as required to return the oil level to the top of the site glass.
5. Install the oil filler plug, run and check for leaks.

DO NOT OVERFILL . The quantity required to raise the oil level from the bottom of the site glass to the top of the site glass is shown in Figure 5-1. Repeated addition of oil between oil changes may indicate excessive oil carry-over and should be investigated.

Use only CLEAN containers and funnels so no dirt enters the reservoir. Provide for clean storage of oils. Changing the oil will be of little benefit if done in a careless manner.

	7-1/2 to 15 HP (5.6 to 11.2 KW)
Refill Capacity For Normal Oil Change	1.0 U.S. Gallon (3.8 Liters)
Bottom of Site Glass to Top of Site Glass	1.0 U. S. Quart (.9 Liter)

Figure 5-1 – APPROXIMATE OIL SYSTEM CAPACITIES

DANGER

Air/oil under pressure will cause severe personal injury or death. Shut down compressor, relieve system of all pressure, disconnect, lockout and tagout power supply to the starter before removing valves, caps, plugs, fittings, bolts and filters.

DANGER

Compressor, air/oil reservoir, separation chamber and all piping and tubing may be at high temperature during and after operation.

CAUTION

Excessive oil carry-over can damage equipment. Never fill oil reservoir above the top of the oil site glass.

OIL CHANGE INTERVAL - Recommended oil change intervals are based on oil temperature. Figure 5-2, page 26, shows how the change interval is affected by temperature.

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

the oil change intervals planned accordingly by the user. Gardner Denver offers a free oil analysis program with the AEON lubricants, and we recommend a sample be sent in at 100 hours on a new unit.

Discharge Temperature	AEON 4000 Change Interval	AEON 9000SP Change Interval
Up to 180° F (82° C)	4000 hrs.	8000 hrs.
180° to 190° F (82° to 88° C)	3000 hrs.	6000 hrs.
190° to 200° F (88° to 93° C)	2000 hrs.	4000 hrs.
200° F+ (93° C)	1000 hrs.	2000 hrs.

Figure 5-2 – OIL CHANGE INTERVAL

DRAINING AND CLEANING OIL SYSTEM

DANGER

Air/oil under pressure will cause severe personal injury or death. Shut down compressor, relieve system of all pressure, disconnect, lockout and tagout power supply to the starter before removing valves, caps, plugs, fittings, bolts and filters.

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

To drain the system, use one of the following methods:

1. Be sure the unit is completely off and that no air pressure is in the oil reservoir.
2. Disconnect, lockout and tagout the power supply to the starter.
3. Using the oil reservoir drain, empty the oil reservoir through the drain valve into a suitable container group.
4. If the drained oil and/or the oil filter element are contaminated with dirt, flush the entire system: reservoir, oil cooler, mixing valve and lines. Inspect the oil separator elements for dirt accumulation; replace if necessary. If a varnish deposit exists, contact the factory for recommendations for removal of the deposit and prevention of varnish.

FILLING OIL RESERVOIR

DANGER

Air/oil under pressure will cause severe personal injury or death. Shut down compressor, relieve system of all pressure, disconnect, lockout and tagout power supply to the starter before removing valves, caps, plugs, fittings, bolts and filters.

DANGER

Compressor, air/oil reservoir, separation chamber and all piping and tubing may be at high temperature during and after operation.

1. Wipe away all dirt around the oil filler plug.

2. Remove the oil filler plug and add oil as required to return the oil level to the top of the site glass.

3. Install the oil filler plug and operate the unit for about a minute allowing oil to fill all areas of the system. Check for leaks.

4. Shut down unit, allowing the oil to settle, and be certain all pressure is relieved.

5. Add oil, if necessary, to bring level to the top of the site glass.

DO NOT OVERFILL as oil carryover will result. The quantity of oil required to raise the oil level from the bottom to the top of the site glass is shown in Figure 5-1, page 25. Repeated addition of oil between oil changes may indicate excessive oil carryover and should be investigated.

Use only CLEAN containers and funnels so no dirt enters the reservoir. Provide for clean storage of oils. Changing the oil will be of little benefit if done in a careless manner.

CAUTION

Excessive oil carry-over can damage equipment. Never fill oil reservoir above the top of the site glass.

LUBRICANT UPGRADE PROCEDURE - Upgrading to a longer life lubricant is essentially a very worthwhile practice. The following are the primary steps to be completed when upgrading or changing the type of lubricant:

1. Thoroughly drain system:
   - Drain oil from airend and cooler while hot.
   - Break low point connections and drain oil from pipe runs.
   - Dump Oil from filter and reinstall used filter.

