GARDNER DENVER®

13–11–603
2nd Edition
January, 1999

TWISTAIR®

OIL–FREE ROTARY SCREW

COMPRESSORS

MODEL

EWC99A – 20 to 30 HP

OPERATING AND SERVICE MANUAL

Gardner Denver

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

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

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

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

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

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

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

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

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

REMANUFACTURED AIR ENDS

Whenever an air end requires replacement or repair, Gardner Denver offers an industry unique, factory remanufactured air end exchange program. From its modern Remanufacturing Center in Indianapolis, IN, Gardner Denver is committed to supplying you with the highest quality, factory remanufactured air ends 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 air end 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 air ends meet factory performance specifications.

Warranty

Gardner Denver backs up every remanufactured air end with a new warranty . . . 18 months from purchase, 12 months from service.

Gardner Denver remanufactured air ends deliver *quality without question . . . year in and year out.*

Call Gardner Denver for information on the air end 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	Air Cooled	Parts List
20, 25, 30	EWC99A	13–11–505

INSTRUCTIONS FOR ORDERING REPAIR PARTS

When ordering parts, specify Compressor MODEL, Method of Cooling, HORSEPOWER and SERIAL NUMBER (see nameplate on unit). The Serial Number is also stamped on top of the cylinder flange to the right of the inlet housing.

All orders for Parts should be placed with the nearest authorized distributor.

Where NOT specified, quantity of parts required per compressor or unit is one (1); where more than one is required per unit, quantity is indicated in parenthesis. SPECIFY EXACTLY THE NUMBER OF PARTS REQUIRED.

DO NOT ORDER BY SETS OR GROUPS.

To determine the Right Hand and Left Hand side of a compressor, stand at the drive side of the package and look toward the compressor. Right Hand and Left Hand are indicated in parenthesis following the part name, i.e. (RH) & (LH).

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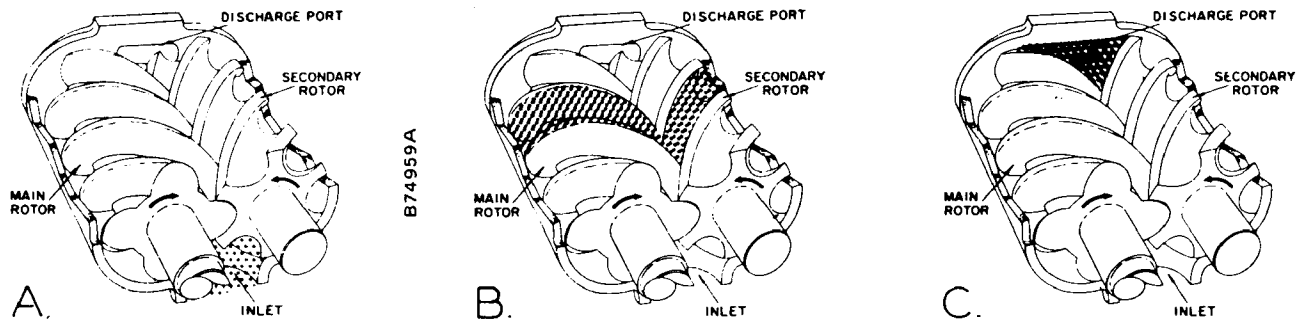


FIGURE 1–1 – TYPICAL COMPRESSION CYCLE

COMPRESSOR – The Gardner Denver 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. Angular contact ball 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 at the bottom on the opposite end of the compressor cylinder. FIGURE 1–1 is an inverted view to show inlet and discharge ports. The compression cycle begins as rotors unmesh at the inlet port and air is drawn into the cavity between the main rotor lobes and secondary rotor grooves (A). When the rotors pass the inlet port cutoff, air is trapped in the interlobe cavity and flows axially with the meshing rotors (B). As meshing continues, more of the main rotor lobe enters the secondary rotor grove, normal volume is reduced and pressure increases.

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

AIR FLOW IN THE COMPRESSOR SYSTEM (FIGURE 1–4, page 3) – Air enters the air filter and passes through the inlet unloader valve to the compressor. After compression, the air/water mixture flows to the separator/reservoir tank where most of the water is removed by velocity change and impingement. The air flows to the aftercooler, then to the moisture separator where the water that has condensed out is removed from the air stream. The air then flows through the package discharge check valve and to the plant air system.

WATER SYSTEM (FIGURE 1–6, page 4) – Water is forced by air pressure from the separator/reservoir tank through the heat exchanger, the system water filter and into the water injection manifold where the water is distributed to the compression chamber injection ports. The water removes the heat of compression and seals internal clearances. Seals minimize water leakage out of the compression chamber.

LUBRICATION – Oil in the oil reservoir at the discharge end of the air end lubricates the discharge end bearings. Grease fittings are located at the inlet end of the air end for periodic lubrication of the inlet end bearings.

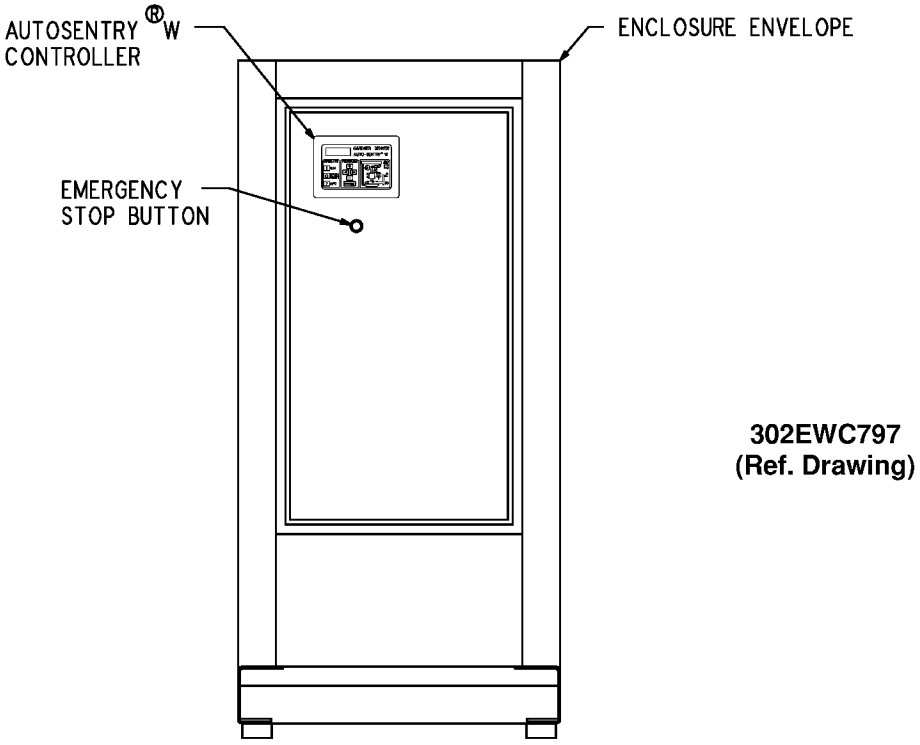


FIGURE 1–2 – COMPRESSOR END

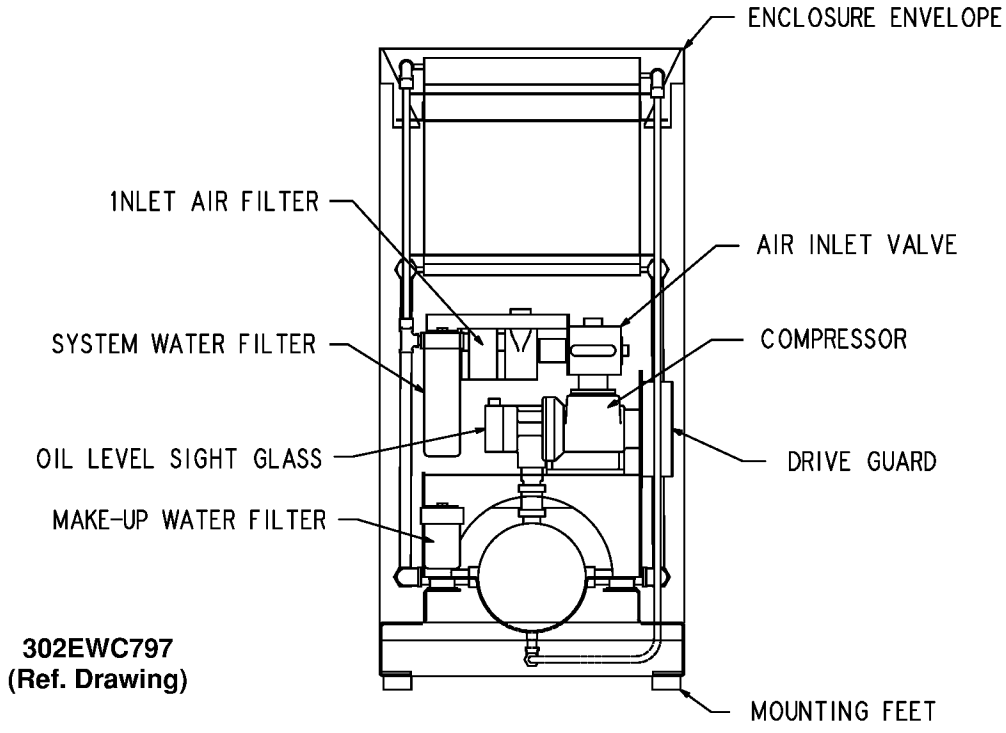


FIGURE 1–3 – COMPRESSOR END (CONTROL BOX REMOVED)

