GARDNER DENVER®

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INTEGRA™
BASE-MOUNTED
COMPRESSORS

MODELS

EFA99F
5, 7-1/2 & 10 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 is 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 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 the Remanufacturing Center in Indianapolis, IN., 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 there are over 200 remanufactured units in inventory at all times, ready for immediate delivery.

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…18 months from purchase, 12 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	Parts List
5, 7-1/2 & 10	100, 125, 150, 175	13-8-532

NOTE: 175 psig only available on 7-1/2 & 10 HP.

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GENERAL INFORMATION

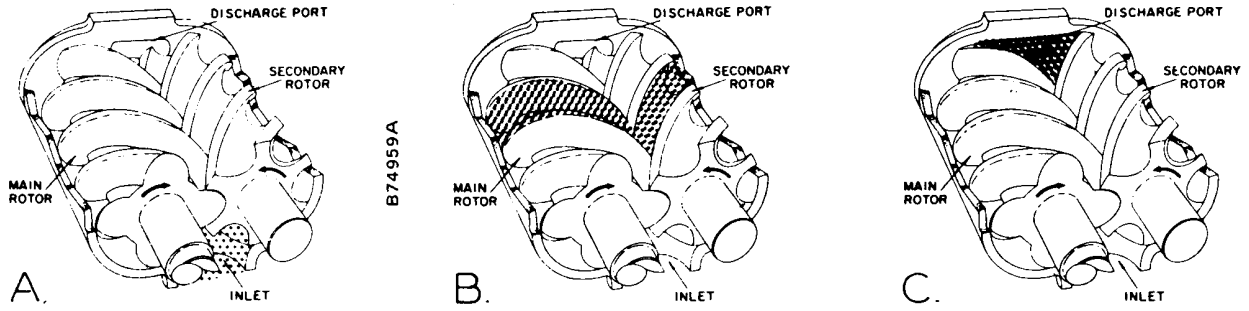


Figure 1-1 – COMPRESSOR CYCLE

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 groove, 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.

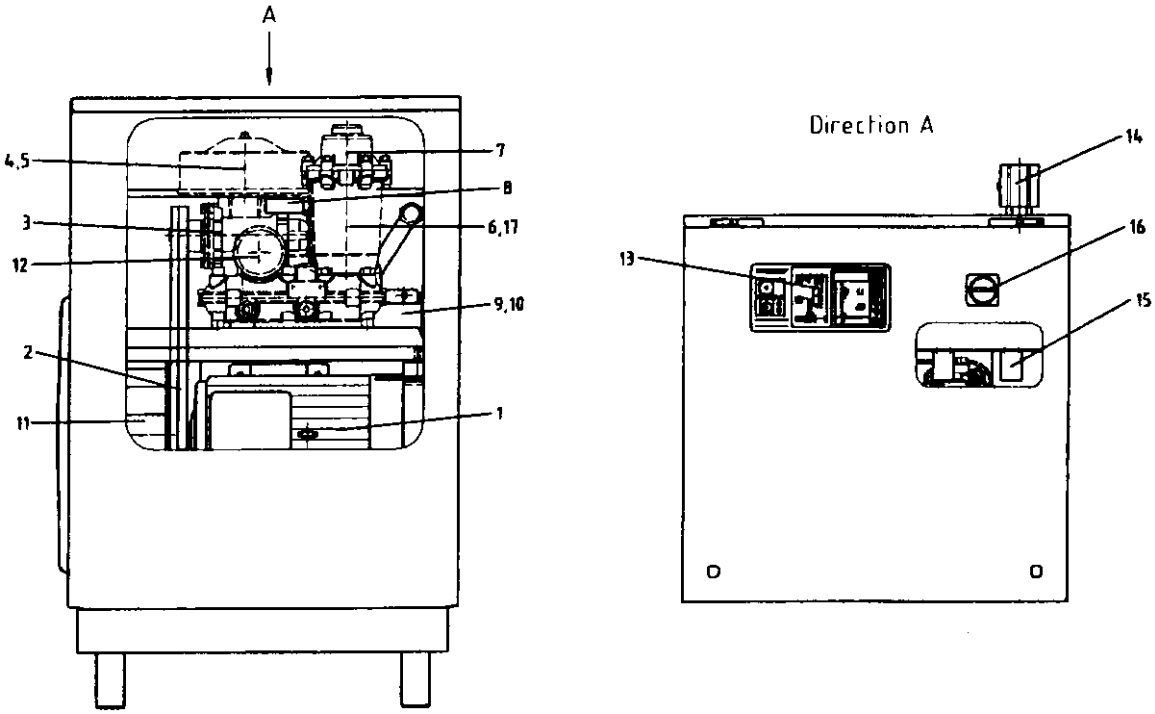
AIR FLOW IN THE COMPRESSOR SYSTEM (Figure 5-1, page 45) - Air enters the air filter and passes through the inlet unloader valve and into the compression chamber where oil is injected into the air. After compression, the air/oil mixture passes into the oil reservoir where most of the entrained oil is 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 into the compressor main oil gallery. A portion of the oil is directed through internal passages to the bearings and input 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.

OPERATING PRINCIPLES

MAIN COMPONENTS

The Gardner Denver screw compressor is a single stage screw compressor with oil cooler. The pressurized air is produced with a screw compressor unit driven by an electric motor. Oil is separated from the compressed air in an oil separation receiver. The pressurized air and the oil are cooled with separate coolers.



No.	Component	Purpose
1	Motor	Airend drive
2	Belts	Power transmission
3	Airend	Air compression
4	Inlet Valve	Output control
5	Inlet Filter	Filtering inlet air
6	Oil Separator	Oil separation
7	Minimum Pressure/Check Valve	Check valve; maintaining minimum pressure for oil flow to bearings
8	Pressure Relief Valve	Protection against too high pressures
9	Oil Cooler	Cooling of oil
10	Aftercooler	Cooling of compressed air
11	Fan	Cooling
12	Oil Filter	Oil filtering
13	Instrument Panel	Compressor operation and control
14	Moisture Separator	Separation of water from compressed air
15	Control Valves	Output control;
16	Main Switch	Power supply
17	Thermal Mixing Valve	Maintains minimum temperature of oil

Figure 1-2 – COMPRESSOR PACKAGE COMPONENTS

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.

- **Stop the unit if any repairs or adjustments on or around the compressor are required**
- **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.**
- **An Excess Flow Valve should be on all compressed air supply hoses exceeding 1/2 inch inside diameter. (OSHA Regulation, Section 1926.302, or local regulations)**
- **Do not exceed the rated maximum pressure values shown on the nameplate.**
- **Do not operate unit if safety devices are not operating properly. Check periodically. Never bypass safety devices.**

DECALS

⚠DANGER

Discharge air used for breathing will cause severe injury or death. Consult filtration specialist for additional filtration and treatment equipment to meet health and safety regulations.

⚠PELIGRO

El aire de descarga utilizado para respirar ocasionará lesiones personales graves o la muerte. Consulte un especialista en filtraciones a modo de informarse sobre equipo de tratamiento y filtración adicional para cumplir con las regulaciones de salud y seguridad.

⚠DANGER

L'air provenant de la purge n'est pas respirable et entraînera des blessures graves ou la mort. Consulter un spécialiste en filtration pour obtenir de l'équipement de filtration et de traitement supplémentaire conforme aux normes de santé et sécurité au travail.

305EFC077

⚠WARNING

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

⚠ADVERTENCIA

La unidad puede arrancar automáticamente y ocasionar lesiones personales o la muerte.
Familiarícese con el modo de operación antes de trabajar en o cerca de la máquina.

⚠AVERTISSEMENT

L'appareil peut redémarrer automatiquement et entraîner des blessures ou la mort.
Connaître le mode de fonctionnement avant de travailler sur ou d'être à proximité de la machine.

306EFC077

⚠WARNING

Rotating machinery can cause personal injury or death.
Keep all guards and safety devices in place.

⚠ADVERTENCIA

Las maquinarias rotatorias pueden ocasionar lesiones personales o la muerte. Mantenga todas las guardas de protección y dispositivos de seguridad en su lugar.

⚠AVERTISSEMENT

Les machines tournantes peuvent entraîner des blessures ou la mort. Garder en place toutes les protections et tous les appareils de sécurité.

307EFC077

⚠DANGER

Air and oil under pressure will cause severe personal injury or death. Stop compressor, lockout and tagout power supply, and relieve system of all pressure before removing valves, caps, plugs, fittings, bolts and filters.

⚠PELIGRO

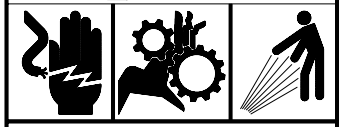
El aire y el aceite bajo presión pueden ocasionar lesiones personales graves o la muerte. Apague el compresor, bloquee y rotule la fuente de alimentación eléctrica, y alivie el sistema de toda presión antes de extraer válvulas, sombreretes, tapones, accesorios, pernos y filtros.

⚠DANGER

L'air et l'huile sous pression entraîneront des blessures graves ou la mort. Arrêter le compresseur, verrouiller et étiqueter l'alimentation, et purger toute la pression du système avant de déposer les soupapes, les capuchons, les prises, les raccords, les boulons et les filtres.

308EFC077

⚠DANGER



High voltage, rotating machinery, air and oil under pressure. Improper modification of equipment will cause severe personal injury or death.
Do not modify unit without written permission from manufacturer.

⚠PELIGRO

Alto voltaje, maquinaria rotatoria, aire y aceite bajo presión. La modificación inadecuada del equipo puede ocasionar lesiones personales graves o la muerte.
No modifique la unidad sin el consentimiento por escrito del fabricante.

⚠DANGER

Haute tension, machines tournantes, air et huile sous pression. Une modification incorrecte de l'équipement entraînera des blessures graves ou la mort.
Ne pas modifier l'appareil sans une autorisation écrite du fabricant.

309EFC077

⚠WARNING

Read operator manual before starting unit.
Failure to adhere to instructions can result in severe personal injury or death.

⚠ADVERTENCIA

Lea el manual del operador antes de poner en marcha esta unidad. El no observar las instrucciones podría ocasionar lesiones personales graves o la muerte.

⚠AVERTISSEMENT

Lire le manuel de l'utilisateur avant de démarrer cet appareil, négliger de suivre les instructions peut entraîner des blessures graves ou la mort.

DECALS

⚠WARNING

Electrical shock can cause injury or death. Disconnect all circuits before working on control. See wiring diagram.

⚠ADVERTENCIA

Las descargas eléctricas pueden ocasionar lesiones o la muerte. Desconecte todos los circuitos antes de trabajar en este control. Vea el diagrama de cableado.

⚠AVERTISSEMENT

Un choc électrique peut entraîner des blessures ou la mort. Débrancher tous les circuits avant de travailler sur cette commande. Voir le schéma de câblage.

⚠WARNING

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

⚠ADVERTENCIA

La unidad puede arrancar automáticamente y ocasionar lesiones personales o la muerte.
Familiarícese con el modo de operación antes de trabajar en o cerca de la máquina.

⚠AVERTISSEMENT

L'appareil peut redémarrer automatiquement et entraîner des blessures ou la mort.
Connaître le mode de fonctionnement avant de travailler sur ou d'être à proximité de la machine.

315EFC077

⚠DANGER

- High voltage. Electrical shock can cause personal injury or death. Open main disconnect switch and disconnect all circuits before working on this control. See wiring diagram. Improper modification of equipment will cause severe personal injury or death. Do not modify unit without written permission from manufacturer.
- Electrical shock from improper grounding can cause injury or death. Ground unit and related equipment according to national electric code and local regulations.
- Electrical arcing can cause a fire when unit is mounted on a combustible surface resulting in personal injury or property damage. Unit must be mounted on a floor plate extended on all sides see installation drawing for proper dimensions.
- Read operator manual before starting unit. Failure to adhere to instructions can result in severe personal injury of death.

⚠PELIGRO

- Alto voltaje. Las descargas eléctricas pueden ocasionar lesiones o la muerte. Abra el interruptor de desconexión y desconecte todas los circuitos antes de trabajar en este control. Vea el diagrama de cableado. La modificación inadecuada del equipo puede ocasionar lesiones personales graves o la muerte. No modifique la unidad sin el consentimiento por escrito del fabricante.
- Las descargas eléctricas producidas por una puesta a tierra inadecuada pueden ocasionar lesiones o la muerte. Ponga a tierra la unidad y equipo relacionado de acuerdo con el código eléctrico nacional y las regulaciones locales.
- Cuando la unidad se monta sobre una superficie combustible, la formación de arco eléctrica puede provocar un incendio y ocasionar lesiones personales o daño a la propiedad. La unidad debe montarse en una placa de apoyo extendida en todos los extremos. Vel el diagrama de instalación para informarse sobre las dimensiones correctas.
- Lea el manual del operador antes de poner en marcha esta unidad. El no observar las instrucciones podría ocasionar lesiones personales graves o la muerte.

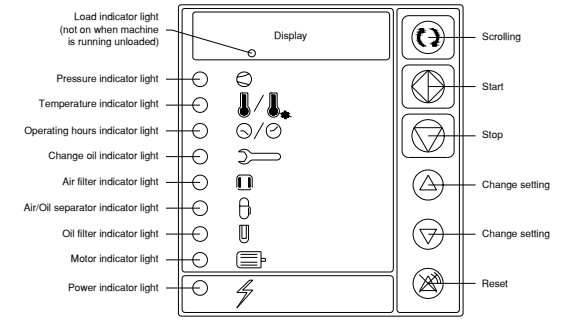
⚠DANGER

- Haute tension. Un choc électrique peut entraîner des blessures ou la mort. Ouvrir le sectionneur principal et débrancher tous les circuits avant de travailler sur cette commande. Voir le schéma de câblage. Une modification incorrecte de l'équipement entraînera des blessures graves ou la mort. Ne pas modifier l'appareil sans une autorisation écrite du fabricant.
- Un choc électrique résultant d'une mise á la terre incorrecte peut entraîner des blessures ou la mort. Mettre á la terre l'appareil et les équipements qui lui sont reliés en respectant les réglements du code national de l'électricité et les réglements locaux.
- Un arc électrique peut produire un incendie si l'appareil est monté sur une surface combustible et entraîner ainsi des blessures ou endommager la propriété. L'appareil doit être monté sur une plaque de plancher étendue sur tous les côtés. Consulter l'illustration d'installation pour connaître les dimensions correctes.
- Lire le manuel d'instructions avant de démarrer l'appareil. Négliger de suivre les instructions peut entraîner des blessures graves ou la mort.