2. Fill system with a 50 percent charge of the new lubricant:
   - Start the machine and stay there to observe.
   - Allow the machine to run about five minutes at temperature, or until temperature stabilizes, then shut down.

3. Thoroughly drain machine.

4. Change to a new filter and separator.

5. Fill system with a full charge of the new lubricant.

6. Machine should then be run normally; however, total run time after the initial changeout should be 50 percent of normal anticipated service life of the new lubricant.
   - Drain all lubricant from system, change filter and separator, and replace with full charge of the new lubricant.

7. Subsequent lubricant changeouts should be at normal intervals.

CAUTION

Improper equipment maintenance with use of synthetic lubricants will damage equipment. Oil filter and oil separator change intervals remain the same as for AEON 4000. See Maintenance Schedule, page 38.

DANGER

Air/oil under pressure will cause severe personal injury or death. Shut down compressor, relieve system of all pressure, disconnect, lockout and tagout power supply to the starter 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 the unit after high temperature stops operation. Find and correct the malfunction before resuming operation.

WARNING

All materials used in Gardner Denver compressor units are compatible with AEON 9000 SP Lubricating Coolant. Use caution when selecting downstream components such as air line lubricating bowls, gaskets and valve trim.

AEON 9000 SP Synthetic Lubricant is not compatible with low nitrile Buna N or acrylic paints. AEON 9000 SP is compatible with most air system downstream components.

Material Safety Data Sheets (MSDS) are available for all AEON lubricants from your authorized Gardner Denver distributor or by calling (901) 363-6100.

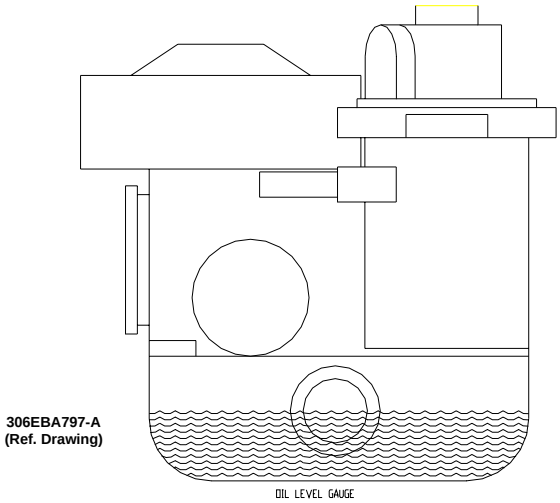


Figure 5-3 – OIL LEVEL GAUGE

OIL LEVEL GAUGE (Figure 5-3) - The oil level gauge indicates the amount of oil in the oil reservoir. Read oil level only when unit is shut down and the air/oil mixture has separated. Add oil only when the oil level is at the bottom of the site glass. Drain oil only when the oil level is above the top of the site glass.

MOISTURE IN THE OIL SYSTEM - In normal humidity and with normal operating temperatures and pressures, the thermal mixing valve controls the oil temperature and prevents moisture contamination of the oil. Unusual cooling of the oil reservoir, short loaded cycle in high humidity or malfunctions of the thermal valve may result in moisture in the oil system which is detrimental to compressor lubrication and could cause oil carryover. If moisture is observed in the oil reservoir, drain the moisture and correct the condition causing the accumulation.

See “Compressor Oil System Check,” page 33 and “Thermal Control (Thermostatic Mixing) Valve,” page 31.

COMPRESSOR OIL FILTER (Figure 1-2, page 2) - This replaceable element filter is a vital part in maintaining a trouble-free compressor, since it removes dirt and abrasives from the circulated oil.

CAUTION

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

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

DANGER

Air/oil under pressure will cause severe personal injury or death. Shut down compressor, relieve system of all pressure, disconnect, lockout and tagout power supply to the starter before removing valves, caps, plugs, fittings, bolts and filters.

DANGER

Compressor, air/oil reservoir, separation chamber and all piping and tubing may be at high temperature during and after operation.

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

COMPRESSOR OIL COOLER - The cooler fan is mounted on the compressor motor shaft; air is exhausted through the oil cooler and away from the unit. Do not obstruct air flow to and from the oil cooler. Allow a minimum of two (2) feet (.6M) clearance around the cooler. Keep both faces of the cooler core clean for efficient cooling of compressor oil.