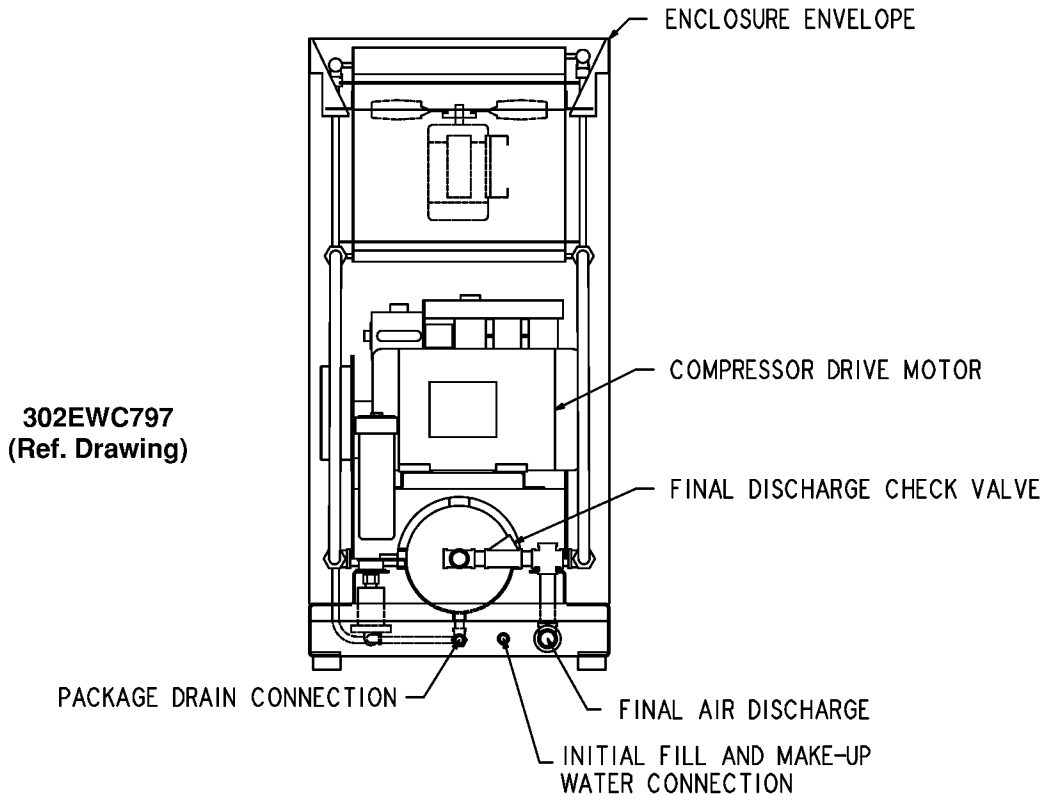


FIGURE 1–4 – DRIVE MOTOR END

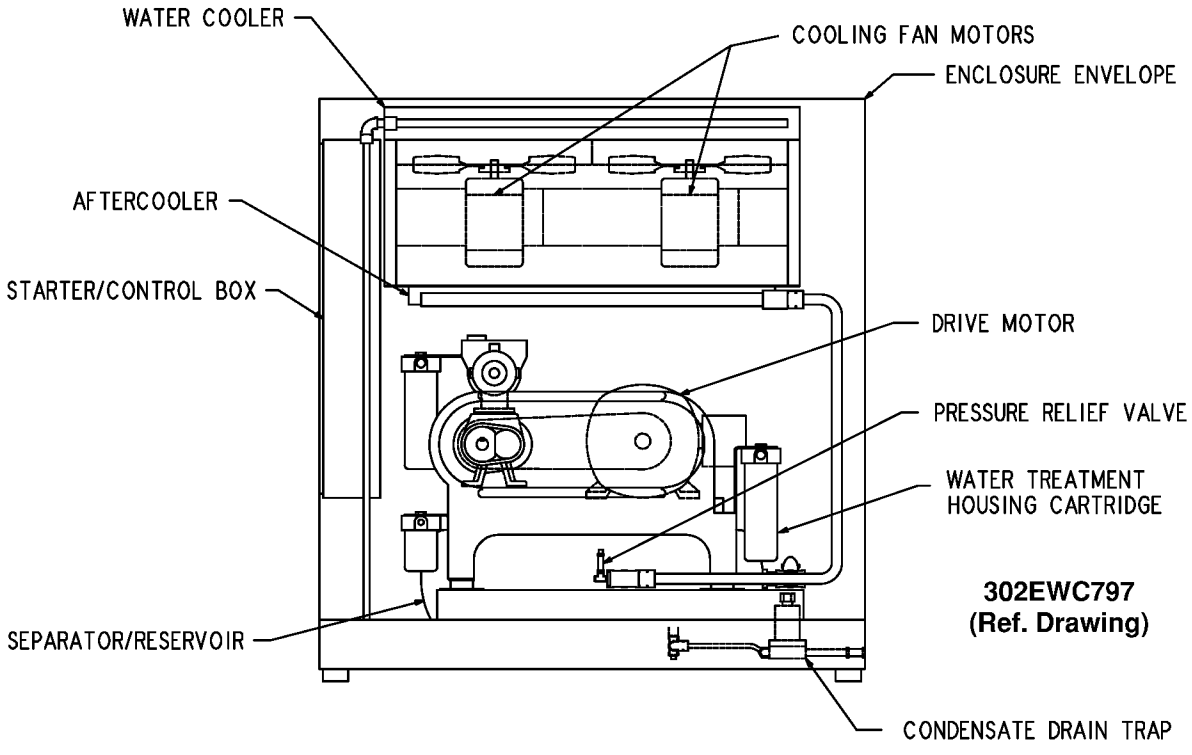


FIGURE 1–5 – DRIVE COMPONENT SIDE

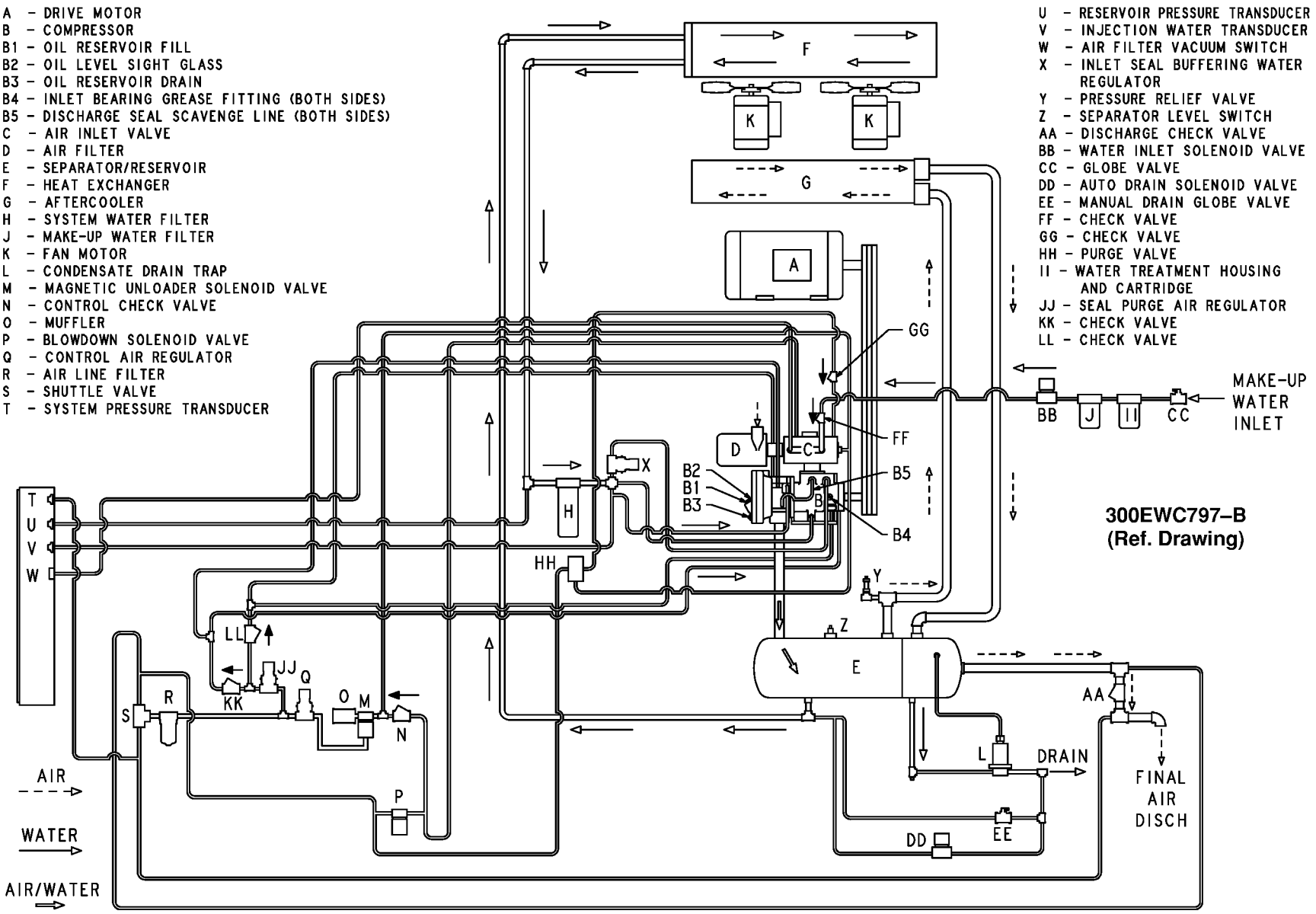


FIGURE 1–6 – AIR/WATER SCHEMATIC

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.

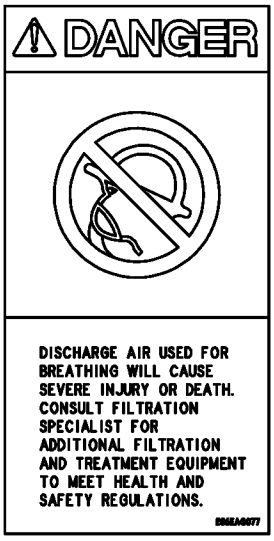
- **Keep fingers and clothing away from revolving fan, drive belts, etc.**
- **Do not use the air discharge from this unit for breathing – not suitable for human consumption.**
- **Do not loosen or remove the oil filler plug, drain plugs, covers, or break any connections, etc., in the compressor air or oil system until the unit is shut down and the air pressure has been relieved.**
- **Electrical shock can and may be fatal.**
- **Compressor unit must be grounded in accordance with the National Electrical Code. A ground jumper equal to the size of the equipment ground conductor must be used to connect the compressor motor base to the unit base.**
- **Fan motors must remain grounded to the main base through the starter mounting panel in accordance with the National Electrical Code.**
- **Open main disconnect switch, tag and lockout before working on the control.**
- **Disconnect the compressor unit from its power source, tag and lockout 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, tag and lockout 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)**
- **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



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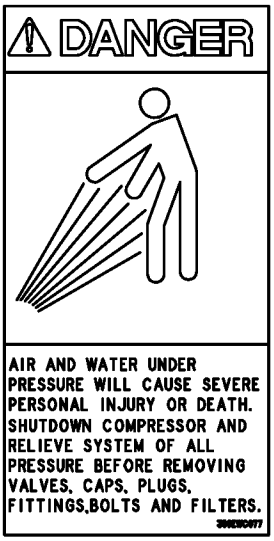