311EFC077

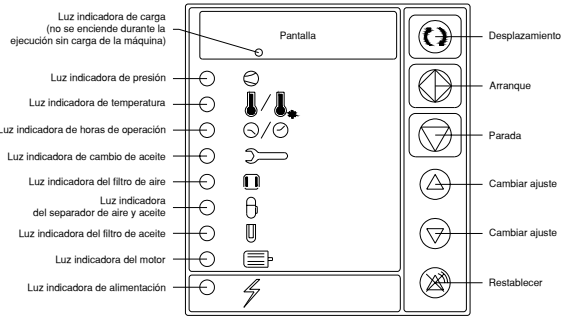
CONTROLLER LEGEND

(Refer to instruction manual for detailed procedure before starting unit)



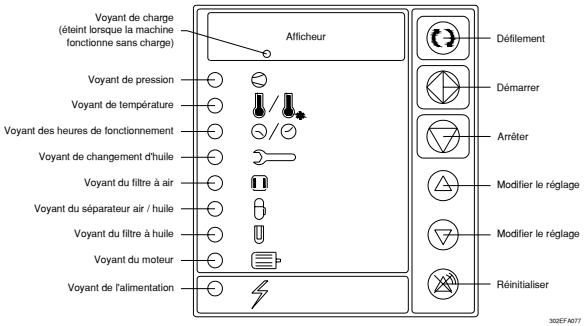
LEYENDA DEL CONTROLADOR

(Antes de poner en marcha la unidad consulte el manual de instrucciones para obtener información detallada sobre procedimiento)



LÉGENDE DU CONTRÔLEUR

(Consulter le manuel d'instructions pour connaître les détails des opérations avant de démarrer l'appareil)



302EFA077

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 (Figure 2-1, page 14) - Proper lifting and/or transporting methods must be used to prevent damage.

CAUTION

Lift compressor unit by base only. Do not use other places such as 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.

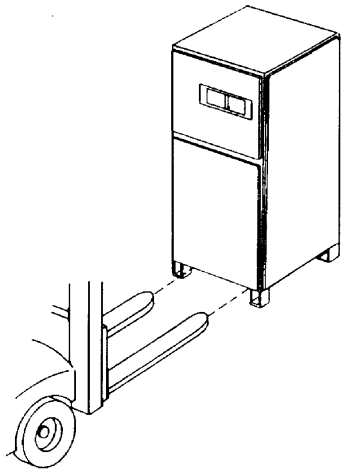


Figure 2-1- PREFERRED LIFTING METHOD

300EFA804-A
(Ref. Drawing)

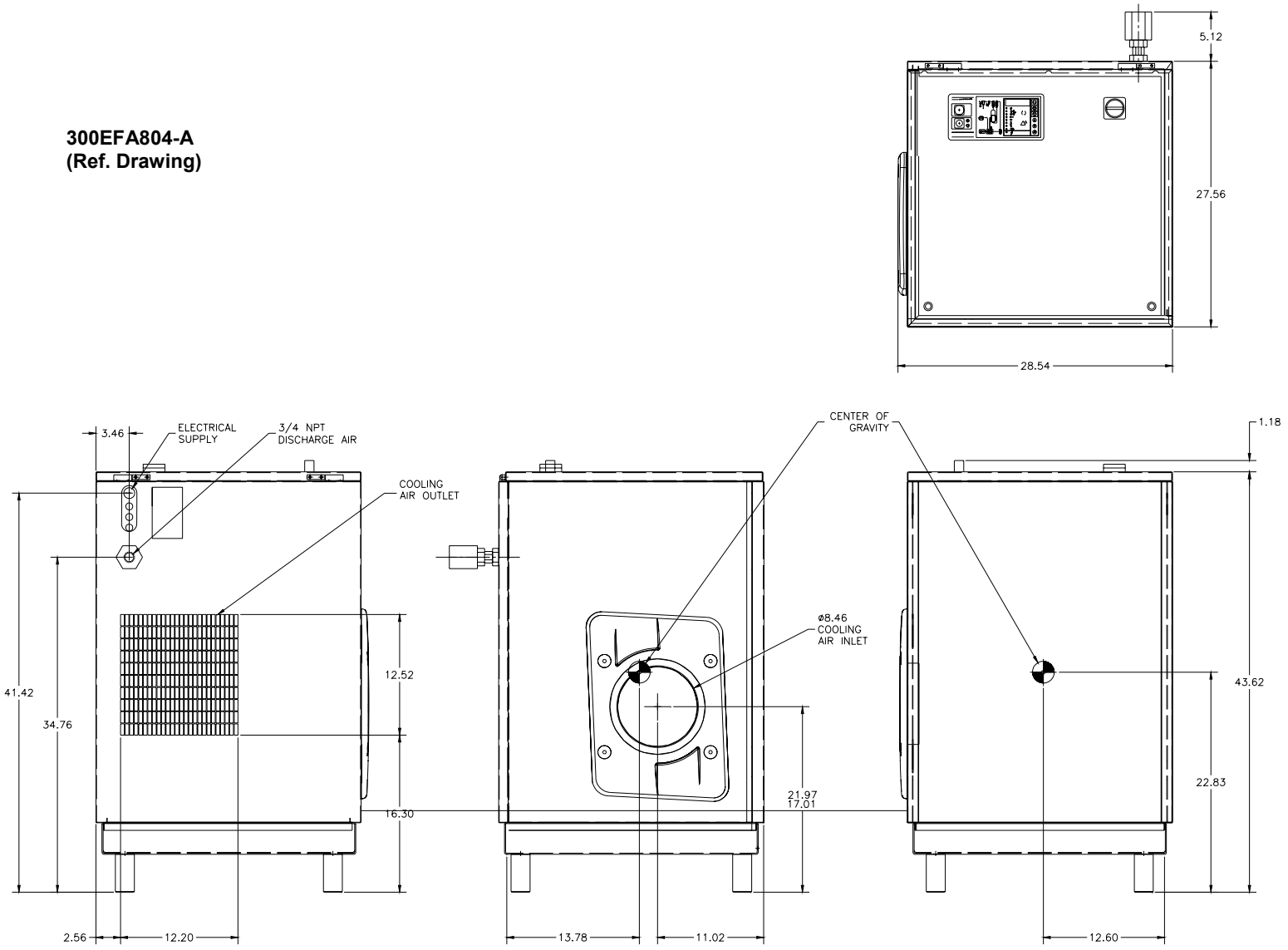


Figure 2-2 – OUTLINE, UNIT PACKAGE

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 2-3 below). 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 starter end and control box end of the unit. Allow three (3) 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, 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.

Minimum Air Flow* For Compressor And Cooling (Cubic Feet/Minute)	
	Air Cooled
All Models	1000 cfm

* 80° F Inlet Air

Figure 2-3 – 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 58.

OIL RESERVOIR DRAIN - The oil drain is piped from the bottom of the reservoir through a shutoff valve. A plastic tube is connected to the shutoff valve for draining the oil.

⚠ 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 panels to be removed. Any of the enclosure panels may be removed by opening the top, removing the screw on the lower left panel and lifting the enclosure panel up to disengage it from the base and the other enclosure panel. The screw is removed by twisting it a half turn and pulling it out

DANGER

Do not operate the compressor with the fan, belts or sheaves exposed. Exposed fan, belts and sheaves may cause injury to personnel.

CAUTION

The enclosure doors are connected to a shutdown switch that will not allow the compressor to operate without the complete enclosure in place.

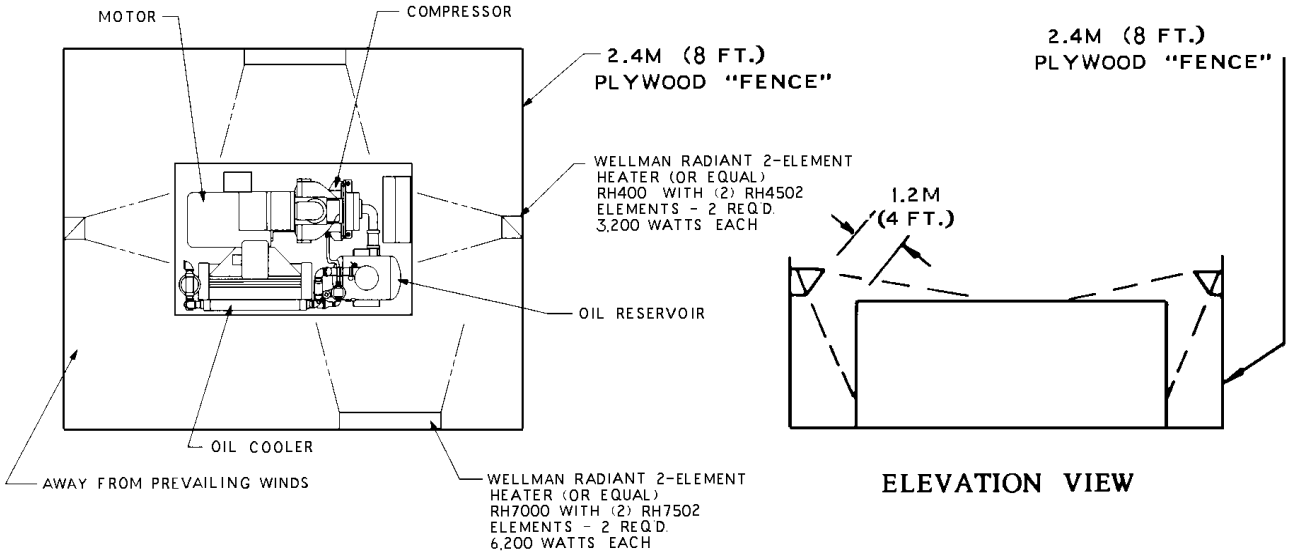


Figure 2-4 – COLD WEATHER INSTALLATION

INSTALLATION FOR COLD WEATHER OPERATION (Figure 2-4) - It is recommended that the unit be installed inside a shelter that will be heated to temperatures above freezing (32° F, 0° C). This will eliminate many of the problems associated with operating 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° 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 9000SP 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

STANDARD MOISTURE SEPARATOR/TRAP - The unit is equipped with a built-in aftercooler, a combination moisture separator and trap 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”, page 18.

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 on the side of the package, (See Outline Drawing 300EFA804). 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 rising too rapidly.

⚠ WARNING

The controller has an automatic start/stop sequence built in. You DO NOT need to close the air service valve. Closing the air service valve on start-up or prior to shutdown will cause rapid cycling, and could cause a high pressure shutdown.

When piping two or more rotary screw units on the same line, each unit is isolated by the minimum pressure/check valve mounted on each compressor package.

If a rotary screw unit is piped 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 piped 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 control box, accessible by opening the cover of the box.

Perform all wiring in accordance with the National Electrical Code (NFPA-70) and any applicable local electrical codes. Wiring must be performed only by qualified electricians.

⚠ WARNING

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

If the optional base mounted air receiver and/or dryer is on this package, 110 volt single phase power will need to be supplied to the optional dryer and to the moisture drain on the air receiver.

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

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⚠ 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

	Standard Service	High Temperature (104° F, 40° C)
Worked Penetration	265-296	220-240
Grease 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

ELECTRIC MOTOR REGREASING INTERVAL

Type of Service	Typical	Rating	Relubrication Interval
Standard	One or Two Shift Operation	5 to 50 HP	3200 Hours
Very Severe	Dirty Locations, High Ambient Temperature (104° F, 40° C)	5 to 50 HP	500 hours

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 Section 5, page 45.

   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 9000SP 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 57, for complete servicing instructions. Be sure the inlet line, if used, is tight and clean.

3. **Piping** – Refer "Installation", Section 2, page 14 and make sure piping meets all recommendations.

4. **Electrical** - Check the wiring diagrams furnished with the unit to be sure it is properly wired. See pages 38 thru 43, for general wiring diagrams and page 19, 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 switch. The emergency stop button must be used to stop the compressor. Compressor drive shaft rotation is counterclockwise when facing the compressor sheave.

⚠ WARNING

The motor is held up to prevent belt damage during shipment. Remove the shipping hardware to lower the motor to its operating position prior to starting the package. Loosen locking nut and unthread the long set screw the majority of the way (this lowers the motor) and tighten the locking nut. Then remove the screws clamping the vibration isolators on the airend sub-base.

⚠ WARNING

The compressor must be stopped with the emergency stop button in order to get an immediate stop.

⚠ 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.

⚠ WARNING

The compressor unit's direction of rotation must be check every time the compressor is reconnected to the power supply.

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 "USER MENU", Section 4, page 30, 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 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.

DANGER

The compressor starts and stops automatically. Automatic restarting can cause injury or death. Open, lockout and tagout main disconnect and any other circuits before servicing the unit.

CAUTION

The enclosure doors are connected to a shutdown switch that will not allow the compressor to operate without the complete enclosure in place.

STARTING THE UNIT - Observe the following starting procedures:

WARNING

After an emergency stop, be sure that the pressure in the air/oil reservoir is less than 5 psig. Wait one minute or more before restarting.

WARNING

The controller has an automatic start/stop sequence built in. You do NOT need to close the air service valve. Closing the air service valve on start-up or prior to shutdown will cause rapid cycling, and could cause a high pressure shutdown.

1. Turn the customer supplied main switch on.
2. Push the Start button.

DAILY CHECK - Refer to "Maintenance Schedule," Section 8, page 63.

STOPPING THE UNIT:

1. Push the Stop button.
2. Wait approximately one minute to allow the compressor to stop.
3. Turn the customer supplied main switch off.