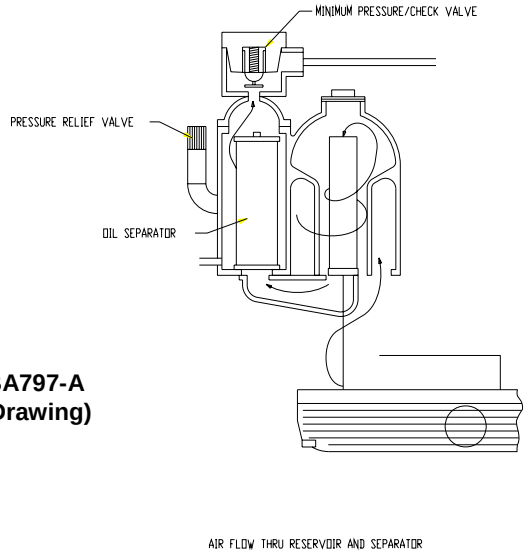


Figure 5-4 – AIR FLOW THROUGH THE RESERVOIR, AIR/OIL SEPARATOR & MINIMUM PRESSURE CHECK VALVE

THERMAL CONTROL (THERMOSTATIC MIXING) VALVE is installed in the system. This valve is used to control the temperature of the oil. On start-up with unit cold, the element is open to bypass, allowing oil to pass directly from the reservoir to the compressor during warm-up. As oil warms, the element gradually closes to the bypass allowing more of the oil from the cooler to mix with oil from the bypass.

After the unit is warmed up, the mixing valve maintains oil injection temperature into the compressor at a minimum of 170°F (77°C). This system provides proper compressor warm-up and prevents moisture contamination of the oil.

To check the element, heat in oil - it should be fully extended at 170°F (77°C). If the unit shuts down due to high air discharge temperature, the cause may be that the element is stuck open to the bypass. When flushing the oil system, remove the mixing valve and clean all parts thoroughly.

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

COMPRESSOR (G-D ELIMINATOR) OIL SEPARATOR located in a separate housing, consists of a renewable cartridge-type separator element and provides the final removal of oil from the air stream.

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

Oil carry-over through the service lines may be caused by a faulty oil separator, overfilling of the oil reservoir, oil that foams, oil return line malfunction, or water condensate in the oil. If oil carryover occurs, inspect the separator only after it is determined that the oil level is not too high, the oil is not foaming excessively, the oil return tube from the bottom of the separator to the compressor cylinder is not clogged or pinched off, the check valve in the oil return is functioning properly, and there is not water or an oil/water emulsion in the oil.

Oil carry-over malfunctions of the oil separator are usually due to using elements too long, heavy dirt or varnish deposits caused by inadequate air filter service, use of improper oil, or using oil too long for existing conditions. Excessive tilt angle of the unit will also hamper separation and cause oil carry-over.

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

Pressure Differential Gauging

1. Be sure the unit is completely off and that no air pressure is in the oil reservoir.

2. Disconnect, lockout and tagout the power supply to the starter.

3. Install accurate pressure gauges upstream and downstream of the air/oil separator.

4. If the differential pressure is greater than 8 psi (.6 bar), change the air/oil separator, see “Removal of Oil Separator For Inspection or Replacement”, page 32.

CAUTION

Using an oil separator element at excessive pressure differential can cause damage to equipment. Replace the separator every year or when the pressure drop across the separator reaches 8 psi.

NOTICE

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

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

Removal of Oil Separator For Inspection or Replacement:

DANGER

Air/oil under pressure will cause severe personal injury or death. Shut down compressor, relieve system of all pressure, disconnect, lockout and tagout power supply to the starter before removing valves, caps, plugs, fittings, bolts and filters.

DANGER

Compressor, air/oil reservoir, separation chamber and all piping and tubing may be at high temperature during and after operation.

1. Be certain the unit is off and that no air pressure is in the oil reservoir.
2. Disconnect, lockout and tagout the power supply to the starter.
3. Remove the minimum pressure/check valve (air/oil separator housing) cover.
4. Lift out the air/oil separator element.
5. Inspect and/or replace the separator as necessary.
6. Clean the sealing surfaces on the air/oil separator and the minimum pressure/check valve.
7. Clean the orifice in the oil return line, the strainer in the oil return line and if necessary the air/oil separator housing.
8. Grease the o-ring on the separator element and install the separator into the housing.
9. Replace the o-ring between the minimum pressure/check valve and the air/oil separator housing.
10. Install the minimum pressure/check valve assembly and tighten the bolts alternately for even tightness.
11. Replace the sealing kit in the minimum pressure/check valve. After the assembling of the valve, leave between a .05 to .08 inch gap between the nut and the cover of the valve. See “Changing Minimum Pressure/Check Valve Seals,” page 19.
12. Run the unit and check for leaks.

COMPRESSOR OIL SYSTEM CHECK - The following readings are based on ambient temperature of 80° F (27° C) with the system in good condition. The compressor should be at operating temperature at the time of the checks. One-half hour of loaded operation is usually sufficient to reach level-out operating temperatures.