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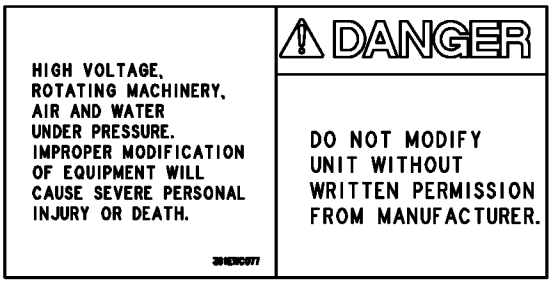

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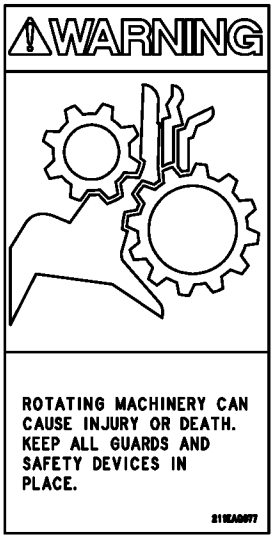

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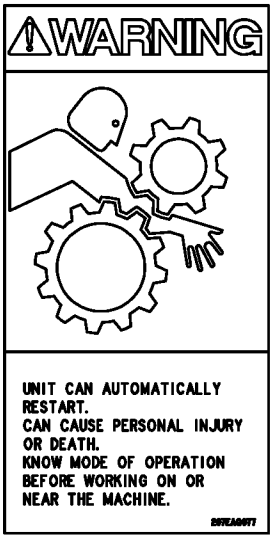

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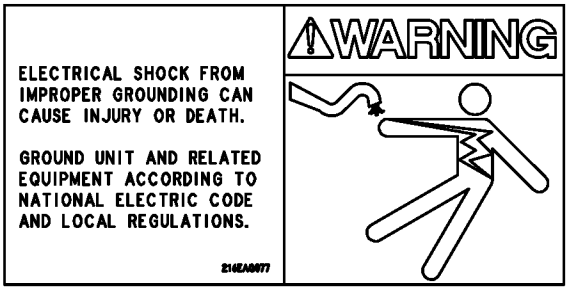

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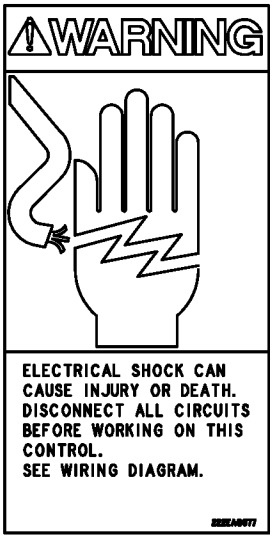

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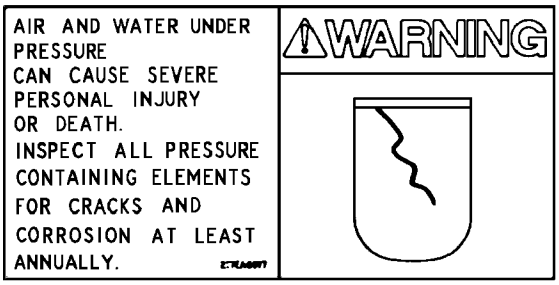

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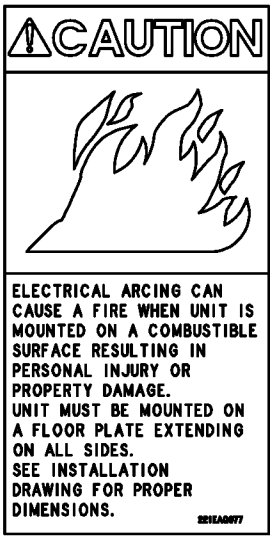

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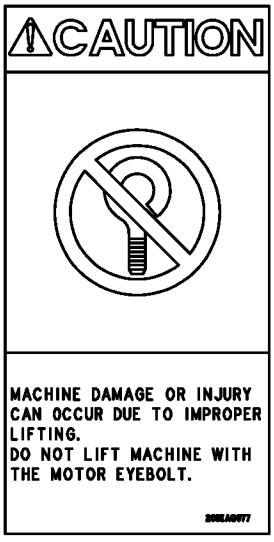

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SECTION 2
INSTALLATION, COOLERS AND WATER SYSTEMS

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

⚠ CAUTION

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

LIFTING UNIT – Proper lifting and/or transporting methods must be used to prevent damage. Towmotor fork clearance is provided by the equipment isolators bolted to the base of the unit. The unit may also be moved into location by rolling on bars.

⚠ 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.

LOCATION – The compressor should be installed in a clean, well–lighted, and ventilated area with ample space all around the unit for maintenance. Select a location that provides a cool, clean, and dry source of air. In some cases it may be necessary to install the air filter at some distance from the compressor to obtain proper air supply.

⚠ WARNING

Do not install this compressor in a location that may be subject to temperatures below 32° F. (0° C.).

Below freezing temperatures will cause damage to the compressor.

The air–cooled unit requires cooling air as well as air to the compressor inlet. Proper ventilation MUST be provided; hot air must be exhausted from the compressor operating area. A typical inlet–outlet air flow arrangement is shown in FIGURE 2–1.

Air–Cooled Units – An air cooled heat exchanger and aftercooler is supplied as standard equipment on all air–cooled units. The air cooled motors and fans are mounted within the cooling module; air is drawn into the

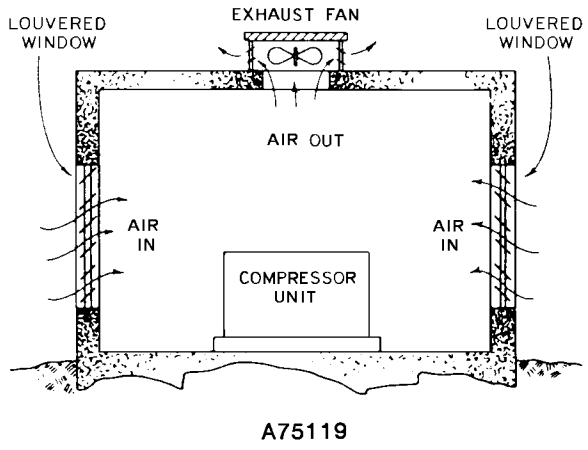


FIGURE 2–1 – TYPICAL COMPRESSOR ROOM

Minimum Air Flow* For Compression And Cooling – Cubic Feet/Minute (Cubic Meters/Minute)	
HP (KW)	Air Cooled
20 – 30 (15 – 22)	5,200 (147)

* 80° F (27° C) Inlet Air

FIGURE 2–2 – AIR FLOW CHART

enclosure through louvers in the side panels, through the aftercooler and exhausted through the heat exchanger at the top of the unit. The air–cooled unit with the standard enclosure requires sufficient flow, FIGURE 2–2, page 9, for the compressor water/aftercooling system and for electric motor cooling. Do not block the air flow to and from the unit. Allow three and one–half (3–1/2) feet to the nearest obstruction on the control box end of the unit. Allow three (3) feet to the nearest obstruction above and on other sides of unit. For continuous efficiency, the heat exchanger and aftercooler cores must be periodically cleaned with either vacuum or compressed air. If wet cleaning is required, shield the motor and spray on a mild soap solution, then flush with clean water.

⚠ WARNING

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

FOUNDATION – The Gardner Denver 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 10° angle lengthwise or 10° sidewise.

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

OIL RESERVOIR DRAIN – The oil drain plug is located at the bottom of the discharge end of the compressor. (See FIGURE 5–1, page 40.)

ENCLOSURE – The compressor, electric motor, water cooler and aftercooler are mounted inside the enclosure.

Service doors are provided for maintenance access. Be sure to allow enough space around the unit for the doors to be opened and removed as necessary for service procedures. The enclosure doors are held by two latches and lift away from the enclosure. The air filter, water filters, and water treatment cartridge are easily accessible through a side or end door.

⚠ DANGER

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

COMPRESSOR WATER SPECIFICATION – The compressor initial fill and make–up water must meet the United States Environmental Protection Agency National Primary and Secondary Drinking Water Regulations (See Table, page 15.) By requiring potable water fit for human consumption, a quality level is defined which is most generally readily available.

⚠ WARNING

Backflow Preventers must be installed on the potable water supply line to the compressor to prevent high pressure air from blowing into the water supply.

⚠ WARNING

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

⚠ WARNING

Compressor water seal leakage may occur. You must have potable make–up water available.

NOTICE

Water may no longer be potable after use in the compressor.

		Maximum Limit
1)	Total Hardness as $CaCO_3$	120 parts per million
2)	Either Total Dissolved Solids or Specific Conductance	500 parts per million 800 Micormhos/cm
3)	pH	7.5 to 9.0

FIGURE 2–3 – ADDITIONAL WATER LIMITATIONS

Total Hardness in Mg/L* as $CaCO_3$	Water Classification
0 – 60	Soft
61 – 120	Moderately Hard
120 – 180	Hard
Greater than 180	Very Hard

* 1 Mg/L = Approx. 1 ppm

FIGURE 2–4 – USGS CLASSIFICATION OF WATER

In addition to the requirements of the National Drinking Water Regulations, the limits listed in FIGURE 2–3 shall not be exceeded.

⚠ WARNING

Use of compressor initial fill and make–up water exceeding these limits could result in excessive scale formation which can facilitate corrosive activity and equipment damage or malfuction.

This unit is equipped with a food–grade hexametaphosphate feeder cartridge which dissolves slowly in water to prevent scale and inhibit corrosive activity. The use of a water considered to be "hard" or "very hard" by the U.S. Geological Survey (See FIGURE 2–4 for the U.S.G.S. classification of water) will result in increased frequency of required water filter and cartridge replacements and lead to scale build–up which can cause equipment malfunction and/or damage. If a proposed water supply is questionable, the water should be analyzed. If the water does not comply with this specification, a water treatment service can recommend equipment to satisfy this specification. Hardness can often be reduced by using a sodium ion exchange water softener. The use of deionized water is not recommended.

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

MOISTURE SEPARATOR/TRAP – Since the unit is equipped with a built–in aftercooler, an integral moisture separator and drain trap is furnished with the unit. The moisture from the trap is piped to the unit drain line.

CONTROL PIPING – External control piping is not necessary since the 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 Chart, FIGURE 2–5.

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

Length of Inlet Line	Diameter of Pipe Size
0 to 10 Feet (0 to 3 Meters)	Same as Compressor Inlet Opening
10 to 17 Feet (3 to 5 Meters)	One Size Larger Than Inlet Opening
17 to 38 Feet (5 to 11.5 Meters)	Two Sizes Larger Than Inlet Opening

FIGURE 2–5 – INLET LINE LENGTHS

DISCHARGE SERVICE LINE – The discharge service line connection on the unit is made from the right side at base level from the motor end of the package. When manifolding two or more rotary screw units on the same line, each unit is isolated by the check valve in the unit discharge line. If a rotary screw unit is manifolded to another compressor, be sure the other compressor has a check valve in the line between the machine and the manifold. If a rotary screw and reciprocating compressor are manifolded together, an air receiver must be located between the two units.