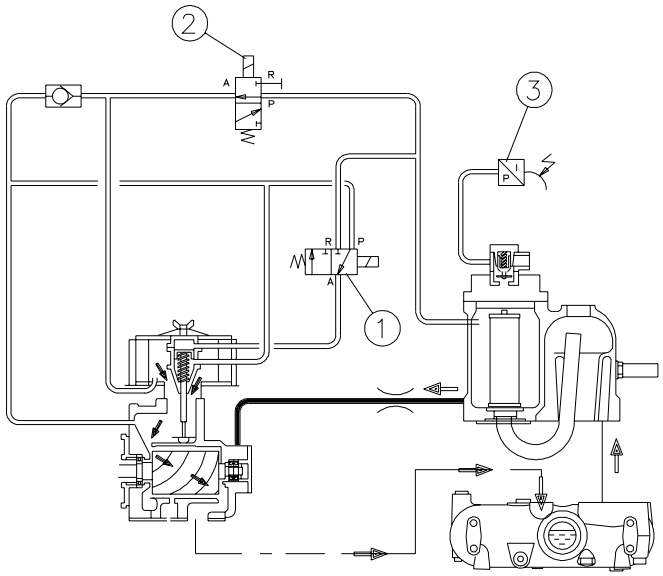
EMERGENCY STOP – The compressor stops when the Emergency Stop button is pushed.

To restart the compressor, wait one (1) minute after Emergency Stop, then turn the Emergency Stop button clockwise to release it. Start the compressor per the instructions above. If an alarm has been set, press the Reset button before starting.

SECTION 4
CONTROLS & INSTRUMENTATION

GENERAL DESCRIPTION - The rotary screw compressor package is prewired with all controls, motor and starter for the voltage and horsepower at the time of ordering. It is necessary only to connect the compressor unit to the correct power supply and the shop air line. A standard compressor package consists of the compressor, air/oil reservoir, oil cooling system and filter, motor, starter/control box and control components.

This compressor unit features the AIRPILOT ELECTRONIC CONTROLLER, which integrates all the control functions under microprocessor control. Its functions include safety and shutdown, compressor regulation, operator control, and advisory/maintenance indicators. The keypad and display provide the operator with a logical and easily operated control of the compressor package and indication of its condition.



Ref. No.	Description
1	Inlet Valve Solenoid
2	Blowdown Valve/Purge Valve
3	Pressure Transducer

300EFC797-A
Ref. Drawing)

Figure 4-1 – CONTROL SCHEMATIC

AIRPILOT ELECTRONIC CONTROLLER - The controller controls all the functions connected to the regulation of the compressor. The unit adjusts the following parameters of the compressor's operation:

Discharge pressure regulating method: Blowdown/stopping automatics, start/stop operation.

Unload pressure: The pressure at which the compressor unloads.

Load pressure: The pressure at which the compressor goes from unload to full output.

High discharge temperature shutdown operation.

High pressure shutdown operation.

Compressor motor starting time.

Compressor automatic time delay before shutting down (air/oil separator is blowndown first).

Drain time and interval for water separator.

Compressor blowdown time before restart. (The air/oil separator must be blowndown before starting).

Control System Operation - The purpose of the control system is to adjust the production of compressed air according to the demands of the system and to lower power consumption.

Compressor Running Fully Loaded - When the compressor runs loaded, the inlet valve is open and the compressor produces compressed air.

As the compressor package starts, the motor is started after a four second delay, the inlet control solenoid valve Item 1, Figure 4-1, page 25, is energized. This opens a connection between the unit's inlet and the back side of the inlet valve piston. A partial vacuum on the inlet valve plate and piston cracks open the inlet valve and the compressor starts producing compressed air. When the pressure in the air/oil separator increases, the pressure on the upper side of the piston opens the valve completely, and the compressor runs at full capacity.

Compressor Running Unloaded - When the compressor is running unloaded, the inlet valve is closed and the compressor produces no compressed air. At the same time, to minimize power consumption, the air/oil separator is blown down. When the discharge pressure reaches the unload pressure programmed into the controller, the inlet control solenoid valve, Item 1, Figure 4-1, page 25, closes the connection to the upper side of the inlet piston and the air/oil reservoir, and the inlet valve spring closes the inlet valve plate.

At the same time, the blowdown valve, Item 2, Figure 4-1, page 25, opens and the air/oil reservoir is blown down. The purge valve, Item 2, Figure 4-1, page 25, is used for bleeding a small amount of air back into the inlet side of the compressor. This lowers the noise the compressor makes when running in the unloaded condition.

Automatic Start/Stop - If demand for compressed air stops, the compressor runs unloaded and blown down until the automatic timer has counted down, then the unit shuts down. When the demand for compressed air rises enough to drop the pressure below the load pressure programmed into the controller, the compressor automatically starts.

STARTER/CONTROL BOX (Figure 4-2, page 28) - The following parameters of the compressors operation can be adjusted:

1. Unload Pressure – the pressure at which the compressor unloads (upper limit).
2. Load Pressure – the pressure at which the compressor loads (lower limit).
3. Compressor Automatic Timer – time the unit runs unloaded before the motor stops.
4. Automatic Start after power shutdown.
5. Condensate Removal open time.
6. Condensate Removal close time.

The AIRPILOT ELECTRONIC CONTROLLER has a 7-digit LED display for showing information. The normal display shows operating pressure and temperature.

The electronic controller has a built-in automatic restart for restarting the compressor package after a power failure. This function is switched off in the factory settings. See USER MENU, "Automatic start after power failure", page 31,

The version identification of the electronic controller is on a label behind the controller and on the display when the controller is powered up.

AIRPILOT ELECTRONIC CONTROL OPERATION - Normal starting and stopping the compressor package

DANGER
Automatic restarting can cause injury or death. Open, lockout and tagout main disconnect and any other circuits before servicing the unit.

WARNING
After an emergency stop, be sure that the pressure in the air/oil reservoir is less than 5 psig. Wait one minute or more before restarting.

CAUTION
The enclosure doors are connected to a shutdown switch that will not allow the compressor to operate without the complete enclosure in place.

Starting the compressor package:

1. Turn the customer supplied main switch on.
2. Push the start button.

Stopping the compressor package:

1. Push the stop button.
2. Wait one minute to allow the compressor to stop.
3. Turn the customer supplied main switch off.

Emergency Stop of the compressor package:

1. Depress the Emergency Stop button.
2. To restart the compressor, wait one (1) minute, then turn the Emergency Stop button clockwise to release it. Start the compressor per the above instructions. In case of alarm, press the Reset button before restarting.

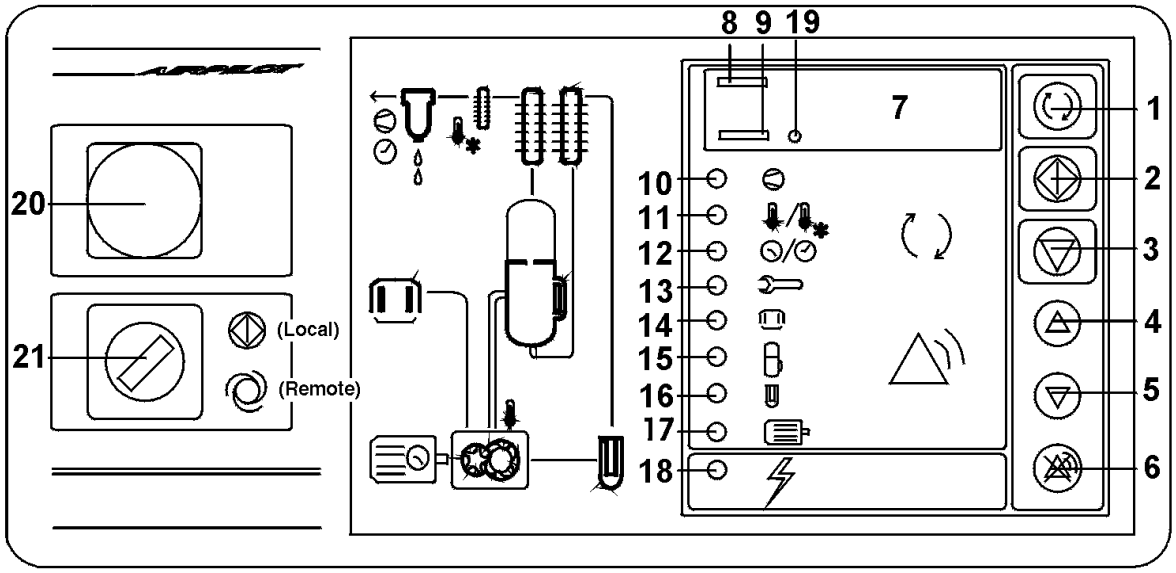


Figure 4-2 – STARTER/CONTROL BOX AND INSTRUMENT PANEL

INSTRUMENT PANEL (Figure 4-2) – The following is a description of the various displays, buttons and indicator lights on the AirPilot Electronic controller:

1. Scrolling
2. Start
3. Stop
4. Change Setting (up)
5. Change Setting (down)
6. Reset (return to basic display)
7. Display
8. Left upper segment of display
9. Left lower segment of display
10. Pressure indicator light
11. Temperature indicator light (running temp/dew point)
12. Operating hour indicator light (total hours/loaded hours)
13. Change oil light
14. Air filter indicator light
15. Air/oil separator indicator light
16. Oil filter indicator light
17. Motor indicator light
18. Power indicator light
19. Load indicator light (not on when machine is running unloaded)
20. Emergency stop
21. Remote control selecting switch

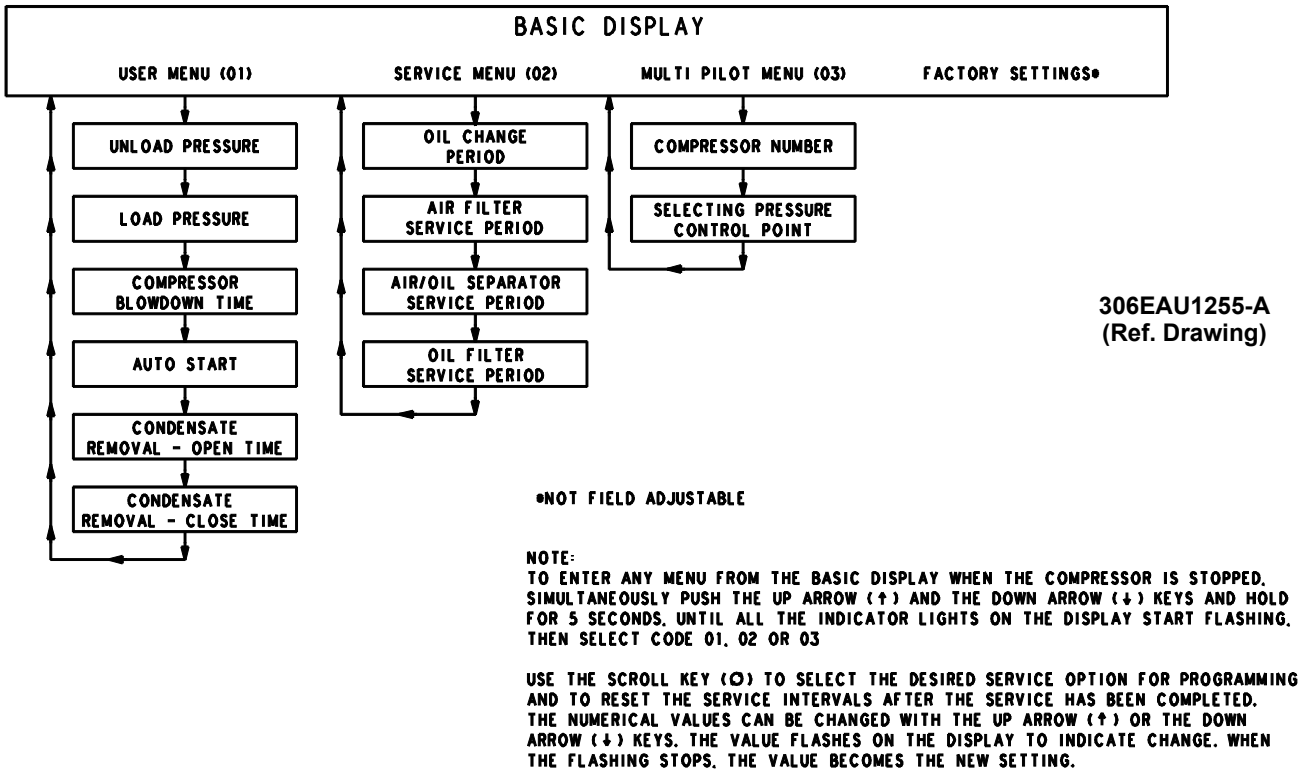


Figure 4-3 – AIRPILOT ELECTRONIC CONTROLLER

PROGRAMMING AND SETUP INSTRUCTIONS FOR THE AIRPILOT ELECTRONIC CONTROLLER

The AIRPILOT ELECTRONIC CONTROLLER has five menus, three of which can be accessed by the operator.

The other menus contains the factory settings of the compressor. Access to the factory settings menu requires a special code. See Figure 4-3, for a diagram of how the menus are setup.

The basic display menu shows the compressor's running mode and information on the compressor's various functions.

The other menus are for programming. Programming and setup is accomplished with the program keys, see Figure 4-2, page 28. The programming menus are accessed by simultaneously depressing the up arrow and the down arrow keys and holding for 5 seconds. All indicator lights will light up and the display will start flashing. The 3 different menus can then be chosen using the up arrow key. The up arrow key and the down arrow key will increase or decrease displayed numeric values, step through the top level menus or if pushed simultaneously will enable the user to go into the program mode. The top level menu is 01 for the user menu, 02 is for the service menu and 03 is for the multipilot menu. The scroll (↻)key will enable the user to go through the various menu options, to change the numeric value on the display, use the up arrow or the down arrow keys. The value on the display starts flashing to indicate it is being changed. The flashing stops when the value is changed.

NOTICE
The basic display can be entered from all menus by depressing the reset key. The basic display will also return after one minute, if the panel is not used.

The following are the compressor running modes:

DISPLAY	RUNNING MODE
Off illuminated	Compressor switched off
Off flashing slowly	Compressor in blowndown mode
Off flashing quickly	Stop command given, compressor running unloaded before stopping.
On illuminated	Compressor switched on
On flashing quickly	Compressor in automatic mode and can start at any time.