Air and Oil Discharge Temperature - 170° F to 200° F (77° C to 93° C) - Check with a thermometer at the discharge housing.

Compressor Oil Inlet Temperature - 160° F to 175° F (71° C to 79° C) - Install a tee at the oil filter outlet and check with a thermometer.

Oil Inlet Pressure - Check at the fitting in the line near the compressor oil inlet. With air receiver pressure at 100 psi (6.9 bar), oil inlet pressure should be 80 to 90 psig (5.5 to 6.2 bar).

Oil Cooler Oil Pressure Differential- Check differential across the oil system by measuring oil inlet pressure as described above.

Oil Cooler Temperature Differential - The oil temperature differential depends on the temperature of the air at the oil cooler fan and cleanliness of the core faces. As ambient temperatures and core restrictions increase, the oil cooler outlet temperature will increase. The oil inlet temperature is approximately the same as the air discharge temperature.

SECTION 6
AIR FILTER

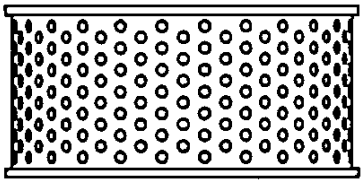


Figure 6-1 – STANDARD DUTY AIR FILTER

STANDARD DUTY AIR FILTER (Figure 6-1) - Service and replacement instructions are given in the following sections: Filter Element and Filter Element Life.

Filter Element - The element should be serviced when inspection indicates an accumulation of dirt on the outside of the element. Clean every 100 to 500 operating hours depending on dust conditions. Inspect every few days until experience determines the proper time interval for servicing.

To Service:

1. Remove element from filter housing.

2. Blow off excess dirt with air nozzle. Direct air blast parallel to element pleats at a slight upward angle. Do not point air blast directly at element.

3. Inspect for rupture by placing a bright light inside the element. The slightest rupture requires replacement of the element.

Filter Element Life - The element should be replaced after eight cleanings or if visual inspection indicates a rupture, crack or pin hole in the pleated media. Inspection should be done by placing a bright light inside the element.

⚠ WARNING

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

SECTION 7
BELT DRIVE

Proper drive belt tension and alignment are provided at the factory, however, good practice dictates checking the drive alignment and tension after shipment and before initial start-up.

Sheaves should align straight across the front with a straight edge. The best tension is just enough tension to keep belts from “squealing” on start-up.

CAUTION

Excessive belt tension can damage the equipment. Tension the belts as shown in Figure 7-2, Page 37.

REPLACING THE COMPRESSOR BELTS

1. Disconnect, lockout and tagout the power supply to the starter.
2. Remove the belt guards.
3. Using adjusting screws, jack the motor base up to loosen the belt tension. Remove the belts.
4. Install new belts, tighten belts using the adjust screws. Check for correct belt tension.
5. Check sheave alignment. (See “SHEAVE ALIGNMENT”, Page 36.
6. Assemble the guards.

CAUTION

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

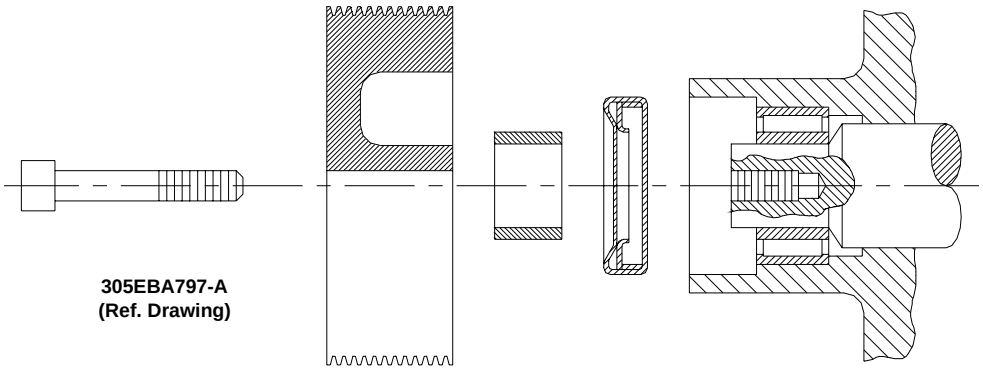


Figure 7-1 – DRIVE SHEAVE

REPLACING THE COMPRESSOR SHEAVE AND SHAFT SEAL (Figure 7-1, page 35)

1. Disconnect, lockout and tagout the power supply to the starter.

2. Remove the guards.

3. Using the adjusting screws, jack the motor base up to loosen the belt tension, Remove the belts.

4. The mounting bolt of the sheave has a left hand thread. The bolt can be loosened by giving the handle of the hex socket key a sharp blow with a hammer. Open the screw only by about 1/4".