⚠ DANGER

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

The oil–free air discharging from the EWC package is saturated with water vapor at discharge temperature. An air dryer may be required if the air is used in a moisture sensitive process. In addition, the compressed air has been mixed with contaminants that entered the intake of the compressor.

UNIT WATER DRAIN – The unit drain port should be connected to a floor drain. The drain line must slope downward away from the unit to allow excess condensate to flow by gravity. As necessary, the automatic water management system will open the drain solenoid valve to drain excess water. Since the drain solenoid valve may open at any point during compressor operation, high temperature water under pressure may be discharged from the unit. It is recommended that the compressor water drain port be hard piped to the floor drain.

⚠ DANGER

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

AIR/WATER RESERVOIR WITH INTEGRAL MOISTURE SEPARATOR – The air/water reservoir–separator combines multiple functions into one vessel. On one end of the vessel, the lower half functions as a reservoir, providing water storage capacity for the system and the upper portion serves as primary air/water separation. The reservoir also provides limited air storage for control and gauge actuation. Secondary moisture separation is achieved downstream of the aftercooler on the other end of the vessel.

CHANGING THE SYSTEM WATER FILTER – When the injection water pressure differential through the filter reaches 30 psid, an advisory will appear on the "AUTO SENTRY®–W" control panel as an alternating message on the lower line of the display and a yellow indicator in the status area. Change both the system and make–up water filters when this occurs. To change the water filter:

1. Be sure the unit is completely off and that no air pressure is in the system.
2. Disconnect, tag and lockout the power supply to the starter.
3. Drain the water from the filter housing by either turning the petcock or removing the plug on the bottom of the filter assembly.
4. Remove the nut at the top of the filter assembly, while holding the filter housing to keep it from dropping. When the nut is removed, change the filter, and reassemble.
5. Repeat Steps 3 and 4 on the make–up water filter.
6. Reconnect the power supply to the starter, start the machine and check for leaks.

CHANGING THE MAKE–UP WATER FEEDER CARTRIDGE – The material in the feeder cartridge is slowly dissolved as make–up water is added to the compressor system. If no material is observed inside of the cartridge by a periodic visual inspection, replace the empty cartridge. To replace the feeder cartridge:

1. Be sure the unit is completely off and that no air pressure is in the system.
2. Disconnect, tag and lockout the power supply to the starter.
3. Shut off the supply of make–up water to the cartridge housing.
4. Remove the clear housing and empty cartridge.
5. Remove the cap from the top and the seal from the bottom of the new cartridge and insert into the housing and reassemble.
6. Turn on water supply, reconnect the power supply, start the machine and check for leaks.

COMPRESSOR INJECTION WATER SYSTEM CHECK – The following readings are based on an ambient temperature of 80° F. inlet cooling air on air–cooled units with the cooling system in good, clean 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 Water Discharge Temperature – 105° to 125° F. – Read on the "AUTO SENTRY®–W" control panel.

Compressor Injection Water Inlet Temperature – 90° to 110° F. – Check anywhere on the line from the heat exchanger to the compressor inlet.

Water Injection Cooler Temperature Differential (Air Cooled Heat Exchanger) – The water temperature differential depends on the temperature of the air at the water injection cooler fan and the cleanliness of the core faces. As ambient temperatures and core restrictions increase, the injection water outlet temperature will increase. The injection water outlet temperature is approximately the same as the package exhaust air temperature. The outlet temperature may be checked by installing a tee in the water line between the separator/reservoir and the cooler.

Water Injection Cooler Pressure Differential (Air Cooled Heat Exchanger) – 5 to 7 psid – Check injection water pressure differential in the same place as temperature. (See above.)

ELECTRICAL WIRING – Standard Units – The Twistair® compressor is factory wired for all starter to motor and control connections for the voltage specified on the order. It is necessary only to connect the unit starter to the correct power supply. The standard unit is supplied with an open drip–proof motor, a NEMA 12 starter and control enclosure. See "Location" paragraph for distance to nearest obstruction on starter and control box sides of the unit.

⚠ WARNING

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

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

⚠ WARNING

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

MOTOR LUBRICATION – Long time satisfactory operation of an electric motor depends in large measure on proper lubrication of the bearings. The charts on the next page 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, tag and lockout 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 the unit and run for about 20 minutes to expell 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, tag and lockout power supply to the starter before working on the electric motor.

ELECTRIC MOTOR GREASE RECOMMENDATIONS (–30° to 50° C)

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

ELECTRIC MOTOR REGREASING INTERVAL

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

U.S. EPA National Drinking Water Regulations *

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

1 Primary – Toxic health hazard, enforceable maximum.

2 Secondary – Aesthetic characteristics, desireable goals not enforceable.

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

SECTION 3
STARTING & OPERATING PROCEDURES

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

1. **Compressor Oil** – Compressor Oil – Check air end oil level. The normal oil level is in the center of the sight glass. Oil level must be within the operating range. Add or drain oil to correct level using the same type of oil. (See FIGURE 5–1, page 40).

⚠ DANGER

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

⚠ CAUTION

Use of improper lubricants will cause damage to equipment. Do not mix different types of lubricants or use inferior lubricants. See Section 5, page 39, for lubrication recommendations.

NOTICE

Regular maintenance and replacement at required intervals of the air and water filters are necessary to achieve maximum service of this screw compressor. Use only genuine Gardner Denver filters designed and specified for this compressor.

2. **Air Filter** – Inspect the air filter to be sure it is clean and tightly assembled. Refer to Section 6, "Air Filter," page 42, for complete servicing instructions. Be sure the inlet line, if used, is tight and clean.
3. **Piping** – Refer to Section 2, "Installation," page 9, 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 FIGURE 4–10 and FIGURE 4–11, pages 36 and 37, for general wiring diagrams and Section 2, page 9 for installation instructions.
5. **Grounding** – Equipment must be grounded in accordance with Section 250 of the National Electrical Code.

⚠ WARNING

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

6. **Rotation** – Check for correct motor rotation using "JOG MODE." An arrow on the compressor/motor beltguard shows correct rotation. Compressor drive shaft rotation must be counterclockwise standing facing the compressor sheave.

⚠ WARNING

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

7. **System Pressure** – Set the controls to the desired unload and load pressures. DO NOT EXCEED MAXIMUM OPERATING PRESSURE ON COMPRESSOR NAMEPLATE. See Section 4, "Controls and Instruments," for procedure.

⚠ WARNING

Operation at excessive discharge air pressure can cause personal injury or damage to equipment. Do not adjust the full 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.

STARTING THE UNIT – It is a good practice to prime the compressor air end and separator/reservoir prior to initial start–up following the installation of the compressor package and following a manual draining of the water reservoir. Pour 2 to 3 gallons of water in through the inlet valve to prime the unit.

Start the unit by pushing the [RUN] key. The unit will reach normal operating temperature in approximately 5 minutes. Check the package operating information by pressing the [INFO] key or keypad cursor [<][>] keys at any time during compressor operation.

DAILY CHECK – Refer to Section 8, "Maintenance Schedule," page 45.

STOPPING THE UNIT – Press [STOP/RESET] key. The air/water reservoir will automatically blow down as the motor stops.

SECTION 4
CONTROLS & INSTRUMENTATION

GENERAL DESCRIPTION – The Gardner Denver TWISTAIR® waterflooded rotary screw compressor 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, to the shop air line, and to the appropriate water supply. A standard compressor unit consists of the compressor, water reservoir, water cooling system and filters, lubrication reservoir, motor type as specified, NEMA 12 starter / control box, and control components as described below.

This compressor unit features the AUTO SENTRY®–W 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 and indication of its condition.

AUTO SENTRY®–W OPERATION

Normal operation is controlled by the keys in the OPERATE island of the AUTO SENTRY®–W controller. Prior to starting, press the [STOP/RESET] key to place the controller into its READY state (as indicated on the display). Press the [RUN] key to start the compressor. The green LED will light near the automatic operation symbol whenever operation is enabled.

The [STOP/RESET] key may be pressed at any time to stop the compressor under normal conditions. If the compressor has been running, the reservoir pressure is relieved before stopping the motor. The display will count down to zero during the normal stop.

An optional control may be wired into the AUTO SENTRY®–W controller to interrupt and restart the unit based on controls by others. When stopped by these controls, the display indicates remote stop.

⚠ WARNING

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

In any mode, the compressor will start only if reservoir pressure is below 5 psig (0.3 bars). The display will indicate if the control is waiting for a reservoir blowdown, along with the remaining pressure. The controls also delay initial loading of the compressor until a startup delay has been completed.

Constant Run Mode Operation – This mode is best used in applications where there are no long periods of unloaded operation, or for minimum response time to sudden demands. The compressor unit will start and run continuously, using its controls to load and unload the compressor. This matches average delivery to demand.

When the air demand is less than the compressor capacity, the air pressure rises to the unload point of the control. It will then unload (but not blow down) and will not deliver any air to the system. Air demands are supplied by air stored in receivers and plant piping. When the pressure falls to halfway between the unload and load pressures, the W controller again fully loads the compressor.

When first starting, the controller will keep the compressor fully unloaded and blown down until the system pressure drops below the load pressure. Once loaded, the reservoir will remain fully charged, regardless of demand. Responses to demand are thus immediate, and system pressures will be maintained in the upper portion of the programmed pressure band.

Low Demand Mode Operation – The low demand mode reduces power consumption by relieving pressure in the reservoir during unloaded operation. This mode is best used where there is moderate air storage and there are unloaded periods during the day, but frequent motor starting and stopping is undesirable. During periods of moderate to high demands, this mode is identical to the constant–run mode described above.

During low demand periods, the controller will also open the blowdown valve while unloaded, to minimize the motor load. A timer is reset when this occurs. Plant demands and control air pressure is supplied from the plant air system while the compressor is unloaded. When the system air pressure drops to the load pressure, the blowdown valve recloses and the compressor fully loads.

Subsequent blowdown periods are not allowed until the timer has completed its cycle. This cycle eliminates frequent blowdowns while the plant has high air demands, and the energy required to re–pressurize the reservoir. The timer is adjustable from 1 to 20 minutes.