Use the scroll key (⟲) to get the following information:

DISPLAY	RUNNING MODE
Pressure light on (1)	Discharge pressure
Temperature light on (2)	Compressor temperature
Operating hours light on (3)	Operating hours
Operating hours flashing (3)	Loaded hours flashing
Change Oil light on (4)	Change oil
Air filter light on (5)	Replace air filter
Oil separator light on (6)	Replace air/oil separator
Oil filter light on (7)	Replace oil filter
No lights on	Compressor running mode on display

USER MENU - To enter the User Menu from the basic display when the compressor is stopped, simultaneously push the up arrow and the down arrow keys and hold for 5 seconds, until all the indicator lights on the display start flashing, then select code 01.

Use the scroll key (⟲) to select the desired option for programming. The numerical values can be changed with the up arrow or the down arrow keys. The value flashes on the display to indicate change. When the flashing stops, the value becomes the new setting.

The following can be programmed through the User Menu.

Setting the unload pressure:

The pressure indicator light and the upper left segment of the display illuminate when the unload pressure is in the programming mode.

The discharge pressure shifts as the unload pressure is changed (the pressure differential remains constant).

The unload pressure set at the factory is equal to the compressor's maximum pressure which cannot be exceeded.

Setting the discharge pressure:

The pressure indicator light and the lower left segment of the display illuminate when the discharge pressure is in the programming mode.

NOTICE
Changing the discharge pressure will cause the pressure difference to change.

Compressor automatic timer:

The automatic timer determines how long the compressor runs unloaded before stopping.

The operating hour light illuminates when the unloading time is programmable. This timer is factory set at 5 minutes.

Automatic start after power failure:

This mode is disabled by setting the value to 0. Other values define the starting delay of the compressor when power is restored, recommend one (1) minute or longer.

The operating light flashes when automatic starting is programmable.

DANGER
Automatic restarting can cause injury or death. Open, lockout and tagout main disconnect and any other circuits before servicing the unit.

Condensate removal, open time:

Condensate removal open time is in seconds.

The air filter light illuminates when this can be programmed.

NOTICE
A short condensate removal time and a long interval may cause water to enter the network. Warm, humid intake air requires longer and more frequent condensate removal times.

NOTICE

Long condensate removal time at short intervals waste compressed air.

Condensate removal, close time:

Condensate removal close time is in seconds. This is time between condensate removal.

The oil separator light illuminates when this can be programmed.

SERVICE MENU - To enter the SERVICE MENU from the basic display when the compressor is stopped, simultaneously push the up arrow and the down arrow keys and hold for 5 seconds, until all the indicator lights on the display start flashing, then select code 02.

Use the scroll key (↻) to select the desired service option for programming and to reset the service intervals after the service has been completed. The numerical values can be changed with the up arrow or the down arrow keys. The value flashes on the display to indicate change. When the flashing stops, the value becomes the new setting. The following can be programmed through the SERVICE MENU.

Oil change interval:

The service light illuminates when the new oil interval can be set. The factory recommends using Figure 5-3, page 47, as a guide.

Air filter interval:

The air filter light illuminates when the new service interval can be set for the air filter. See Section 6, page 57, for change intervals.

Air/oil separator interval:

The air/oil separator light illuminates when the new service interval can be set for the air/oil separator. The factory recommends this be set at 4000 hours.

Oil filter interval:

The oil filter light illuminates when the new service interval can be set for the oil filter. The factory recommends this be set at 1000 hours.

NOTICE

After replacing the oil, filters or separators, the service interval must be reset in the controller.

MULTIPILOT MENU - Contact Gardner Denver Customer Service. To enter the MultiPilot Menu from the basic display when the compressor is stopped, simultaneously push the up arrow and the down arrow keys and hold for 5 seconds, until all the indicator lights on the display start flashing, then select code 03.

The settings in this menu are used when the compressor is connected to the optional MultiPilot control through an RS 485 communication line. An additional printed circuit board is needed. Contact Gardner Denver Customer Service.

Use the scroll key (↻) to select the desired option for programming. The numerical values can be changed with the up arrow or the down arrow keys. The value flashes on the display to indicate change. When the flashing stops, the value becomes the new setting. The following can be programmed through the MULTIPILOT MENU.

Compressor identification number:

The display shows alternately the text RS 485 and the compressor number.

When no indicator lights are on, the compressor identification number can be changed.

The number flashes quickly as its value is being changed.

Selecting the pressure control point:

The compressor's pressure control point can be changed here. The text LOCAL indicates control by the compressor, while the text PILOT means control by the MultiPilot system.

REMOTE CONTROL OPERATION - Remote control operation is selected by turning the selector switch on the cabinet clockwise, Figure 4-2, page 28, detail number 21.

In the remote control mode the compressor is operated with a closing contact which is connected to terminal blocks 22 and 30 of the compressor control box. The compressor is started by closing the contact and stopped by opening it.

Parameter	Setting Range	Factory Setting
Unload pressure	45 psig to compressor maximum pressure (see nameplate)	Maximum pressure rating for the package as built at the factory
Load pressure	45 psig to compressor maximum pressure (see nameplate)	Differential pressure = 10 psi
Automatic timer	1-20 minutes	3 or 5 minutes
Automatic start delay	0 or 10-240 seconds	0
Condensate removal, open time	1-20 seconds	2 seconds
Condensate removal, close time	10-120 seconds	60 seconds
Air filter replacement interval	0-4000 hours	1500 hours
Oil change interval	0-4000 hours	4000 hours
Air/oil separator replacement interval	0-8000 hours	4000 hours
Oil filter replacement interval	0-4000 hours	1000 hours

CONTROL DEVICES

CONTROLLER - See “AirPilot Electronic Controller", page 25, for description.

Relief Valve - (A) pressure relief valve(s) is (are) installed in the final discharge line and set to approximately 120-125% of the unit’s full load operating pressure for protection against over pressure. Periodic checks should be made to ensure its (their) operation.

The relief valve should be tested for proper operation at least once every year. To test the relief valve, manually open the valve with the hand lever. Hold the valve open for a few seconds and allow it to snap shut.

⚠ 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. To prevent injury, always wear eye and ear protection and stand clear of the discharge port when testing the relief valve.

⚠ 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 4-4, page 37) - This valve is normally used for control functions, but also serves to relieve air/oil reservoir pressure following a shutdown. The blowdown valve is a pneumatic operated valve which is piped into the air/oil reservoir, ahead of the minimum pressure check valve. When the valve is open, the system blows down. When the valve closes, the system pressurizes.

Oil Level Gauge - This gauge is located on the oil reservoir and indicates the oil level. See Section 5, page 45, for information on how to correctly read the gauge.

Minimum Discharge Pressure/Check Valve (Figure 5-1, page 45) - An internal spring-loaded minimum pressure/check valve is used in the final discharge line to provide a positive pressure on the coolant system of the compressor even if the air service valve is fully open to atmospheric pressure. This valve also functions as a check valve to prevent backflow of air from the shop air line when the unit stops, unloads or is shutdown.

The valve incorporates a spring-loaded piston which maintains approximately 65 psig in the air/oil reservoir. When the air pressure on the upstream (air/oil reservoir) side of the valve rises above 45 psig, the spring is overridden and the valve opens to full porting.

The valve does not require adjustment. If the valve fails to function, check the valve for dirt or burrs, and if the o-rings or seals are worn. See the Parts List for a listing of the kits available for rebuilding or replacing the valve. Repair kits are available from your local authorized Gardner Denver distributor.

Changing Minimum Pressure/Check Valve Seals

1. Be sure the unit is completely off and that no air pressure is in the oil reservoir. Close the service valve.
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 six (6) bolts holding the cover onto the separator housing.
5. Remove the snap ring in the cover.
6. Remove the internals 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, with no pressure in the system.
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.

Inlet Valve – The inlet valve opens and closes to control delivery and closes to unload the compressor. At shutdown, the inlet valve closes to prevent the back flow of air.

The inlet valve position is controlled by air pressure, which is controlled by the AIRPILOT ELECTRONIC CONTROLLER, through the inlet valve solenoid. When the discharge pressure reaches the unload pressure programmed into the controller, the inlet solenoid valve de-energizes, allowing system pressure below the inlet valve piston, through the shuttle valve, closing the inlet valve, The compressor runs unloaded for the pre-set time programmed into the controller or until the system pressure reaches the load pressure. When the system pressure reaches the load pressure programmed into the controller, the inlet solenoid valve is energized. After a 2 second delay, the inlet valve solenoid allows pressure out from below the inlet valve piston. A partial vacuum is formed in the inlet line, the inlet valve opens and the compressor runs loaded.

The inlet valve does not require adjustment. If the valve fails to function, check the valve for dirt or burrs, and if the o-rings or seals are worn. See the Parts List for a listing of the kits available for rebuilding or replacing the valve. The seals will need to be replaced periodically. The interval will depend on the environment and the operating conditions. Repair kits are available from your local authorized Gardner Denver distributor.

Inlet Valve Solenoid (Figure 4-4, page 37) – This valve controls the position of the inlet valve in response to signals from the controller. When the inlet solenoid valve is energized, after a delay of 2 seconds, it allows the pressure to escape from below the inlet valve piston. A partial vacuum is formed in the inlet line, the inlet valve opens and the compressor runs loaded. When the inlet solenoid valve is de-energized, it allows system pressure under the inlet valve piston, through the shuttle valve, closing the inlet valve.

Blowdown Solenoid Valve (Figure 4-4, page 37) – This valve is normally used for control functions, but also serves to relieve air/oil reservoir pressure following a shutdown. The blowdown solenoid valve de-energizes, opening the blowdown line from the air/oil separator housing, whenever the inlet valve solenoid de-energizes and closes the inlet valve or whenever the machine is shutdown. The blowdown solenoid valve energizes to close the blowdown valve when the inlet solenoid valve opens the inlet valve.

Shuttle Valve (Figure 4-4, page 37) – This valve, also known as a double check valve, is a device which will take two (2) supply signals and allow the one with the highest pressure to pass through. The shuttle valve is used to provide control air pressure from either the reservoir or plant air system, as required during different operating conditions.

Isolation Switch for Motor Power – This switch disconnects power to the motor if the side panels and the top panels are not in place. **The control circuit will remain energized.**