5. Pull the sheave off the rotor shaft with a gear puller.

6. The wear sleeve will come off with the sheave.

7. Always replace both the sleeve and the shaft seal. The sleeve is removed by tapping it off with a drift, through the three holes in the sheave.

8. When installing the sheave or shaft seal, carefully clean the shaft end and the seal housing surfaces.

9. Apply a coat of Loctite 542 or 545 to the outside diameter of the shaft seal. Install the shaft seal using a suitable drift.

10. Install the wear sleeve onto the rotor shaft with a suitable drift.

11. Apply a thin coat of Loctite 609 to the sheave surface that will be against the inside of the sleeve, press the sleeve into place and install the pulley using the mounting bolt. Torque bolt to 60 ft-lbs.

12. Install new belts. Check for correct belt tension and re-attach the wire guard.

13. Align sheaves with a straight edge. (See "Sheave Alignment").

14. Assemble the guards

SHEAVE ALIGNMENT

The sheave alignment and belt tightening system consists of a hinged plate for the motor which is supported between (2) posts and a slotted platform for the Tempest units. To achieve proper sheave alignment the sheaves must be adjusted for both parallel and angular alignment. The alignment between the motor and air-end sheaves should be confirmed with the use of a straight edge. If the sheaves are properly aligned, the straight edge should touch the two outer edges of each sheave for a total of four points of contact. Gaps between the outer edges of either of the sheaves and the straight edge indicate sheave misalignment.

The airend sheave is set in the parallel and angular direction by mounting it on the air-end shaft that is part of the Tempest unit that is bolted to the platform. The platform has been set in the parallel and angular directions by its inherent design. The motor sheave is set in the parallel direction by sliding it on the motor shaft to position it in line with the airend sheave. (Check for alignment with straight edge.) **Note**: It may be necessary to loosen the Tempest unit and slide it in the platform mounting slots to keep the motor sheave fan blades in the correct position in the cooler orifice ring.

The motor sheave is set in the angular direction by means of (2) jack bolts and the hinged plate. To start the angular alignment process check to make sure the locking nuts on the jack bolts are loose. The motor sheave can be aligned in the angular direction to the same plane as the airend sheave by turning down the jack bolts on one side or the other of the hinged plate. (Check for alignment with straight edge.) It also may be necessary to use the nuts that are on the jack bolts to push up on one side or the other of the hinged plate. **Note**: At this point it may also be necessary to make minor adjustments of the position

of the sheave on the motor shaft to get proper alignment. Once proper alignment has been obtained, lock the sheave in place on the motor shaft; then the jack bolt lock nuts must be tightened. One set of nuts is tightened down against the base to lock the jack bolts in place. The second set is locked down to sandwich the hinged plate against the jack bolt heads. When lock nuts are in place, a final alignment check should be made with the straight edge.

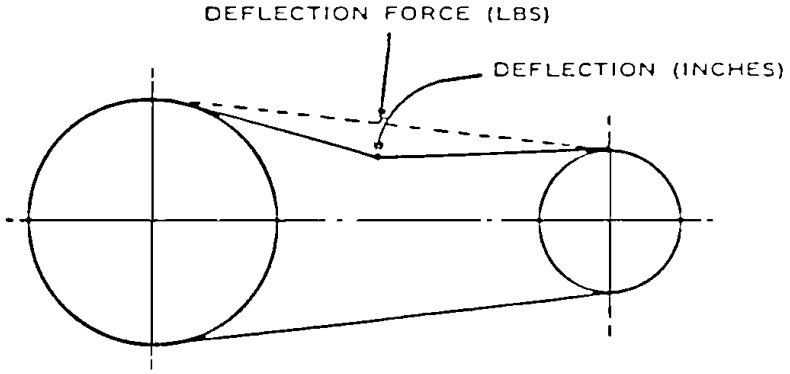
Note: Any of the following actions will require the sheave alignment be checked and any or all of the above steps repeated. (Initial start up at customer site, compressor change, motor change, unit relocation, or when the belts are replaced.)

It's important to note that the belts should not be over tightened. To check belt tension use a Gardner Denver Belt Tension Gauge, Part Number 00543217. V-belt tension will drop after the first 8-24 hrs of unit run time. Failure to check and re-tension the belts after the initial run-in period will result in belt slippage and premature belt failure. Please see Figure 7-2, for proper belt tension.

CHECKING BELT TENSION - Using a spring scale, apply a perpendicular force to each belt at the midpoint of the span and measure the deflection. Correct deflection force and deflection are shown in Figure 7-2. To tighten belts, merely increase the center distance.