Automatic Mode Operation – This mode provides automatic start and timed stop, and is best used in applications with long unloaded periods and adequate

storage to allow the compressor to be stopped for periods of light demands. Operation during periods of moderate to heavy demands is identical to the low demand and constant run modes described above.

The automatic time delay is adjustable from 5 to 20 minutes. If the controller operates unloaded for this period with no demand, the compressor drive motor is halted to eliminate its power consumption. The controls will remain in this state until pressure drops below the load pressure.

This is the most common selected mode of operation, as it automatically will operate the compressor unit in the most efficient manner for the demand of the air system.

Sequence Mode Operation – This mode provides for communication between controllers, operating only as many as are required for economical operation. This is best used on applications with large storage capacity and diverse loads. The lead unit will operate identically to the automatic mode; operation will be automatically staged for each lag unit (up to 8 total). For more information, refer to the sequencing instructions later in this chapter.

An optional expansion board must be installed for sequencing operation. Communication between controllers is achieved by interconnection of a communications cable to expansion board connectors. A "unit number" must be assigned to each unit in this mode, but the display will indicate the unit's actual operating ranking.

AUTO–SENTRY®–W CONTROL DISPLAY

The display above the keypad is used to provide operating information to the user. If a shutdown has occurred, the display will indicate the cause.

During normal operation, the display will show the system pressure, compressor discharge temperature, total running hours, and operation mode. Alternate displays are available by pressing the [?] INFO or the keypad cursor [<] [>] keys, and will be identified on the display. These include:

Water Filter Differential Pressure	DIF PRES
Reservoir Pressure	RES PRES
Water Injection Pressure	INJ PRES
System Pressure	SYS PRES
Compressor Discharge Temperature	DIS TMP
Total Hours	TOT HRS
Loaded Hours	LOAD HRS

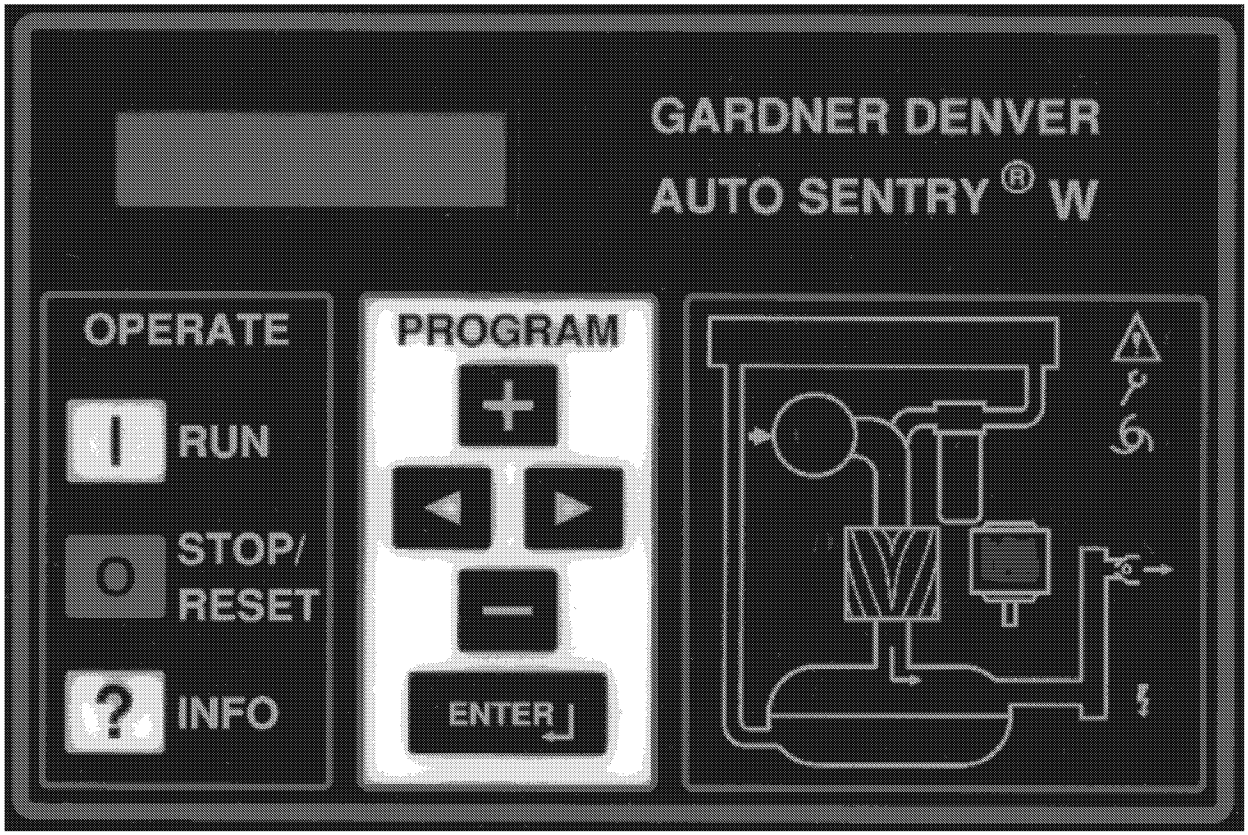


FIGURE 4–1 – AUTO SENTRY® –W CONTROLLER DISPLAY

Remaining Blowdown Time	BD TMR
Remaining Auto Time	AUTO TMR

Remaining blowdown and auto times are only available in Low Demand, Automatic, and Sequence modes, as appropriate.

If no keys are pressed for 5 seconds, the display will revert to its normal mode.

The display is also used as a service reminder for normal maintenance items. If service is recommended, the yellow LED next to the service symbol will come on, and a message will alternate with the normal lower line message. These messages are intended to advise of conditions which may lead to a shutdown.

If a protective shutdown occurs, the red LED next to the shutdown symbol will be on and the top line of the display will indicate "SHUTDOWN." The lower line will indicate the cause of the shutdown.

SERVICE ADVISORIES

The AUTO SENTRY®–W controller turns on an advisory when it detects operation which needs service attention, but does not warrant shutting down the compressor. Some of these are normal maintenance procedures, and are intended to serve as a reminder to perform routine service. Others are conditions which can reduce the maximum compressor performance. It will remain in effect until reset. Check the display during routine inspections, and perform maintenance as suggested. Refer to the troubleshooting section for detailed information about each advisory.

Temperature advisories may be cleared while the unit is running by simply pressing the [ENTER] key. To reset the service advisories, press the [STOP/RESET] key to stop operation of the compressor. After it has stopped, disconnect power and service as required. After servicing, restore power and reset the controller as indicated in the programming / maintenance section below.

PROTECTIVE SHUTDOWNS

The AUTO SENTRY®–W will shut down the unit following any fault detected in the following devices. Long–term problems will have a brief blowdown period before fully shutting down. Following a shutdown, a message will be displayed, with the top line indicating "SHUTDOWN" and the lower line indicating the cause. The shutdown light will be steadily lit while the shutdown condition is present, or will flash if the condition no longer exists. Refer to the troubleshooting section for detailed information about each shutdown. To resume operation, the cause of the shutdown must be corrected and the controller reset by pressing the [STOP/RESET] key.

Motor Protective Devices – Overload heaters are furnished for the starter in the voltage range specified. There are three (3) overloads in the starter of proper size for the starter and its enclosure. Note that motor nameplate current must be multiplied by 0.577 for wye–delta starters. The display will indicate that an overload relay has tripped. The overload relay is reset by pressing the button on the relay itself, then the controller may be reset. Motor current (amps) and voltage must be measured in the affected motor wiring to locate the cause for high current. Proper starter coil and contact action is also monitored and errors in operation will cause a shutdown with the cause displayed as a starter or contact error.

High Temperature – The compressor is protected from high discharge temperature by a thermistor probe located in the compressor discharge. The AUTO SENTRY®–W will shut the compressor down if temperature exceeds 190° F (88° C) (or lower per user adjustment) or if rapid temperature rise is detected. Shutdown will also occur if the temperature falls below freezing. The thermistor probe is also checked for open or shorted circuits, and the display will indicate a fault, if found.

⚠ CAUTION

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

Water Filter Differential Pressure – The pressure drop across the water filter is continually monitored by the AUTO SENTRY®–W. The unit will be shut down at a differential pressure of approximately 40 psid (2.8 bars). This becomes active only after the compressor has been running and pressures have had time to stabilize.

The pressure drop can be monitored at any time by selecting the alternate display "DIF PRES" (water filter differential pressure) with the [?] HELP key. This should be checked while the compressor is delivering at full capacity. A service advisory comes on to recommend maintenance prior to this shutdown.

High Water Level – If the water management controls are unable to maintain proper water levels, the compressor will shutdown to prevent damage. Check wiring and piping of the drain and fill solenoid valves. A shutdown also occurs if wiring errors are detected in the float switch, and the display will indicate a bad float switch.

High Pressure – The AUTO SENTRY®–W will first attempt to unload and blow down the unit if excessive pressures are detected in the reservoir or the plant system. If unsuccessful, a shutdown will occur. Shut down will also occur if a defective transducer is detected. The display will indicate the location of the high sensed pressure or transducer (xducer) error. Check that all adjustments have been properly made, and all connections are secure.

Emergency Stop – Press the emergency stop button to shut down the unit and the controller. To restart, pull the button out to its normal position and reset the controller. This should be used for emergency purposes only – use the keypad [STOP/RESET] for normal controlled stopping.

Power Failure – Following power interruptions, the controller will remain in a shutdown state (unless programmed for auto restart).

External Device – This input is provided for user– or dealer– installed devices needed by specific applications. Other shutdown field selectable messages include: high vibration, phase relay, low voltage relay, and water press. An optional expansion board must be installed to use this feature.

Other Shutdowns – The controller runs continuous diagnostic checks of its own operation and the sensors to which it is connected. Refer to the service section for a complete listing of shutdowns and remedial actions.

PROGRAMMING AND SETUP FOR THE AUTO SENTRY®–W CONTROLLER

Programming and setup is accomplished with the PROGRAM keys. See FIGURE 4–1, page 19. In all steps, the [ENTER] key will cause the controller to accept the displayed value into memory and advance to the next programming function. The plus [+] and minus [–] keys will increase and decrease displayed numeric values, or step through menu selections. During numeric adjustments, the right [>] and left [<] arrow keys move the cursor (flashing digit) to the position desired. Use the [+] and [–] keys to change the number at the cursor. At any point in the programming and setup routine, the [STOP/RESET] key can be pressed to exit and return to the ready mode without altering the adjustment. In all steps of the programming routine, the top line of the display will give a description of the parameter to be programmed, while the bottom line shows the variable that is capable of being altered by programming.