WARNING

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

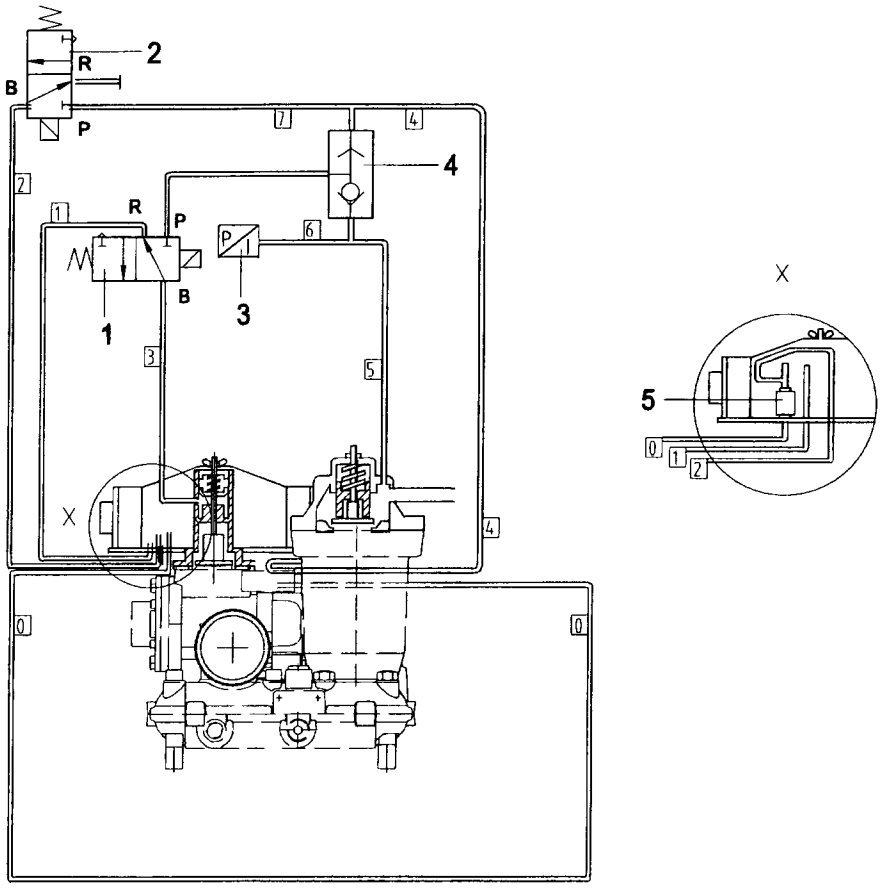


Figure 4-4 – COMPRESSOR RUNNING LOADED

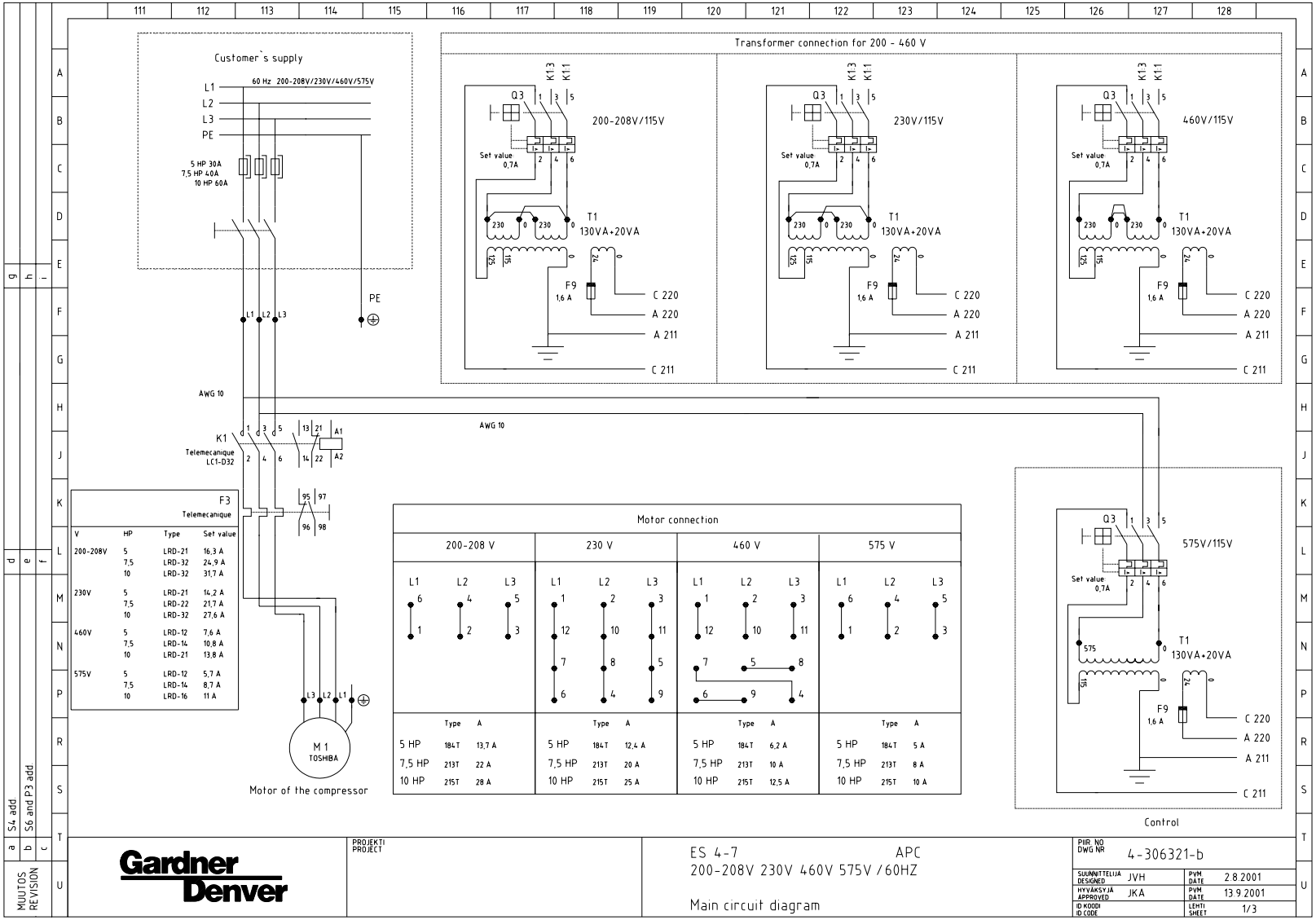
Ref. No.	Component	Function
1	Solenoid Valve (Blowdown)	Exhausts the oil separator during unloaded running
2	Solenoid Valve (Inlet Valve)	Opens and closed the intake valve
3	Pressure Transducer	Transmits the discharge pressure signal
4	Shuttle	Allows the pressure of the oil separator or the compressed-air system (the higher one) to close the intake valve
5	Check Valve	Unloading noise reduction by leading blow-out air into intake

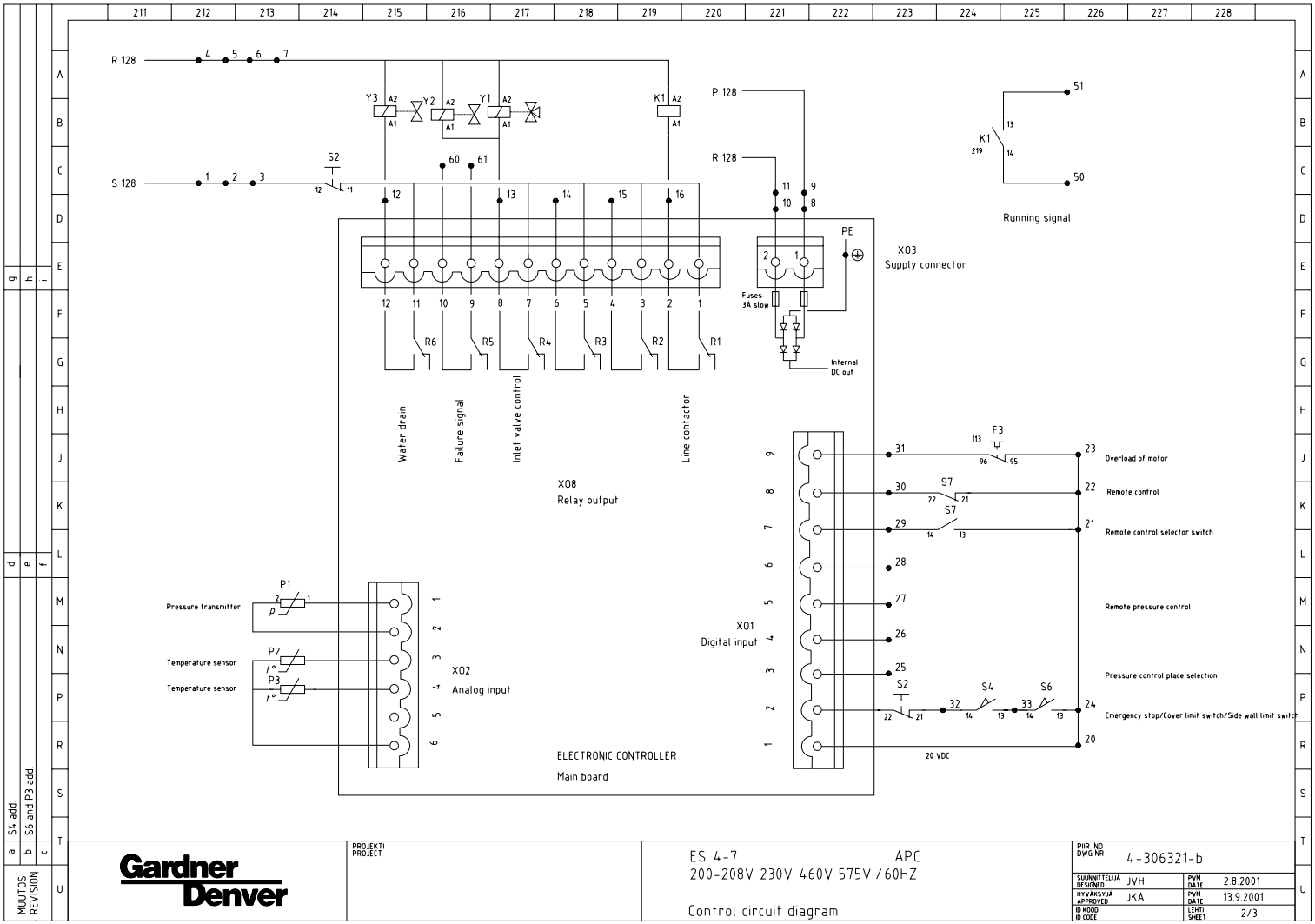
Pressure Transducer (Figure 4-4, page 37) – This transducer is connected after the minimum pressure/check valve. It converts the pressure in the plant air system into an electrical signal for use by the controller.

ALARMS

Indication on the control panel	Cause
Pressure light flashing	Overpressure alarm causing compressor to shutdown or pressure sensor fault
Temperature light flashing	Temperature alarm
Temperature light flashing fast	Temperature alarm, causing shutdown
Service light flashing	Oil change service alarm
Air filter light flashing	Air filter replacement required
Air filter light flashing fast	Air filter indicator switch triggered
Air/oil separator light flashing	Air/oil separator replacement required
Oil filter light flashing	Oil filter replacement required
Motor light flashing fast	Motor overloaded
All lights flashing fast	Emergency Stop button depressed

WIRING DIAGRAMS – 3 PHASE




R 128
S 128
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Y2
Y1
K1
S2
P 128
R 128
PE
X03
Supply connector
Fuses
3A slow
Internal
DC out
Running signal
K1
R6
R5
R4
R3
R2
R1
Water drain
Failure signal
Inlet valve control
Line contactor
X08
Relay output
F3
Overload of motor
S7
Remote control
S7
Remote control selector switch
Remote pressure control
Pressure control place selection
S2
S4
S6
Emergency stop/Cover limit switch/Side wall limit switch
20 VDC
P1
Pressure transmitter
P2
Temperature sensor
P3
Temperature sensor
X02
Analog input
X01
Digital input
ELECTRONIC CONTROLLER
Main board
S4 add
S6 and P3 add
MUUTOS
REVISION
PROJEKTI
PROJECT
ES 4-7 APC
200-208V 230V 460V 575V / 60HZ
Control circuit diagram
PIIR. NO
DWG NR
4-306321-b
SUUNNITTELIJA
DESIGNED
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PVM
DATE
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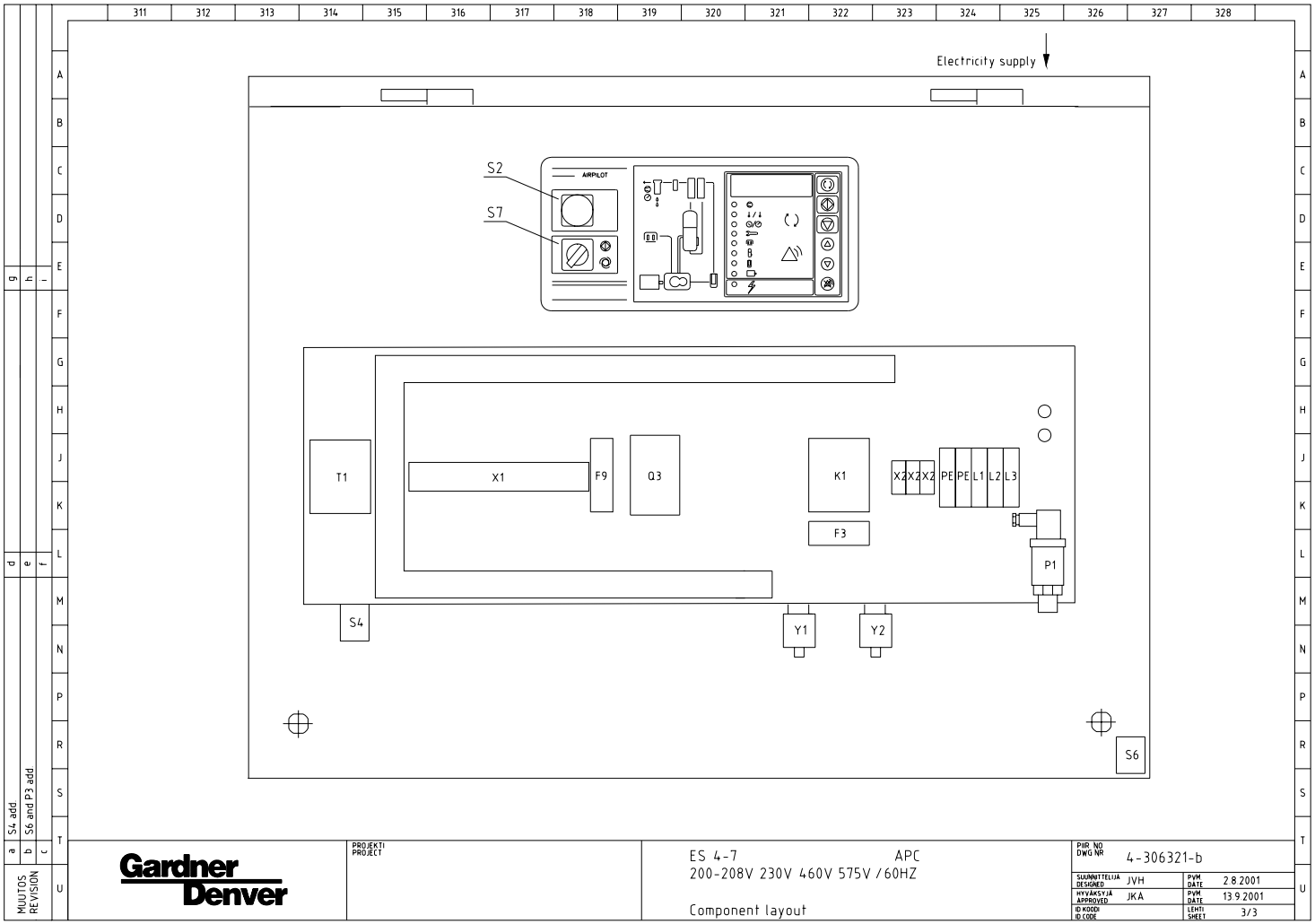
WIRING DIAGRAMS – 3 PHASE