NOTICE

When a new set of belts is installed on a drive, the initial deflection force should be 1/3 greater than shown in Figure 7-2. Recheck tension frequently during the first 24 hours of operation



Motor H.P.	Deflection Force Pounds	Deflection In Inches
7.5	6-8	5/16
10	6-8	5/16
15	6-8	5/16

Figure 7-2 – BELT TENSION – J SECTION MICRO-V BELTS

SECTION 8
MAINTENANCE SCHEDULE

SERVICE CHECK LIST –

Air Filter - Operating conditions determine frequency of service. See "Air Filter," SECTION 6, page 34.
Motor Lubrication - Refer to SECTION 2, page 12.

Every 8 Hours Operation

1. Check the reservoir oil level - add oil if required. See SECTION 5, page 24. If oil consumption is high, refer to "Excessive Oil Consumption," page 41.

2. Observe if the unit loads and unloads properly.

3. Check discharge pressure and temperature.

Every 125 Hours Operation

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

Every 150 Hours Operation

1. Check/change the air filter.

Every 1000 Hours Operation

1. Change oil filter element.

Every 4000 Hours Operation

1. Change the compressor lubricant. UNDER ADVERSE CONDITIONS, CHANGE MORE FREQUENTLY (refer to "Oil Change Interval", Figure 5-2, page 26). Flush system if required.

Every Year

1. Check the relief valve for proper operation. See Section 4, page 17.

2. Change oil separator, see "Compressor Oil Separator," page 31, for further details (or when 8 psi pressure differential across the element).

MAINTENANCE SCHEDULE (See Detail Notes above)

Maintenance Action	Every 8 Hours	Every 125 Hours	Every 150 Hours	Every 1000 Hours	Every 4000* Hours	Every Year
Check/Change Air Filter **			•			
Change Oil Separator ***						•
Check Reservoir Oil Level	•					
Check for Proper Load/Unload	•					
Check Fault Indicator Lights	•					
Check Dirt Accumulation on Cooler		•				
Change Oil Filter Element & Clean Oil Return Strainer				•		
Change Compressor Lubricant (AEON 4000)					•	
Check Relief Valve						•
Change Inlet Valve Seals						•

* See Oil Change Interval Chart, Figure 5-2, page 26, for specific lubricant life.

** Check/change more often in dirty environments.

*** Also change when 8 psi ΔP across the element.

SECTION 9
TROUBLESHOOTING

SYMPTOM		POSSIBLE CAUSE		REMEDY
Compressor fails to start	1.	Wrong lead connections.	1.	Change leads.
	2.	Blown fuses in control box.	2.	Replace fuse
	3.	Motor starter overload heaters tripped	3.	Reset and investigate cause of overload.
	4	Pressure in reservoir.	4	Inspect blowdown valve.
Compressor starts but stops after a short time	1.	High discharge temperature.	1.	See “High Discharge Air Temperature,” this section.
	2.	High separator/ high compressor temperature light on.	2.	See “High Discharge Air Temperature”, this section.
	3.	Blown fuse in starter/ control box.	3.	Replace fuse (investigate if fuses continue to blow).
	4.	Motor starter overload heaters trip.	4.	Reset and investigate cause of overload.
Compressor does not unload (or load)	1.	Improperly adjusted control.	1.	Refer to SECTION 4, page 17 and adjust control.
	2.	Air leak in control lines.	2.	Determine source of leak and correct.
	3.	Restricted control line.	3.	Clean control lines.
Compressor cycles from load to unload excessively	1.	Insufficient receiver capacity.	1.	Increase receiver size.
	2.	Restriction in service piping.	2.	Inspect and clean service piping.
	3.	Restriction in control tubing.	3.	Inspect and clean control tubing.
	4.	Plugged aftercooler.	4.	Inspect and clean aftercooler.
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.	Minimum pressure valve stuck closed.	3.	Replace valve.

SYMPTOM		POSSIBLE CAUSE		REMEDY
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 oil filter or cooler (interior).	3.	Replace filter or clean cooler.
	4.	Low compressor oil.	4.	Add oil to proper level.
	5.	Thermostatic mixing valve stuck open	5.	Repair or replace valve.
Excessive Oil Consumption	1.	Oil carryover through lines.	1.	See “Oil Carryover,” in this section.
	2.	Oil leaks at all fittings and gaskets.	2.	Tighten or replace fittings or gasket.
Oil Carryover	1.	Overfilling the reservoir.	1.	Drain excess oil from system.
	2.	Clogged, broken or loose oil return lines.	2.	Tighten or replace faulty lines.
	3.	Ruptured oil separator element.	3.	Replace element.
	4.	Loose assembly.	4.	Tighten all fittings and gaskets.
	5.	Foam caused by use of incorrect oil.	5.	Use Gardner Denver AEON 2000, 4000 or 9000 SP lubricating coolant.
	6.	Inoperative minimum pressure valve.	6.	Replace seals in valve.
	7.	Operation at elevated discharge temperatures.	7.	Reduce temperature. See “High Discharge Air Temperature”, this section.
	8.	Scavenge line check valve failure.	8.	Replace check valve.
	9.	Water condensate in oil.	9.	Check oil reservoir temperature and if low, change thermal mixing valve element to higher temperature.