The following is a step by step guide to programming the AUTO SENTRY®–W. Remember, between each step, it is necessary to press the [ENTER] key to store the new value and advance to the next step.

Main Adjustments Menu

1. The compressor must be stopped prior to making any adjustments. If the unit is running, press the [STOP/RESET] key to place the control in the "READY" state.

   Adjustments can also be performed while in the "SHUTDOWN" state. After the adjustments are completed, the W controller returns to this state until the cause is repaired and the controller is manually reset.

2. Press the [ENTER] key to begin programming. This enters the adjustments menu. The adjustments are broken into five groups as shown in FIGURE 4–2, page 22. To select a group, press [+] or [–] until the desired group is shown on the bottom line of the display. Press [ENTER] to proceed to the group adjustments detailed below.

Operation Adjustments

1. In the top line, "**DISPLAY UNITS**" is indicated. The bottom line will indicate "ENGLISH" (PSIG, Fahrenheit) or "METRIC" (Bars, Celsius) units of measurement. Select the desired display units and press [ENTER] to proceed.

2. The top line displays, "**OPERATING MODE**". The bottom line will indicate the selected mode. Refer to the description of modes at the beginning of this chapter, and select the desired mode, using the [+] or [–] keys. When the desired mode is shown, press the [ENTER] key to save and proceed.

3. In the top line, "**START TIMER**" is displayed. The bottom line will indicate a time between 2 and 10 seconds. This is the time that the controller spends in the unloaded 'start' mode. If reduced–voltage starting is used, it should be set longer than the starter's timer.

4. In the top line, "**UNLOAD PRESSURE**" is displayed. The bottom line will indicate a pressure value. It is to be set at the nameplate rating of the compressor for normal operation. Under NO circumstances, is this adjustment to be set in excess of the compressor nameplate pressure.

5. In the top line, "**LOAD PRESSURE**" is displayed. The bottom line will indicate a pressure value. This setting determines the point at which machine startup occurs in AUTO and SEQUENCE modes and when the compressor will load up from the blown down condition. Note that LOAD PRESSURE cannot be set within 7 PSI of the UNLOAD PRESSURE. It is necessary that all machines to be sequenced have the same UNLOAD and LOAD PRESSURE setpoints.

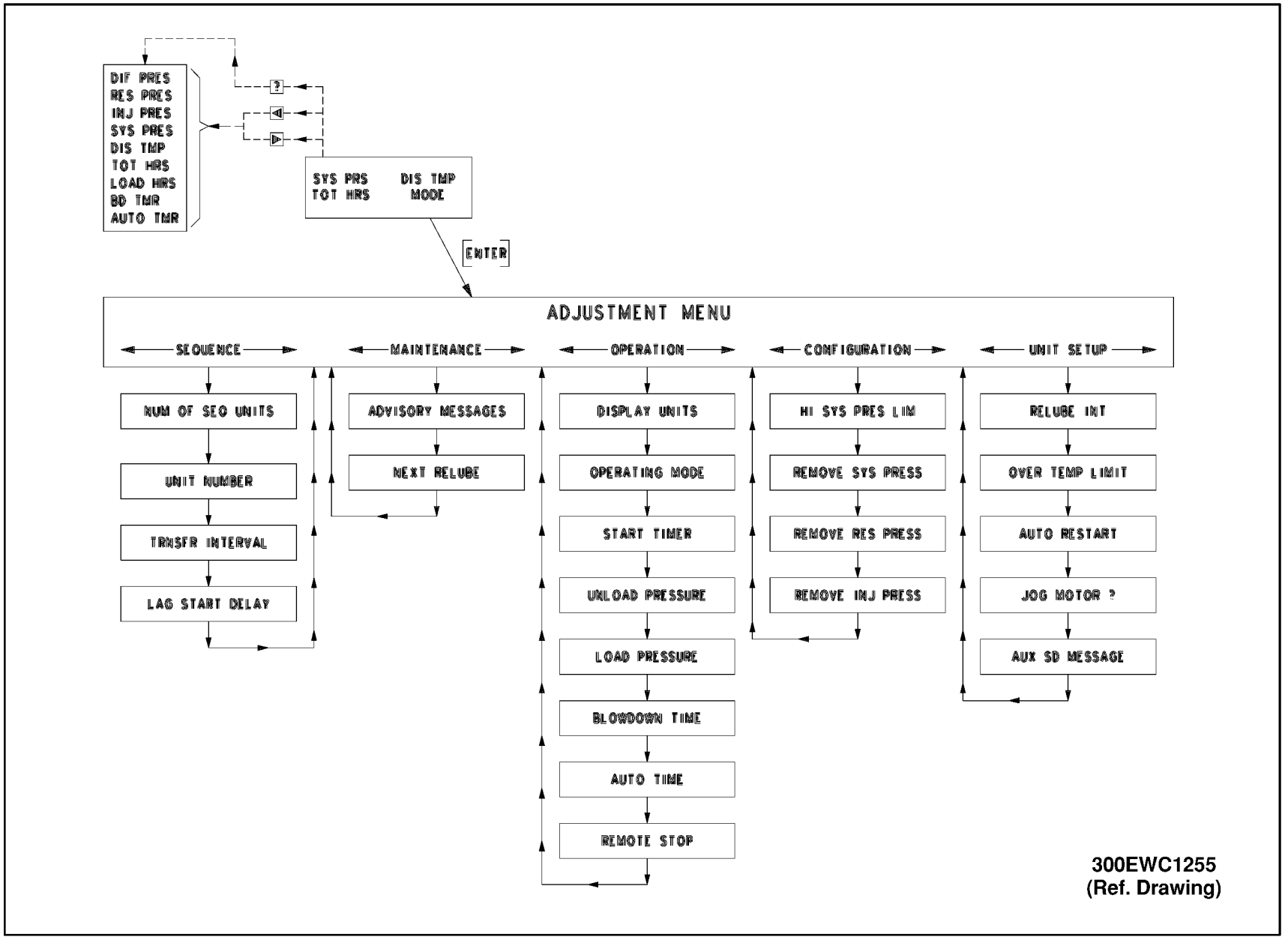


FIGURE 4–2 – FLOW CHART FOR SET–UP PROGRAMMING

6. In the top line, "**BLOWDOWN TIME**" is displayed. The bottom line will indicate a time between 1 and 20 minutes. It is factory set at 10 minutes. This is the minimum time interval between blowdowns. A longer blowdown time minimizes wasteful dumping of compressed air when loading is likely to occur in a short time.

7. In the top line, "**AUTO TIME**" is displayed. The bottom line will indicate a time between 5 and 20 minutes. It too, is factory set at 10 minutes. Its function is to prevent too frequent motor starting, and to allow the motor a 'cool–down' period before stopping.

8. In the top line, "**REMOTE STOP**" is displayed. The bottom line indicates either "TIMED" or "IMMEDIATE". Refer to the description of "Remote On/Off" later in this section for additional details. Select the desired response to the remote input and press [ENTER] to proceed.

9. This completes the operational adjustments. The controller will return to the main adjustments menu.

Maintenance Adjustments

1. If any service advisories are in effect (yellow ADVISORY indicator is on), they will be displayed on the top line. The bottom line indicates "**LEAVE ADVISORY**" (do not reset) or "**CLEAR ADVISORY**" (turn it off). Select the desired action and press [ENTER] to proceed.

2. The top line displays "**NEXT RELUBE**" and the hours remaining are displayed on the bottom line. Press the [+] or [–] keys to switch to the lubrication change interval (see UNIT SETUP) if service was performed early. Press [ENTER] to proceed.

3. This completes the maintenance adjustments. The controller will return to the main adjustments menu.

Sequence Adjustments

See "SEQUENCING COMPRESSORS WITH THE AUTO SENTRY®–W, page 25, for more details on setting up and optimizing a sequenced compressor installation.

1. In the top line, "**NUM OF SEQ UNITS**" is displayed. The bottom line will indicate a number in the range of one through eight. This will be factory set at "1". This should be set to a number corresponding to the number of compressors that are currently installed on this air system that also have AUTO SENTRY®–W controllers. It should be noted that all AUTO SENTRY®–W compressors on the system must have the same number programmed here to operate correctly in SEQUENCE mode. Adjust as required, and press [ENTER] to proceed.

NOTICE

Setting the value in step 1 to one indicates that no sequencing is to take place. Consequently, steps 2, 3, and 4, which relate to sequencing, are skipped by the AUTO SENTRY®–W; the controller will return to the main adjustments menu.

2. In the top line, "**UNIT NUMBER**" is displayed. The bottom line will again indicate a number of one through eight and be factory set at "1". Each AUTO SENTRY®–W in a sequenced system must have a unique number here. The sequence mode will not function if two or more compressors have the same UNIT NUMBER. The most efficient machine–to–machine communications will occur when the lowest possible numbers are used. Example: 1, 2, and 3 for a three compressor installation.

   This is the only setting which must be different for each unit in a sequenced system. All other settings should normally be the same for all units.

3. In the top line, "**TRANSFER INTERVAL**" is displayed. The bottom line will indicate a number of hours in the range of 1 to 5000. It is factory set at 24. This is the number of hours that this machine will stay in the role of "master" or "lead" compressor.

   Normally it is desirable to set this to the same value on all sequenced units to equalize running hours. Different values may be programmed, if desired, to help equalize hours.

4. In the top line, "**LAG START DELAY**" is displayed. The bottom line will indicate a number in the range of 15 to 600 seconds. It is factory set at 30. This is the length of time this machine will wait before starting when the pressure drops below the load point. This should be set to the same value for all sequenced units. Its setting will depend on the amount of air storage volume in the system. Too small a number will result in more compressors being started than is necessary to satisfy the demand.

5. This completes the sequence adjustments. The controller will return to the main adjustments menu.

Configuration Adjustments

1. In the top line, "**HI SYS PRES LIM**" is displayed. The bottom line will indicate a value that is factory set 20 – 25 PSI above name plate. This is the pressure that will cause a shutdown if exceeded due to a malfunction such as a stuck inlet valve or broken control line. This should be set at or slightly below the rating of the pressure relief valve. The controller will attempt a number of actions as it approaches to prevent the pressure from reaching this limit.

2. In the top line, "**REMOVE SYS PRESS**" is displayed. The bottom line displays the current pressure being sensed at the package discharge. At this point, steps must be taken to ensure that system pressure is, in fact, zero psig. Remove the line to the system pressure transducer. Pressing [ENTER] will now cause the AUTO SENTRY®–W to calibrate the transducer output to zero PSIG. Obviously, pressure measurement errors will be encountered if 'zeroing' is done with pressure at the transducer. If large errors are detected, the controller will demand that the transducer be checked.