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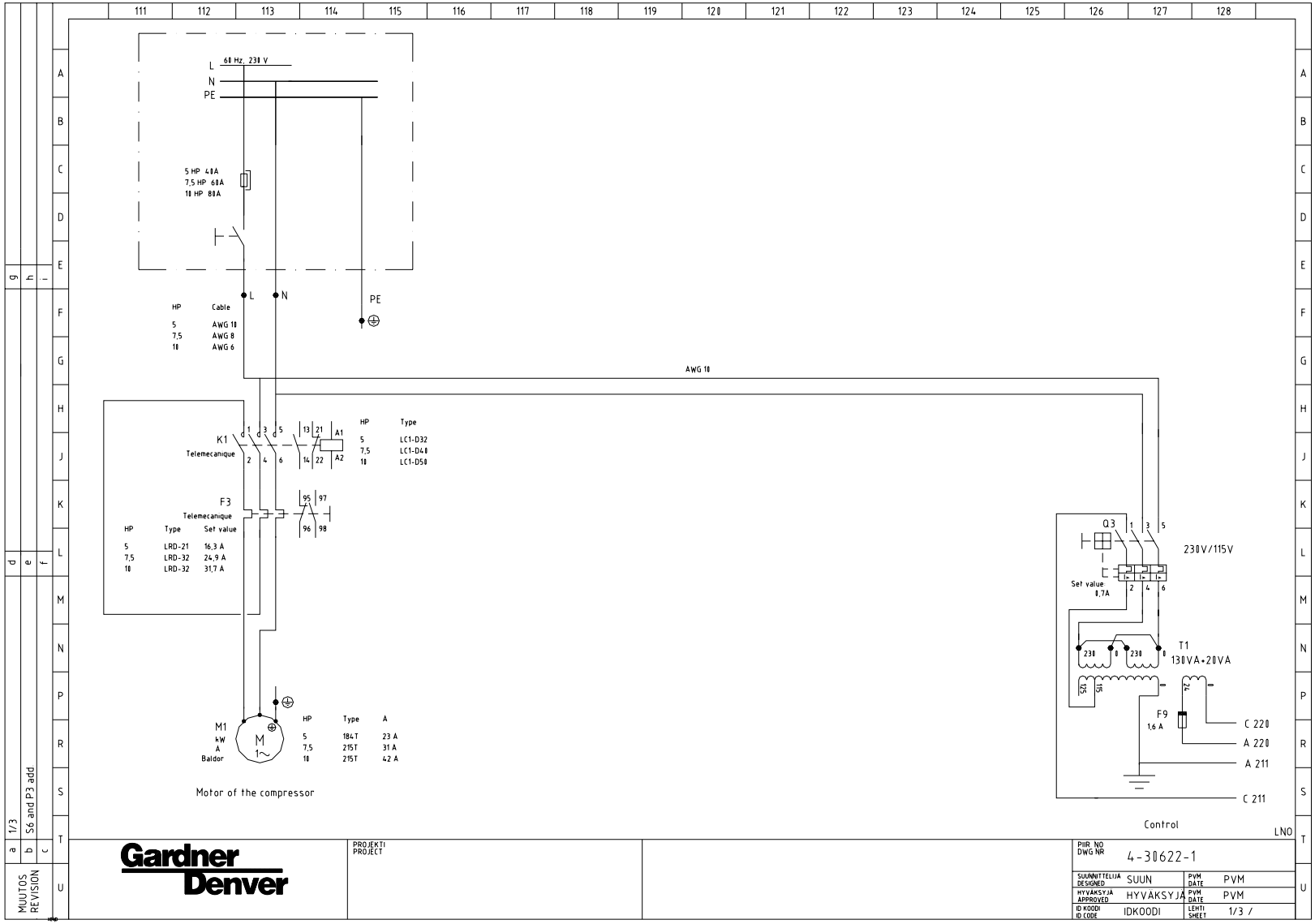
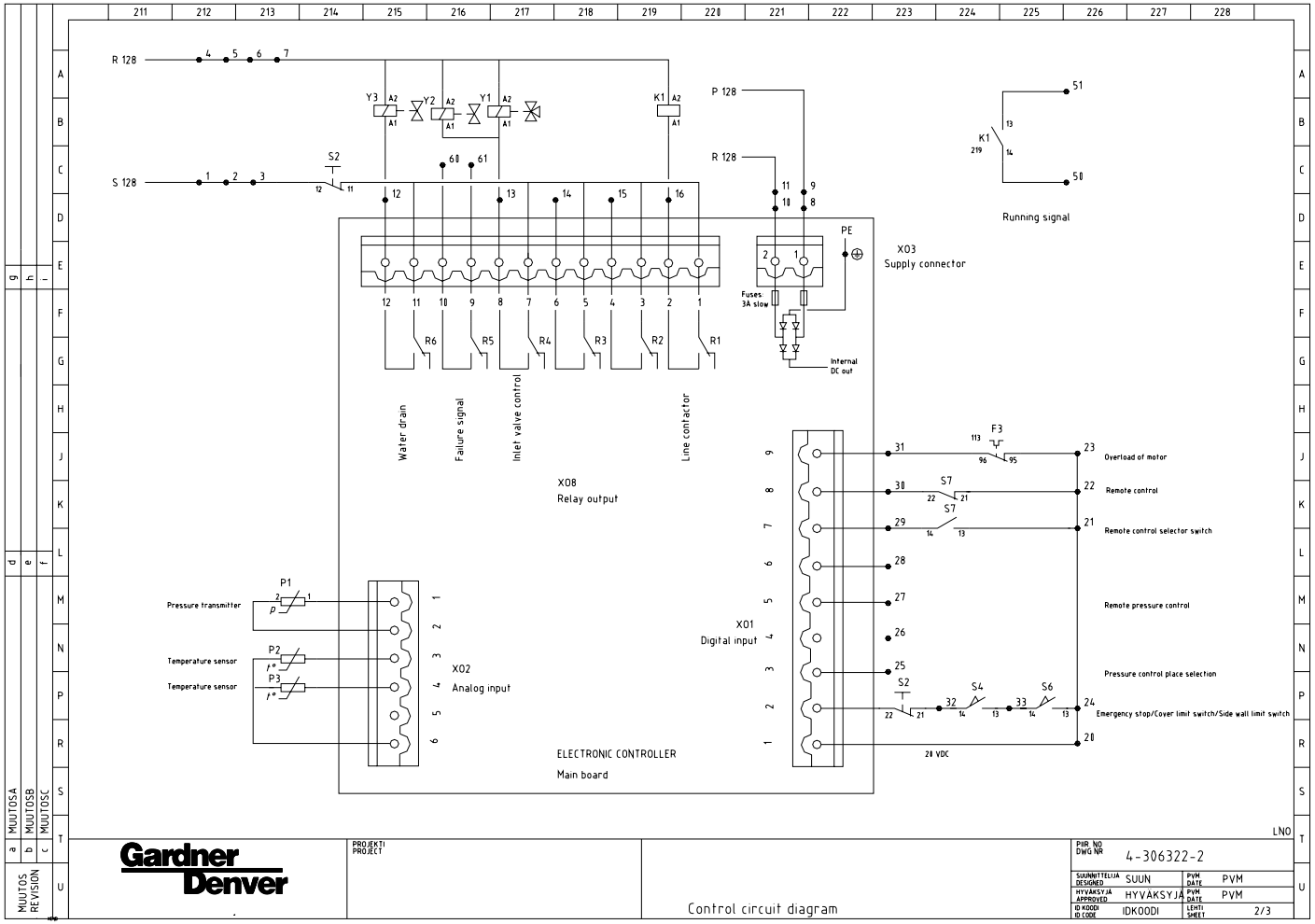
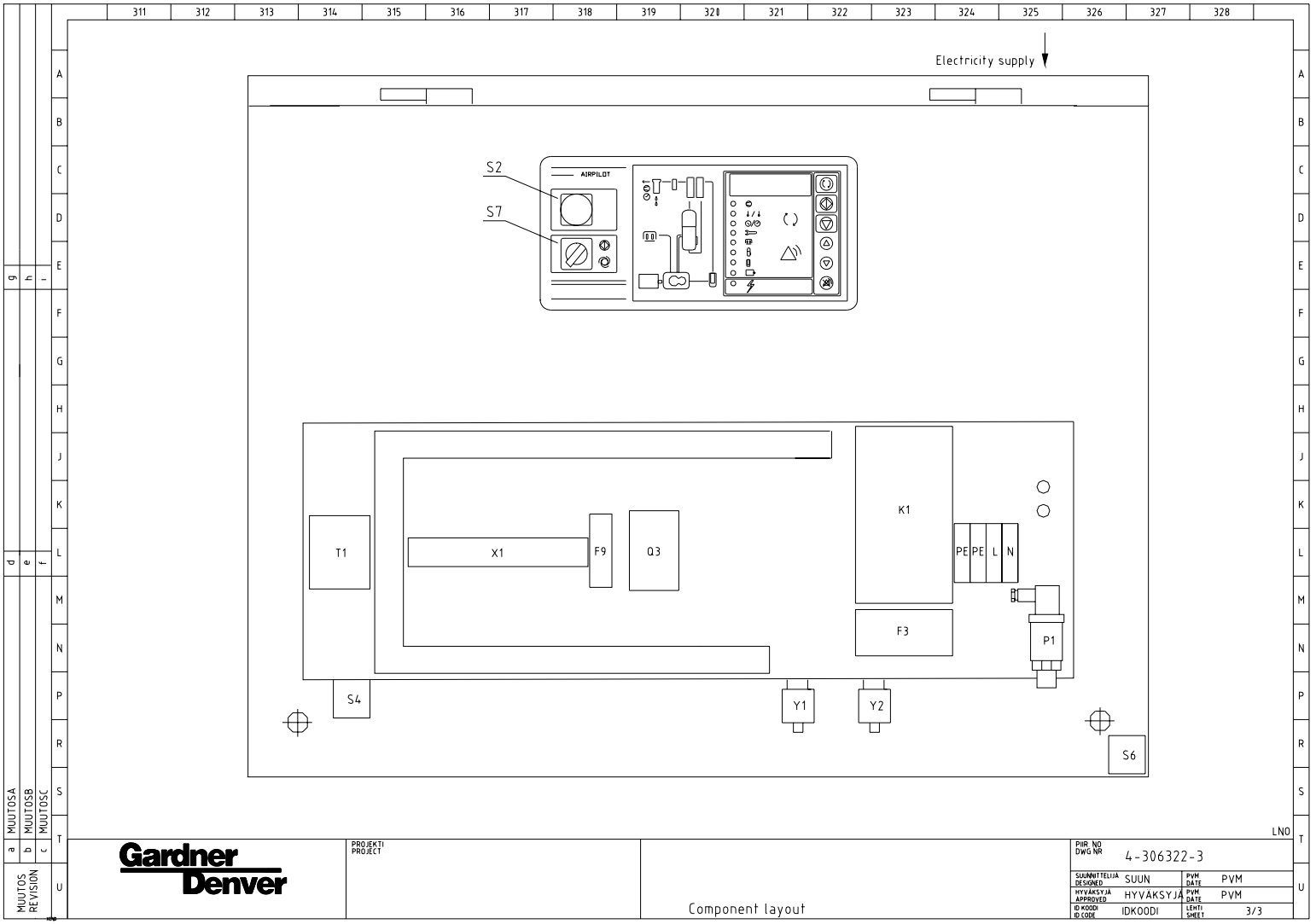


WIRING DIAGRAM – 1 PHASE



WIRING DIAGRAM – 1 PHASE



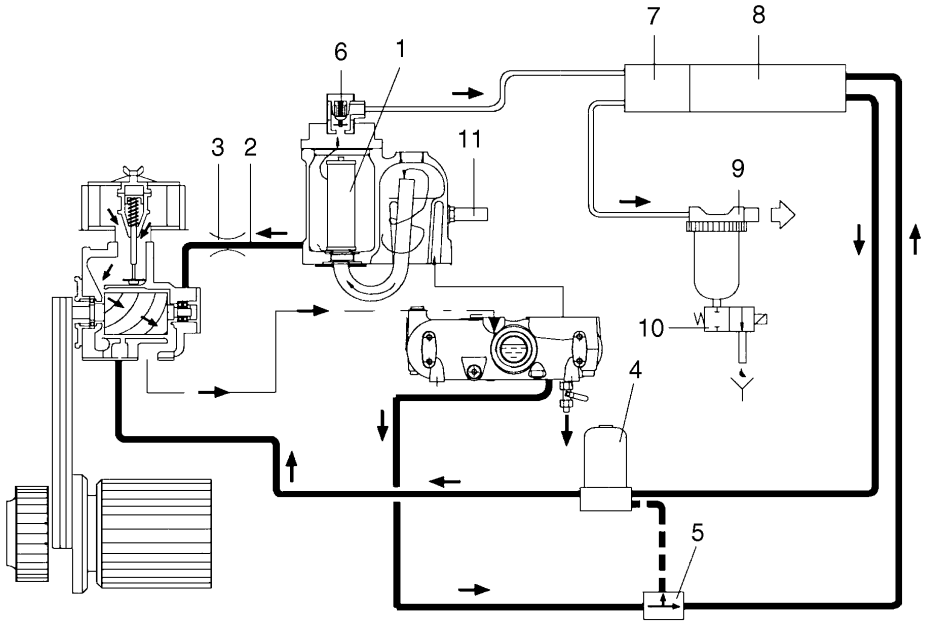
SECTION 5
LUBRICATION
OIL COOLER, OIL FILTER & SEPARATOR

COMPRESSOR OIL SYSTEM (**Error! Reference source not found.**) 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 air then passes to the aftercooler. The oil separated from the air is sent to the oil cooler and recirculated throughout the system. Oil separated at the air/oil separator is sent via an oil return line through an orifice and back into the compressor.

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.



Ref. No.	Description
1	Air/oil Separators
2	Oil Scavenge Line
3	Orifice
4	Oil Filter
5	Thermostatic Mixing Valve
6	Minimum Pressure/Check Valve
7	Aftercooler
8	Oil Cooler
9	Moisture Separator
10	Drain
11	Pressure Relief Valve

Figure 5-1 – FLOW DIAGRAM

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” paragraph, page 46, or low temperature, see “Installation for Cold Weather Operation,” page 17. 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° F-210° F. for a period of more than four (4) hours due to continuing high ambient air temperature, use Gardner Denver AEON 9000SP 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,” page 17 and Figure 2-4, page 17.

PROCEDURE FOR CHECKING OIL LEVEL (Figure 5-4, Page 51) - Check the oil level when the compressor is shutdown and the oil/air mixture has separated. The oil should be visible between the min. and max. range, shown in Figure 5-4, page 51. If the oil level is above the max. range, the oil must be drained. If the oil level is below the min. range, oil must be added.

ADDITION OF OIL BETWEEN CHANGES – Oil must be added when the oil level is below the min. range on the oil gauge. The oil must be checked with the machine shutdown, blowndown and the air/oil mixture settled out to air and oil.

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 carryover can damage equipment. Never fill oil reservoir above the max. range of the gauge.

11To 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.

4. Remove the oil filler plug and add oil as required to return the oil level to the max. line on the dipstick.

5. Install the oil filler plug, run and check for leaks.

DO NOT OVERFILL. The quantity required to raise the oil level from the min. line to the max. line, (Figure 5-4, page 51), is one (1) quart (Figure 5-2). 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.

Refill Capacity For Normal Oil Change	1.25 U.S. Gallons (5 Liters)
Bottom of Site Glass to Top of Site Glass	1 U.S. Quart (1 Liter)

Figure 5-2 – APPROXIMATE OIL SYSTEM CAPACITIES

OIL CHANGE INTERVAL - Recommended oil change intervals are based on oil temperature. Figure 5-3, 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	AEON™ 9000TH Change Interval
Up to 180°F (82°C)	4000 hrs.	8000 hrs. *	8000 hrs. *
181°F to 190°F (82°C to 88°C)	3000 hrs.	6000 hrs.	8000 hrs. *
190°F to 200°F (88°C to 93°C)	2000 hrs.	4000 hrs.	8000 hrs. *
200°F to 209°F (93°C to 98.3°C)	1000 hrs.	2000 hrs.	8000 hrs. *
210°F to 219°F (98.9°C to 103.9°C)	N/A	N/A	6000 hrs.
220°F to 228°F (104.4°C to 108.9°C)	N/A	N/A	4000 hrs.
229° + (109.4°C +)	N/A	N/A	2000 hrs.