DANGER

Air/oil under pressure will cause severe personal injury or death. Shut down compressor, relieve system of all pressure, disconnect, lockout and tagout power supply to the starter before removing valves, caps, plugs, fittings, bolts and filters

TROUBLESHOOTING AUTOSENTRY T ELECTRONIC CONTROLLER

The electronic controller provides all of the control functions necessary to operate the compressor package. Five indicator lights on the electronic controller provide information on its operating status. Whenever unexpected operation occurs, carefully note which indicators are lit.

GREEN POWER-ON INDICATOR

This light indicates that power is supplied to the controller. If this light is off, it indicates:

- The disconnect, breaker, or fuses serving the compressor are open

- Transformer fuses are open

- The control board fuse is open or

- There is a break in the wiring

If the light is lit steadily, it indicates that the controller has been properly reset and may be operated. Auto restart has not been enabled.

If the light is flashing rapidly, power has been interrupted, and the controller needs to be reset. Turn the switch to the OFF position to reset the controller.

If the light flashes slowly, it indicates that the controller is operational, and is set for automatic restart after power failure.

If the controls drop out while attempting to start, and this light starts flashing, the wiring to the compressor is insufficient for the load. Check for loose connections or undersized wiring to the compressor package.

GREEN AUTOMATIC MODE INDICATOR

This light simply indicates the operating state of the controller. When it is off, the compressor operation is stopped. If the switch is in the OFF position, switch it to ON to start the compressor. If the light is off while the switch is in the ON position, the overload relay has tripped.

When the operating switch is turned on, the light will light to indicate that automatic operation is enabled. The light will be on steadily if the pressure switch closes to load the compressor. The light flashes slowly while running unloaded or while the motor is stopped.

If this light is off, but the top red led flashes, refer to high voltage indication below.

YELLOW HIGH / LOW TEMPERATURE WARNING

This indicator lights if temperatures at either probe are near freezing or near the high temperature shutdown temperature. It will not shut down the compressor, but advises that operating conditions are near the limits of the compressor package. If the conditions improve, the light will begin flashing after all temperatures are back within normal operating range. If the compressor is located in a cold area, provide shelter and heat to prevent icing in the package. If this indicator comes on while the compressor is running, check oil level and proper flow of cooling air through the cooler. Provide adequate ventilation to the package to reduce ambient temperatures.

This may be reset by simply switching the operating switch to the OFF position. The controller will recall any warning following a power interruption, and must be reset with the switch.

RED COMPRESSOR TEMPERATURE
FAULT INDICATOR

These indicators light only if shutdown conditions exist with thermistors used to sense temperatures. The shutdown conditions are (1) high temperature, (2) shorted thermistor or wiring, (3) open thermistor or wiring or (4) extreme low temperature. The indicator will be lit steadily while the condition exists, and flash after the condition is cleared. After the condition is cleared, the controller may be reset by switching the operating switch to the OFF position. The controller will recall any shutdown following a power interruption, and must be reset with the switch.

A steady light usually indicates an open or shorted cable. Check the connections and cable conditions carefully, and service as required.

If the shutdown occurs while the compressor was running, the temperatures drop fairly rapidly, and you will normally see a flashing indicator. Check for proper oil level. Check that the fan is operating properly, the cooler is clean, and that the compressor is located where suitable cooling air is available.

The trip temperature may be lowered by following adjustment instructions, detailed in the controls section of this manual.

HIGH VOLTAGE INDICATION

If the top red led flashes, but all other lights are off, the controller has sensed high voltage. Disconnect power. Refer to the transformer connection information in the installation instructions, and connect the transformer properly. Check that the motor is properly connected for the available voltage. Check all other electrical components for damage. Restore power to the unit and verify proper voltage on the 120 volt secondary of the control transformer.