3. In the top line, "**REMOVE RES PRESS**" is displayed. The bottom line displays the current pressure being sensed in the reservoir. The reservoir pressure transducer may now be 'zeroed' by following the steps outlined in 2 above.

4. In the top line, "**REMOVE INJ PRESS**" is displayed. The bottom line displays the current pressure being sensed in the water line. The water injection pressure transducer may now be 'zeroed' by following the steps outlined in 2 above.

5. This completes the configuration adjustments. The controller will return to the main adjustments menu.

Unit Setup Adjustments

1. In the top line, "**RELUBE INTERVAL**" is displayed. The bottom line will indicate a time interval of 1000 to 2000 hours. After the machine has run for the programmed setting, an advisory will be displayed, requesting relubrication. Adjust as desired and press [ENTER] to proceed.

2. In the top line, "**OVER TEMP LIMIT**" is displayed. The bottom line will indicate 190 degrees F. This is the maximum (and proper) setting for compressor operation. It may be temporarily lowered to verify the function of the temperature shutdown system.

3. In the top line, "**AUTO RESTART**" is displayed. The bottom line will indicate either "OFF" or "ON" The factory setting is "OFF", and the controller will display a power failure shutdown after power has been restored.

   Set this feature to ON when it is necessary to have the compressor automatically restart after a power interruption. There will be a brief delay, then the control resumes the mode it was in prior to the interruption. This feature shall only be enabled when the owner determines that it is safe to do so. It is recommended that compressor access be limited to only trained service personnel when this feature is used.

4. This step is only encountered if the AUTO RESTART function was set to ON in the previous step. In the top line, "**RESTART DELAY**" is displayed. The bottom line will indicate a time between 5 and 60 seconds. It is factory set at 10 seconds. This is the amount of delay introduced before restarting after power has been restored. Set it as desired to allow for power to stabilize before starting compressors.

5. The display now reads "**JOG MOTOR?**" and indicates the amount of time to energize the starter. Adjust with the [+] or [–] key to the smallest value needed to bump the motor and check rotation. 0.1 to 0.2 seconds is normally adequate for factory–furnished full–voltage starters; wye–delta or remote starters may require a little more time. Set back to zero to proceed to the next step.

6. In the top line, "**AUX SD MESSAGE**" is displayed. The bottom line will display the message which will appear if power is removed from the shutdown input on the optional expansion board. Select the most appropriate message for user–furnished shutdown devices, and press [ENTER] to proceed.

7. This completes the unit setup adjustments. The controller will return to the main adjustments menu.

OTHER CONTROL FEATURES

Auto restart after power failure – The AUTO SENTRY®–W controller normally displays "SHUTDOWN – POWER FAILURE" after power has been interrupted and restored. Press the [STOP/RESET] key and select an operating mode to restart the compressor.

If programmed for automatic restart, the controller pauses and begins counting down when power is restored. This time is adjustable in the programming steps noted above. This must be at least several seconds, but may be set longer to allow other plant loads to start up first. After the countdown is complete, the controller resumes the mode of operation prior to the power interruption.

When auto restart is enabled, the green power indicator will blink whenever power is on. With auto restart disabled, the power indicator lights steadily while power is on.

SEQUENCING COMPRESSORS WITH THE AUTO SENTRY®–W

An accessory expansion board, part number 301EWC1173, is required in each controller for sequencing operation. This is included with any package ordered with wye–delta starters, and may be ordered separately and installed on other packages. Refer to expansion board connection instructions later in this section.

Sequencing compressors with the AUTO SENTRY®–W controller is as simple as plugging in a telephone to a wall jack. The only item required to make the system functional is a standard telephone cable identical to cables that connect nearly every telephone to its wall jack. One less cable than the number of compressors to be sequenced is required. For example, to sequence four compressors, three cables are required. A kit, 200EAP752, is available which contains all material needed to sequence up to five compressors. This kit contains 500 feet of cable, eight modular connectors, and a crimping tool to install the connectors.

In spite of its inherent installation simplicity, the sequencing function of a multi–compressor AUTO SENTRY®–W system provides all the necessary features for maintaining pressure over a wide range of plant demands.

Installation

A proper sequencing installation requires two or more Gardner–Denver rotary air compressors complete with AUTO SENTRY®–W controllers, piped into a common air system, interconnected as described above. For best performance, the units must be piped directly to the receiver, without any intervening check valves, dryers, or other restrictions. The receiver should also be sized to prevent excessive drops or rapid rises in pressures during the operation as described below. All standard practices common to sound air compressor installations such as proper sizing of discharge piping, proper electrical supply and conductor sizing, and grounding are to be observed. The serial communications interface meets RS–485 standards, the most widely used interface in harsh, industrial environments today. However it is still recommended that the communications cables be routed through metallic conduit to provide them with both mechanical protection and electromagnetic shielding.

Each expansion circuit board has two modular jacks which accept RJ–12 telephone plugs. One jack is vacant, the other has a short pigtail plugged into it. To interconnect two compressors, plug the cable into the vacant jack on each controller. For installations of more than two units, the pigtail plug must be disconnected on all controllers except the two at each end of the communications line. The order of interconnection has no effect on the system operation. The following conditions are necessary and sufficient for proper operation:

1. Every compressor must have a cable connecting it to another compressor. One less cable than the number of units sequenced must be used.
2. Each board that has only one cable connected to it must have its pigtail plugged into the unused jack. All installations will have two such units.

Operation

1. ESTABLISHING THE INITIAL SEQUENCE

Operation of compressors in sequence requires only selection of the sequence operating mode during adjustments and a press of the [RUN] key on each compressor in the system. Since the sequencing algorithm includes provisions for automatic replacement of a failed master or 'lead' compressor, it is important for the operator to be aware of the hierarchy of events when starting the system.

The first compressor placed into sequence mode will become the master. However, since any compressor first placed into sequence has no way of knowing whether or not a master exists, it will first assume the highest rotation number available. For example if the number of units to be sequenced is programmed at four, any compressor will start out in position four when placed in sequence mode. It will then listen on the communications line for a call from the master.

If no call is received, it will assume position three and again wait for a call from the master. After another lack of a master call, it assumes position two. Subsequently, it assumes position one which makes it the master. As soon as a master is established, it immediately attempts to call all other units and assigns them successive rotation positions. The system is now active.

Before a master is established, the system is not deprived of air. This is due to one of the outstanding features of the AUTO SENTRY®–W sequencing system: pressure control is always executed locally at each indi-

vidual compressor. The effective unload point for compressor control is the programmed unload point minus 3(rotation number – 1). So while compressors count down towards establishing a master, they are also capable of delivering air at a pressure determined by the above formula.

To ensure that two or more machines do not simultaneously decrement their rotation numbers and simultaneously become masters, it is advisable to place the desired master in sequence mode first and wait until the first decrement in rotation number is seen (about 7 seconds) before placing subsequent compressors in sequence mode. If it is desired to dictate the complete initial sequence manually, wait until the previous machine decrements one position and then place the next desired compressor in sequence mode. If it is acceptable to let the master determine the initial sequence, simply wait until the master has decremented its rotation number once, and then place all remaining compressors in sequence mode. Remember that once a master is established, no further self–decrementing is done by the individual compressors. Instead, they will wait until the master assigns them a rotation number.

Rotation numbers are displayed in the bottom display line, with the mode indication. For example, the mode indication for the current master is SEQ1; for the first lag compressor, SEQ2; second lag, SEQ; etc.

2. HOW THE "AUTO SENTRY®–W" CONTROLS PRESSURE WHILE SEQUENCING

Each compressor operates exactly the same as if it were in AUTO mode with one exception: it has a dynamic unload point. The initial unload point is determined by the equation shown above. A compressor is started when the system pressure drops below its programmed load point, after waiting for ['LAG START INTERVAL' times (rotation number – 1)] seconds. This prevents all lag compressors from starting at once. Note that a compressor's ['LAG START INTERVAL' times (rotation number – 1)] timer is not reset to zero until that compressor is started or until another unit in the system stops. This means that the time for the next lag compressor to come on may be somewhat less than 'LAG START INTERVAL'.

EXAMPLE:

In a three compressor sequence system, UNLOAD PRESSURE = 100 PSI; LOAD PRESSURE = 90 PSI; LAG START INTERVAL = 15 seconds. The lead compressor is running alone, maintaining 90–100 PSI when an air tool is brought on line causing the air demand to exceed the capacity of the lead compressor. When the pressure drops to 90 PSI, the #2 unit times out its 15 second timer and starts. It takes 5 additional seconds for the pressure to rise above 90 PSI. The #3 unit whose timer was initially set at 30 seconds (15 x [3 – 1]), has counted down 20 seconds (the total time that system pressure was below 90 PSI). If air demand increases again, the pressure will have to fall below 90 PSI for only 10 seconds more to start unit #3.

As was previously stated, a lag compressor's unload point (PSET for short) is [UNLOAD PRESSURE – 3(rotation number – 1)]. Thus in the above example, the first lag compressor (rotation #2) has a PSET of 97 PSI; the second lag, 94 PSI, and so on. But look what happens in an eight compressor installation: The eighth compressor will have an initial unload point of [100 – 3(8 – 1)], or 79 PSI. Does this mean that an eight compressor installation must operate 21 PSI below the desired operating point when all compressors are running? NO! This is where the AUTO SENTRY®–W dynamic unload point control takes over. This is how it works: Whenever the system pressure is below the programmed LOAD PRESSURE, the PSET of each lag compressor is incremented 1 PSI every thirty seconds. Thus, after a short interval (about five minutes in this example), the PSET of the last sequenced compressor will climb up until either it equals the LOAD PRESSURE, or a decrease in demand causes the actual system pressure to rise above the LOAD PRESSURE. It can be seen then, that except for short periods just after a sudden increase in demand, the AUTO SENTRY®–W, with its dynamic unload point control, will maintain system pressure between the limits of LOAD PRESSURE and UNLOAD PRESSURE. Remember, LOAD and UNLOAD PRESSURE values are programmed by the operator so the operating range is completely programmable and predictable.

Dynamic unload point control will also work in reverse of the operation described above. Obviously, incrementing unload points will cause overlap of the compressors' modulation ranges. While this enables us to maintain a higher pressure than competitor's sequencers, overlap is undesirable as demand decreases, because a system could end up with several compressors cycling instead of running the minimum number of fully loaded compressors. To overcome this, as pressure rises through the range between LOAD and UNLOAD, the lag compressors' setpoints are now decremented, reversing the effect described above during periods of high demand. The AUTO SENTRY®–W keeps track of all functions at all times so there is never any mix–up of unload points and the proper rotation sequence is always maintained.