Figure 5-3 – OIL CHANGE INTERVAL

* Please note that the oil can operate for 8000 hours at this discharge temperature. However, the controller maximum oil life setting is 6000 hours.

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:

1. Be sure the unit is completely off and that no air pressure is in the air/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.
4. Close the drain valve.

If the drained oil and/or the oil filter element are contaminated with dirt, flush the entire system: the reservoir, oil cooler and lines. Inspect the air/oil separator element 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. 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.

4. Remove the oil filler plug and add oil as required to return the oil level to the max. range on the oil gauge.

5. 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.

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

7. Add oil, if necessary, to bring level to the max. range on the oil level gauge (Figure 5-4, page 51).

DO NOT OVERFILL as oil carryover will result. The quantity of oil required to raise the oil level from the min. range to the max. range is shown in Figure 5-2, page 47. 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 carryover 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.

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 63 .

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 9000SP Lubricating Coolant. Use caution when selecting downstream components such as air line lubricating bowls, gaskets and valve trim.

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

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

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

3. 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.

4. 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

5. Thoroughly drain machine.

6. Change to a new filter and separator.

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

8. Machine should then be run normally; however, total run time after the initial changeouts 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.

9. Subsequent lubricant changeouts should be at normal intervals. See ”Oil Change Interval”, Figure 5-3, page 47.

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

OIL LEVEL GAUGE (Figure 5-4, page 51) - The oil level gauge indicates the amount of oil in the air/oil reservoir. Read oil level only when the 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 is above the top of the site glass.

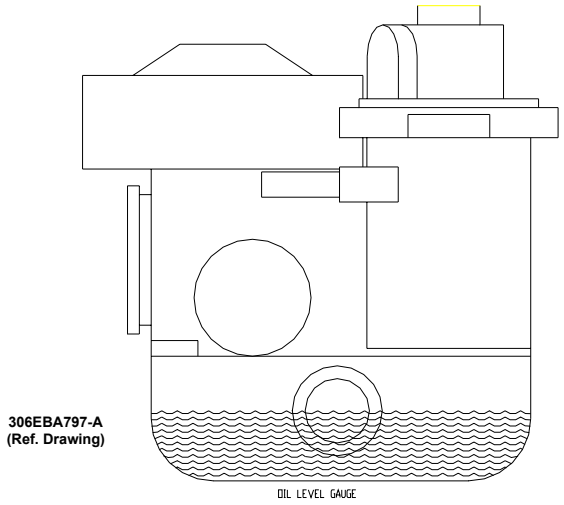


Figure 5-4 – OIL LEVEL GAUGE, OIL FILL AND OIL DRAIN

MOISTURE IN THE OIL SYSTEM – In environments with normal operating temperatures and pressures and low relative humidity, the thermal mixing valve controls the oil temperature and prevents moisture accumulation in the oil. Unusual cooling of the oil reservoir, light duty cycles, high humidity, gross compressor over-sizing or malfunctions of the thermal mixing valve may result in moisture accumulation which is detrimental to compressor lubrication and may cause excessive oil carryover in the lubricant or compressor failure. Please note that the airend discharge temperature must be maintained a minimum of 10° F above the pressure dew point temperature in Figure 5-5, page 52. Failure to maintain the discharge temperature will cause moisture formation and compressor damage. The compressor must be observed to ensure that it is operating properly. The best method for detecting moisture is a disciplined lubricant sampling analysis program every 2,000 hours of operation. If moisture is observed in the oil reservoir, drain the moisture and correct the operating conditions to reduce moisture. See “Thermal Control (Thermostatic Mixing) Valve, page 54, “Water Shutoff Valve”, page 53 and “Compressor Oil System Check”, page 56, for additional system considerations. If moisture accumulation is observed in the lubricant, the best option is a higher temperature mixing valve, AEON 9000TH lubricating fluid and setting the high discharge temperature shutdown to 240° F (new controller software may be required), to prevent water from forming in the oil. Please contact Technical Services in MDC for part numbers, availability and controller software version verification (S/N required).

See “Compressor Oil System Check”, page 56 and “Thermal Control (Thermostatic Mixing) Valve”, page 54.

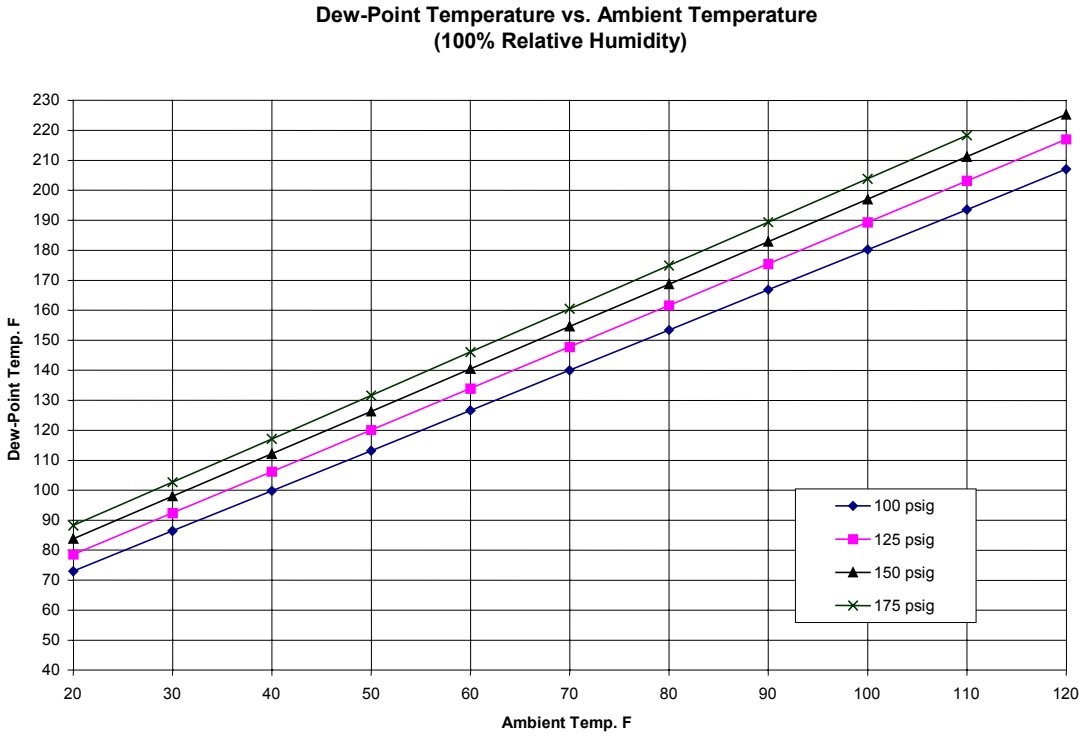


Figure 5-5 – DEW POINT CHART °F

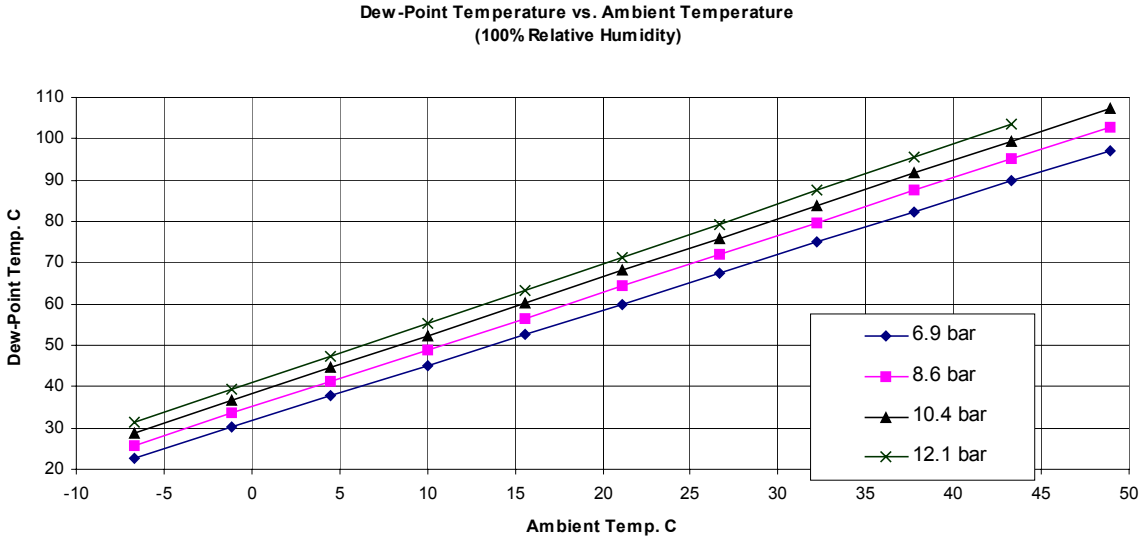


Figure 5-6 – DEW POINT CHART °C

These charts are easily used by reading the ambient temperature along the bottom axis of the chart and then reading the appropriate pressure curve to determine the corresponding dew-point temperature on the left axis of the chart. The compressor discharge temperature must be maintained at a minimum of 10° F above this dew-point temperature to prevent condensation accumulation in the lubricant reservoir. These charts assume 100% relative humidity.

COMPRESSOR OIL FILTER (Figure 5-1, page 45and Figure 5-7, page 54) - 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. Disconnect, lockout and tagout the power supply to the starter.
3. Remove the spin-on element.
4. Clean the gasket face of the filter body.
5. Coat the new element gasket with clean lubricant used in the unit.
6. Screw new element on filter body and tighten clockwise by hand 3/4 turn after contact. DO NOT OVERTIGHTEN ELEMENT.
7. Reset the filter life setting to 1000 hours, see “SERVICE MENU, Section 4, page 32.
8. Run the unit and check for leaks.

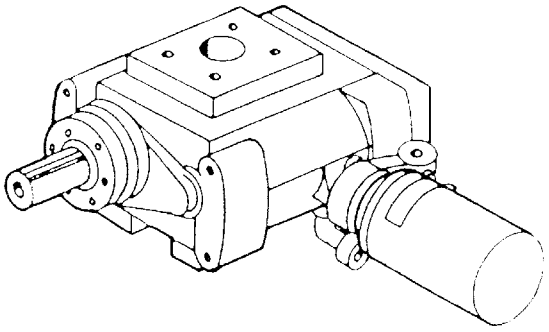


Figure 5-7 – OIL FILTER

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.

THERMAL CONTROL (THERMOSTATIC MIXING) VALVE (Figure 5-1, page 45) - 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 it 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 AIR/OIL SEPARATOR (Figure 5-1, page 45) - 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 carryover 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 carryover malfunctions of the oil separator are usually due to using elements too long, heavy dirt or varnish deposits caused by inadequate air filter service, use of improper oil, or using oil too long for existing conditions. Excessive tilt angle of the unit will also hamper separation and cause oil carryover.

Oil separator element life cannot be predicted; it will vary greatly depending on the conditions of operation, the quality of 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 55.

CAUTION

Using an oil separator element at excessive pressure differential can cause damage to equipment. Replace the separator when the differential pressure is greater than 8 psi or every 4,000 hours (at least once a year).

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. The compressor package will automatically blowdown in about 2 minutes.
2. Close the air service valve located after the compressor package discharge.
3. Disconnect, lockout and tagout the power supply to the starter.
4. Remove the minimum pressure/check valve (air/oil separator housing) cover.

5. Lift out the air/oil separator elements.

6. Inspect and/or replace the separator as necessary.

7. Clean the sealing surfaces on the air/oil separator and the minimum pressure/check valve.

8. Clean the orifice, in the oil return line, the strainer in oil return line, and if necessary, the air/oil separator housing.

9. Grease the O-Ring on the separator element and install the separator into the housing.

10. Replace the O-Ring between the minimum pressure/check valve and the air/oil separator housing.

11. Replace the sealing kit in the minimum pressure/check valve. After the assembling of the valve, leave about .08 inch gap between the nut and the cover of the valve. See “Changing Minimum Pressure/Check Valve Seals,” Section 4, page 35.

12. Install the minimum pressure/check valve assembly and tighten the bolts alternately for even tightness.

13. Open the air service valve.

14. 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

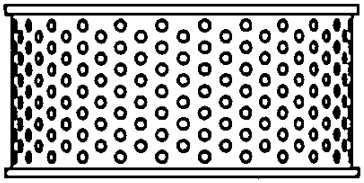


Figure 6-1 – AIR FILTER

STANDARD DUTY AIR FILTER - 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.

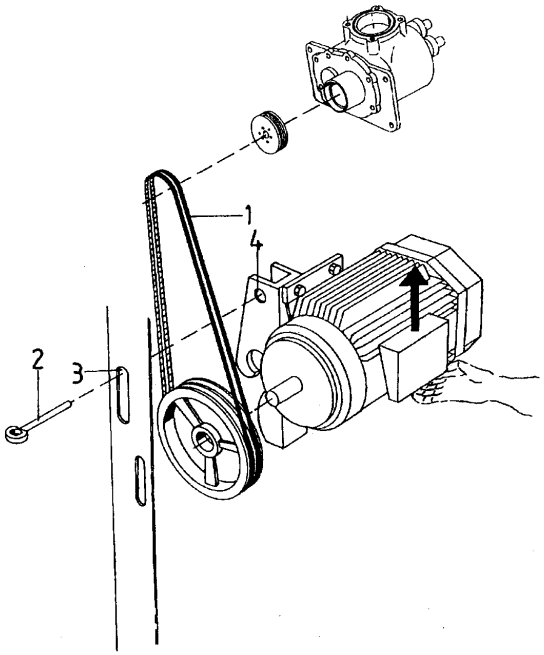
Sheaves should align straight across the front with a straight edge. The best tension is just enough tension to keep belts from “squealing” on start-up.