TROUBLESHOOTING VOLTAGE PROBLEMS

The compressor package has been designed, built, and tested to operate within one of the following standard ranges:

200-208 Volts, 60 Hertz

220-230 Volts, 50 Hertz

230-240 Volts, 60 Hertz

380-416 Volts, 50 Hertz

460-480 Volts, 60 Hertz

575-600 Volts, 60 Hertz

Connection to higher voltages will reduce the life of electrical devices within the compressor package. As voltages get further above the design range, other symptoms may show up.

High voltages may lead to high motor currents. The overload relay will sense these and shut down the compressor to protect the motor.

Overvoltage protection is provided to protect the electronic control. If the controller senses high voltage, it will attempt to turn off its outputs, and will latch into a protective mode. The lower 4 lights will all go off, the top red light will flash.

If the control transformer primary fuses blow, check that the transformer is properly connected for the incoming line voltage.

Operation with lower voltages will reduce motor life and load capacity. As voltages get further below the design range, other symptoms may show up.

Low voltages may lead to high motor currents. The overload relay will sense these and shut down the compressor to protect the motor. If voltage is low while the compressor is off, locate and correct the cause. If the voltage drops low only while the compressor is running, look for poor connections or undersized wiring.

If any of the starters or contactors within the box chatter, or if the electronic controller drops out while attempting to start, it is a clear indication that the wiring is inadequate for the compressor. Look for poor connections or undersized wiring.

OTHER CONTROLS TROUBLESHOOTING

If the overload relay has tripped, disconnect and lock out power. Check all line and load connections to the starter for proper torquing. Check that the overload relay is properly adjusted per the instructions glued inside the control box. Look for any additional sources of heat which may affect the overload relay. Reset the relay by pressing the reset button on the relay. Close up the box and restore power.

If overload problems persist, contact a qualified electrician or motor shop. Measure all incoming voltages with the motor off and at full load. Measure amps while running full load. Correct wiring if voltages are outside of limits or if imbalance is found in any of the sets of readings. If voltages are okay, but amps are high, reduce the load on the motor.

Remember that the overload relay is designed to protect both the motor and the wiring. Do not misadjust this protection.

If the Auto light is steadily lit, but motor does not start, check the starter coil and wiring from the controller to the coil.

If the Auto light is steadily lit, but the compressor does not load, check the solenoid valve coil, the motor starter contact, and the wiring from the controller to these components.

If pressure drops, but the Auto light does not stop flashing, check the adjustment and connections of the pressure switch.

If the pressure rises, but the Auto light stays lit steadily, check the adjustment and connections of the pressure switch.

NOTICE

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

GENERAL PROVISIONS AND LIMITATIONS
Gardner Denver (the "Company") warrants to each original retail purchaser ("Purchaser") of its new products from the Company or its authorized distributor that such products are, at the time of delivery to the Purchaser, made with good material and workmanship. No warranty is made with respect to:

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

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

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

4. Components or accessories manufactured, warranted and serviced by others.

5. Any reconditioned or prior owned product.

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

WARRANTY PERIOD
The Company's obligation under this warranty is limited to repairing or, at its option, replacing, during normal business hours at an authorized service facility of the Company, and part which in its judgment proved not to be as warranted within the applicable Warranty Period as follows.

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

Any disassembly or partial disassembly of the airend, or failure to return the "unopened" airend per Company instructions, will be cause for denial of warranty.

MAJOR PACKAGE COMPONENTS
The drive motor, air or water cooled coolers and the AutoSentry Controller are warranted for 24 months from date of initial use or 27 months from date of shipment to the first purchaser, whichever occurs first.

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

LABOR TRANSPORTATION AND INSPECTION
The Company will provide labor, by Company representative or authorized service personnel, for repair or replacement of any product or part thereof which in the Company's judgment is proved not to be as warranted. Labor shall be limited to the amount specified in the Company's labor rate schedule.

Labor costs in excess of the Company rate schedule amounts or labor provided by unauthorized service personnel is not provided for by this warranty.

All costs of transportation of product, labor or parts claimed not to be as warranted and, of repaired or replacement parts to or from such service facilities shall be borne by the Purchaser. The Company may require the return of any part claimed not to be as warranted to one of its facilities as designated by Company, transportation prepaid by Purchaser, to establish a claim under this warranty.

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

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

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

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

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

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

Gardner Denver

Specifications subject to change without notice.

 Litho in U.S.A.

http://www.gardnerdenver.com **mktg@gardnerdenver.com**

For additional information contact your local representative or

Gardner Denver Compressor Division,
1800 Gardner Expressway, Quincy, Illinois 62301
Customer Service Department Telephone:
(800) 682-9868 FAX: (217) 224-7814

Sales and Service in all major cities.

For parts information, contact Gardner Denver,
Master Distribution Center, Memphis, TN
Telephone: (800) 245-4946 FAX: (901) 542-6159