⚠ WARNING

The motor is held up to prevent belt damage during shipment. Remove the shipping hardware to lower the motor to its operating position prior to starting the package. Loosen locking nut and unthread the long set screw the majority of the way (this lowers the motor) and tighten the locking nut. Then remove the screws clamping the vibration isolators on the airend sub-base.

⚠ CAUTION

Excessive belt tension can damage the equipment. Tension the belts as shown on Figure 7-1. See Replacing the Compressor Belts, page 59.



Ref. No.	Description
1	Belt
2	Pin
3	Slot
4	Hole in Motor Support

Figure 7-1 – BELT DRIVE TENSIONER

REPLACING THE COMPRESSOR BELTS

1. Disconnect, tagout and lockout the power supply to the starter.
2. Open the top enclosure door and remove the enclosure around the motor.
3. Raise the motor, until the locking pin (2) can be inserted through the slot (3) and into the hole (4) in the bracket.
4. Remove the belts (1).
5. Install new belts (1).
6. Remove the locking pin (2) and lower the motor. The weight of the motor keeps the belts properly tensioned.
7. Check sheave alignment.
8. Replace the enclosure and close the top enclosure door.

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.

REPLACING THE MOTOR SHEAVE

1. Disconnect, tagout and lockout the power supply to the starter.
2. Open the top enclosure door and remove the enclosure around the motor.
3. Raise the motor, until the locking pin (2) can be inserted through the slot (3) and into the hole (4) in the bracket.
4. Remove the belts (1).
5. Remove the 2 screws in the motor bushing/sheave assembly and insert one in the jack bolt hole (Figure 7-2).

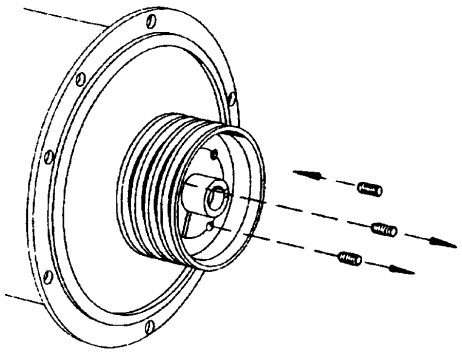


Figure 7-2 – REMOVING THE MOTOR SHEAVE

6. Tighten the screw until the drive bushing and sheave are loose. They can be removed from the shaft by hand when loosened.

7. When installing a new motor sheave and bushing, remove all protective grease from the bushing and sheave. Install the bushing into the sheave and align the holes (Figure 7-3, page 60).

8. Grease the mounting screws and lightly tighten them. The position of the mounting screws are shown in Figure 7-3, page 60. The threads are in the sheave only.

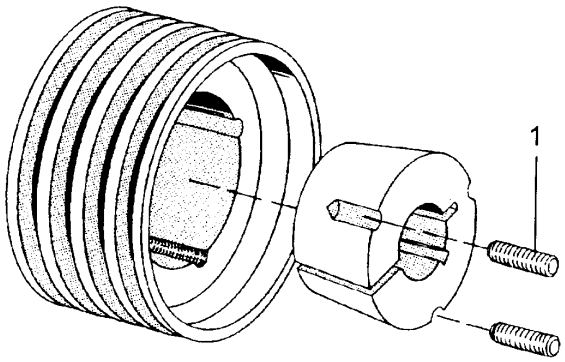


Figure 7-3 – INSTALLING BUSHING IN DRIVE SHEAVE

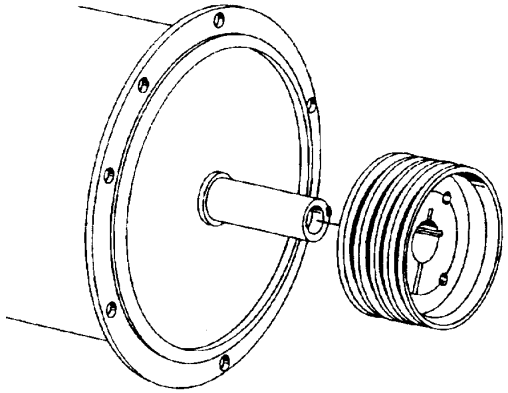


Figure 7-4 – INSTALLING DRIVE SHEAVE ON COMPRESSOR OR MOTOR

9. Clean the shaft and mount the sheave assembly, Figure 7-4. When mounting the sheave assembly, the bushing clamps to the shaft first, the sheave can still be moved a little. This can affect the alignment of the sheaves.

10. Tighten the screws evenly.

11. Tap the bushing lightly with a drift, and retighten the screws. REPEAT THIS PROCEDURE SEVERAL TIMES TO MAKE SURE THE BUSHING AND SHEAVE ASSEMBLY IS TIGHT ON THE SHAFT.

NOTICE

The bushing size is marked on the end of the bushing

Bushing Size	Torque
1610	15 Ft-Lbs (20 Nm)
2012	23 Ft-Lbs (31 Nm)

12. Fill the holes in the bushing/sheave with grease to protect them from dirt and debris.

13. Replace the old belts with new ones. For proper belt life, use only genuine Gardner Denver belts.

14. Remove the locking pin (Item 2 in Figure 7-1, page 58) and lower the motor. The weight of the motor keeps the belts properly tensioned.

15. Check the sheave alignment.

16. Replace the enclosure and close the top enclosure door.

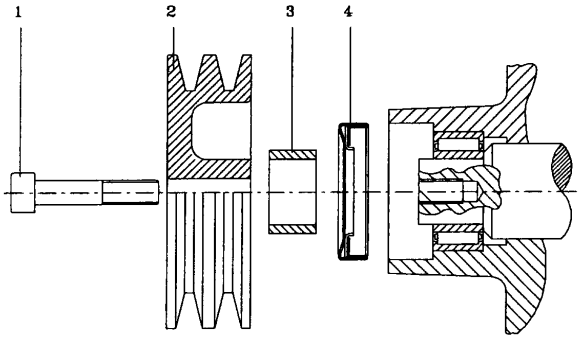


Figure 7-5 – DRIVE SHEAVE

REPLACING THE COMPRESSOR SHEAVE AND SHAFT SEAL

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

2. Open the top enclosure door and remove the enclosure around the motor.

3. Raise the motor, until the locking pin (2) can be inserted through the slot (3) and into the hole (4) in the bracket.

4. Remove the belts (1).

5. Remove the 2 screws in the motor bushing/sheave assembly and insert one in the jack bolt hole (Figure 7-2, page 59).

6. The mounting bolt of the compressor sheave has a left hand thread. The bolt can be loosened by giving the handle of the handle of the hex socket key a sharp blow with a hammer, while holding the sheave in place using Gardner Denver tool EFC03476918. Remove the screw only about ¼".

7. Pull the sheave off of the rotor with a gear puller.

8. Note, the wear sleeve will come off with the sheave.

9. Always replace both the wear sleeve and the shaft seal. The sleeve is removed by tapping it off with Gardner Denver tool EFC03476918, or by tapping it off with a drift, through the three holes in the sheave.

10. Remove the shaft seal.

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

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

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

14. Apply a thin coat of Loctite 609 to the shaft surface that will be against the inside of the sleeve, press the sleeve into place and install the sheave using the mounting bolt. Hold the sheave in place with Gardner Denver tool EFC03476918 and tighten the left handed bolt to 60 ft-lbs (80 Nm).

15. Replace the old belts with new ones. For proper belt life, use only genuine Gardner Denver belts.

16. Remove the locking pin (Item 2 in Figure 7-1, page 58) and lower the motor. The weight of the motor keeps the belts properly tensioned.

17. Check the sheave alignment.

18. Replace the enclosure and close the top enclosure door.

SECTION 8
MAINTENANCE SCHEDULE

SERVICE CHECK LIST –

Air Filter - Operating conditions determine frequency of service. See "Air Filter," SECTION 6, page 57.

Motor Lubrication - Refer to SECTION 2, page 20.

Every 8 Hours Operation

1. Check the reservoir oil level - add oil if required. See Section 5, page 45. If oil consumption is high, refer to "Excessive Oil Consumption," page 67.

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", Section 5, page 47). Flush system if required.

Every Year

1. Check the relief valve for proper operation. See Section 4, page 34.

2. Change oil separator, see "Removal of Oil Separator for Inspection or Replacement", Section 5, page 45, for further details (or when 8 psid 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 & Orifices				•		
Change Compressor Lubricant (AEON 4000) *					•	
Check Relief Valve						•
Check Condition of Hoses					•	•
Check Operation of Condensate Removal Solenoid Valve	•					
Change Inlet Valve Seals						•

* See “Oil Change Interval Chart”, Figure 5-3, page 47, for specific lubricant life.

** Check/change more often in dirty environments.

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

**** Must be checked when the compressor is stopped and the air/oil mixture is separated.

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.	Plant pressure higher than pressure setting in controller.	3.	Wait for plant pressure to drop below load pressure.
	4.	Main motor overloaded	4.	Test motor thermistors. Check the temperature and volume of cooling air at the inlet.
	5.	Pressure in reservoir	5.	Inspect blowdown valve.
	6.	Emergency Stop depressed.	6.	Release button
	7.	Compressor stopped due to high temperature shutdown.	7.	See "High Discharge Air Temperature," this section.
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 flashing.	2.	See page 38, Controller Alarms.
	3.	Blown fuse in starter/ control box.	3.	Replace fuse (investigate if fuses continue to blow).
	4.	Motor starter overload heaters or thermistor in motor tripped..	4.	Reset and investigate cause of overload.
	5.	Compressor stopped because of high discharge pressure.	5.	See "High Discharge Pressure," this section.
Compressor does not unload (or load)	1.	Improperly adjusted control.	1.	Refer to Section 4, USER MENU page 30 and adjust control.
	2.	Air leak in control lines.	2.	Determine source of leak and correct.
	3.	Restricted control line.	3.	Clean control lines.
	4.	Faulty inlet valve solenoid.	4	Replace solenoid valve.

SYMPTOM		POSSIBLE CAUSE		REMEDY
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.
	5.	Pressure load/unload settings set too close.	5.	Set load/unload pressure settings farther apart.
Compressor runs unloaded too often	1.	Volume of compressed air system too small.	1.	Check the volume of the piping and air receivers. An additional air receiver may be required.
	2.	Pressure range too narrow.	2.	Extend pressure range.
Compressor starts too slowly	1.	Wye Delta switch time set too long.	1.	Contact your Gardner Denver distributor.
	2.	Minimum Pressure/Check Valve is faulty.	2.	Repair or replace.
	3.	Supply voltage is too low.	3.	Check the supply voltage.
	4.	Wrong oil type	4.	Use Gardner Denver 2000, 4000 or 9000SP Lubricating Coolant.
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.
	4.	Oil separator clogged.	4.	Replace.
	5.	Intervals of moisture separator drainage incorrectly set.	5.	Check the setting in the AirPilot controller.
	6.	Condensate drain solenoid valve is faulty.	6.	Replace.
	7.	Leaks in the compressed air system.	7.	Check for leaks, fix any leaks found.
	8.	V-Belts broken.	8.	Replace.
	9.	V-Belts slipping.	9.	Test belt tensioning.
	10.	Pressure limits incorrectly set.	10.	Check/correct pressure limits in the AirPilot Controller.
	11.	Aftercooler is frozen	11.	Thaw out. This machine cannot operate in temperatures below 32° F (0° C).

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.	Faulty temperature sensor.	5.	Replace sensor.
	6.	Thermostatic mixing valve stuck open .	6.	Repair or replace valve.
	7.	High ambient temperature	7.	Provide sufficient flow of ambient air.
	8.	Air guide for fan installed wrong.	8.	Check concentricity of the air guide & fan. Also the distance from the fan to the air guide is .04-.16 inches (1-4mm).
High Discharge Pressure	1.	Inlet valve solenoid valve faulty.	1.	Replace solenoid valve.
	2.	Air service valve closed.	2.	Open air service valve.
	3.	Inlet valve plate seal is leaking.	3.	Replace
	4.	Aftercooler is frozen.	4.	Thaw out. This machine cannot operate in temperature below 32° F (0° C).
	5.	Faulty blowdown valve piston.	5.	Replace piston.
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 gaskets.
	3.	Shaft seal leaking.	3.	Replace shaft seal.
Oil carryover	1.	Overfilling the reservoir.	1.	Drain excess oil from system.
	2.	Clogged, broken or loose oil return lines. Scavenge line orifices or check valve clogged.	2.	Tighten or replace faulty lines, clean or replace faulty orifice plate.
	3.	Ruptured oil separator element.	3.	Replace element.
	4.	Oil separator clogged.	4.	Replace element.
	5.	Loose assembly.	5.	Tighten all fittings and gaskets.

SYMPTOM		POSSIBLE CAUSE		REMEDY
Oil Carry-Over continued	6.	Foam caused by use of incorrect oil.	6.	Use Gardner Denver 2000, 4000 or 9000SP Lubricating Coolant.
	7.	Inoperative minimum pressure valve.	7.	Replace seals in valve.
	8.	Operation at elevated discharge temperatures.	8.	Reduce temperature. See “High Discharge Air Temperature”, this section.
	9.	Water condensate in oil.	9.	Check oil reservoir temperature and if low, change thermal mixing valve element to higher temperature.
Inlet Valve leaks oil after emergency stop.	1.	Inlet valve seal leaking.	1.	Replace seals in valve.
	2.	Control line check valve failed.	2.	Replace check valve.

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 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

230-240 Volts, 60 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.

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.

WARRANTY
ROTARY SCREW COMPRESSORS AND VACUUM PACKAGES
OIL INJECTED – OIL FREE

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/or 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
Air or water cooled coolers and the AirPilot Controllers are warranted for 24 months from date of initial use or 27 months from date of shipment to the first purchaser, whichever occurs first, as provided in, and subject to the terms of the original component manufacturer's warranty.

DRIVE AND FAN MOTOR
The drive and fan motor (if applicable) are warranted for 60 months from start-up or 63 months from shipment, whichever occurs first. The warranty is applicable only to Toshiba low voltage motors (600 Volts or less). High voltage motors and other manufacturer motors furnished due to customer request or special requirements carry the motor manufacturer's warranty.

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 AND HEREBY EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING WITHOUT LIMITATION, EXPRESSED, IMPLIED OR STATUTORY WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE.

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.

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Customer Service Department Telephone:
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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