The Automatic Sequence Change

After the master (lead) compressor has served for the duration programmed (TRANSFER INTERVAL), it relinquishes control and assigns itself the highest available rotation number. The lag compressors detect the loss of the master and decrement their rotation num-

bers. Number 2 becomes number 1, the new master, number 3 becomes number 2, etc.

It should be noted also that whenever the master detects a missing rotation number, such as when a compressor is turned off that was previously in the rotation, it will automatically 'close the gap' by decrementing the rotation numbers of all compressors whose rotation numbers were greater than the missing number. Likewise, if for whatever reason, the master compressor fails to carry out its role, all lag compressors begin decrementing their rotation number until a new master is established. Regardless of the scenario, the end result will always be that the compressors that remain in rotation will always end up with the lowest possible rotation numbers.

Other Features

Any air system will exhibit pressure differences from one point to the next. Even a well designed multi–compressor installation will show 'minor' pressure variations between one compressor's discharge point and another compressor's discharge. These points will also vary from the central system (normally the air storage receiver). The AUTO SENTRY®–W sequencing system is designed to tolerate minor variations. These pressure differences wreak havoc with conventional sequencers. If a central sequencer is used, it will be sensing a lower pressure than is seen at each compressor. With such systems, there is always a chance that the sequencer could cause a compressor to over pressure due to this pressure drop. The alternative has been to set the central sequencer to a lower pressure to prevent this or allow local override of the sequencer by the local pressure control, neither of which is desirable in the scheme of maintaining plant pressure efficiently with sequencing. The AUTO SENTRY®–W sequencing system will automatically adjust the system to prevent over pressures in any individuals.

The AUTO SENTRY®–W sequencing system lets each compressor control itself independently between setpoints derived to cause staggered operation, or sequencing. The aforementioned pressure drops can also cause derogatory effects (mainly skewed, or out of sequence operation) to the sequencing algorithm used by the AUTO SENTRY®–W.

Since these pressure variations are not constant (they will vary due to demand changes, compressor load / unload changes, and number of compressors running), any scheme to compensate for the pressure variations must be dynamic. The exclusive dynamic unload point control feature enables this error correction scheme to be accomplished rather easily.

Here's how it works: The master continually receives system pressure values from every machine in the sequence rotation. The values are averaged and this average is then distributed to all lag compressors. All compressors, lead and lag, then compare their local pressure reading to the average and adjust their PSET by the amount of error. The effect is that all compressors are controlling to a single pressure reading, a reading that is not one that is picked up somewhere removed from the compressor, but an average of actual discharge pressures.

It should be noted that the pressure displayed on the top line by all sequenced compressors is this average.

CONNECTION OF EXPANSION BOARD AND EXTERNAL CONTROL CIRCUITS

The AUTO SENTRY®–W controller has a connection port for use with an expansion board, part number 301EWC1173. This provides interconnection points for external controls and indicators. This allows simple connection to remote controls and indicators, or integration into any plantwide controls system. The expansion board also provides the data port for communications in sequencing. The expansion board is pre–installed on any unit with factory–mounted wye–delta starters.

To install on other units, stack the expansion board over the main control board, and mount with the hardware included. Use the cable to connect the expansion board to the main board. The AUTO SENTRY®–W controller automatically detects the presence or absence of the expansion board, but 120V input circuits must be connected to the expansion board for proper operation. Spare terminals are provided at the control terminal strip in the box for connection of the following 120v circuits. Connect either to unused existing terminals, or mark blank terminal locations for new points shown.

Connect from the expansion board plug to terminals as follows:

Expansion Plug	Panel Terminal
J1–1	8 (existing)
J1–2	no connection
J1–3	23 (new)
J1–4	24 (new)
J1–5	10 (existing)
J1–6	21 (new)
J1–7	20 (new)
J1–8	19 (new)

Remote On / Off – Remote on–off control of the system requires only a simple two–wire control, with an isolated contact suitable for 120 volts, 1 amp. This may be a switch, a timer contact, a relay contact, or a PLC output. To connect, simply run the two wires to the control enclosure, remove the jumper (if present) between terminal 9 and 23, and connect the pair of wires from the switch to terminals 9 and 23.

The air compressor will operate normally in its selected mode whenever this contact is closed (turned on). Note that the keypad is always the master control; the [RUN] key must be pressed to place the control into an operating mode. The remote is not capable of starting a unit after the [STOP/RESET] key has been pressed to place the controller in the READY state. When the contact is opened (turned off), operation depends on how the controller has been programmed and what it is doing prior to opening the contact.

If the compressor was already stopped in automatic or sequence modes, it will remain stopped and will not restart until the contact is closed. The display will flash the message "REMOTE STOP" to indicate that it is waiting for the remote signal.

If the compressor was running in any mode when the contact was opened, and the remote response is programmed for "IMMEDIATE", the compressor will immediately unload and blowdown. After completion of blowdown, the motors will stop, and the unit will be in the "REMOTE STOP" mode as indicated above.

If the compressor was running in any mode when the contact was opened, and the remote response is programmed for "TIMED UNLOAD", the compressor will immediately unload and blowdown. It will then continue to run unloaded for whatever period has been programmed for "AUTO TIME" (or will complete the remaining auto time if already blown down). After completion, the motors will stop, and the unit will be in the "REMOTE STOP" mode as indicated above. This is the preferred setting for automatic remote controls which may cycle in less than 1/2 hour, as the motor is always cooled evenly and rapid start cycles are prevented.

If remote control is not desired, this input must be jumpered to operate the compressor. Connect a jumper between terminals 9 and 23.

Auxiliary Shutdown – This input allows factory or field connection of shutdown switches not included on the standard package. Simply connect a two–wire switch to terminals 9 and 24. The switch must be selected which has contacts closed for normal conditions, and open to shutdown the compressor. If the contact is opened, the compressor will be shut down, and will display a user selectable message (refer to unit setup adjustments for list of messages).

If no additional switch is desired, this input must be jumpered to operate the compressor. Connect a jumper between terminals 9 and 24.

Alarm Relay – The expansion board is provided with an alarm relay which may be connected to a remote mounted indicator light, horn, or into a PLC input of a plantwide control system. The contact is commercial rated 2 amps at 120 volts. The relay is turned on whenever there is a shutdown condition requiring service at the compressor, and remains off during normal operation, stopping, or power off conditions. The external connections from the controller are from an isolated form C (single–pole, double–throw) contact. This allows control of either a "compressor okay" or a "compressor shutdown" remote indicator.

To use this relay, connect the supply wire for the remote circuit to terminal 21 (relay common) on the terminal strip. Connect a wire to the indicator from either terminal 19 (normally open) or from terminal 20 (normally closed). Connect the other side of the indicator to its neutral.

OTHER CONTROL DEVICES

In addition to the electronic controller noted above, the following components are also used to control operation of the compressor unit.

Relief Valve (FIGURE 1–5, page 3) – 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, raise the system operating pressure to 75% of the relief valve set pressure and manually open the valve with the hand lever. Hold the valve open for a few seconds and allow it to snap shut.

⚠ WARNING

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

⚠ CAUTION

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

⚠ WARNING

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

Insure properly set valves are installed and maintained.

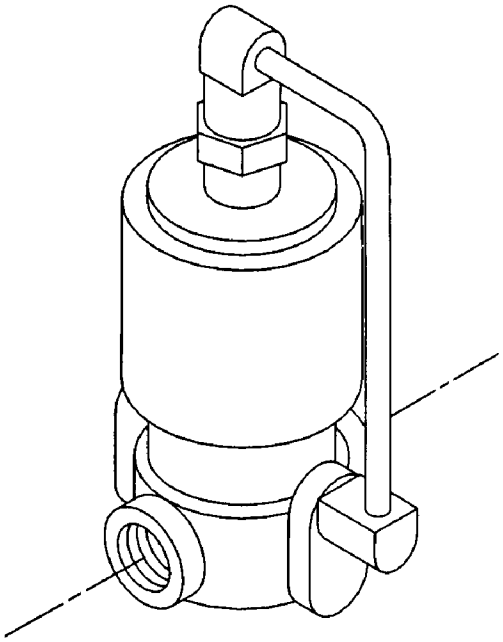


FIGURE 4–3 – BLOWDOWN VALVE

Blowdown Valve (FIGURE 4–3) – This valve normally is used for control functions, but also serves to relieve reservoir pressure following a shutdown. See additional blowdown valve description below.

Discharge Check Valve – (FIGURE 1–4, page 3) – A check valve to prevent back flow of air from the shop air line when the unit stops, unloads, or is shut down.

Inlet Valve (FIGURE 1–3, page 2, and FIGURE 4–4, page 30, this section) – The Inlet valve opens to load 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 in its piston cylinder, which is controlled by the AUTO SENTRY®–W through the magnetic unloader solenoid valve.

Magnetic Unloader Solenoid Valve – This valve controls the position of the inlet valve in response to the AUTO SENTRY®–W. With the valve de–energized, the normally open unloader valve allows control pressure to the inlet piston to close the inlet valve. If the valve is energized, control pressure is relieved from the inlet piston to allow the valve to open.

Control Air Pressure Regulator – This pressure regulator is used to supply a constant and low control pressure to prevent damage to the inlet valve from "slamming." The regulator should be set for 25–30 psig.

Seal Purge Air Pressure Regulator – This pressure regulator is used to provide a constant and low control pressure for proper seal operation. The regulator should be set for 5–7 psig.

Inlet Seal Buffering Water Pressure Regulator – This pressure regulator is used to provide a constant and low pressure water supply for proper operation of compressor inlet seals. The regulator should be set for 2–3 psig.

Shuttle Valve (FIGURE 4–5, page 30) – Also known as a double check valve, the shuttle 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.

Blowdown Valve (FIGURE 4–3) – The blowdown valve is a two–way solenoid valve which is piped into the water reservoir outlet ahead of the discharge check valve. When the solenoid is de–energized, the valve opens and the coolant system is blown down. When the solenoid is energized, the valve closes to allow the coolant system to pressurize. A control air check valve is provided to ensure that the inlet valve is closed during blowdown.

System Pressure Transducer – This transducer is connected after the discharge check valve. It converts the pressure in the plant air system into an electrical signal for use by the AUTO SENTRY®–W controller for control.

Reservoir Pressure Transducer – This transducer is connected to the coolant system. Its signal is used to prevent loaded starts, monitor coolant pressure, and monitor the condition of the water filter.

Injection Pressure Transducer – This transducer is connected to the coolant system. Its signal is used to

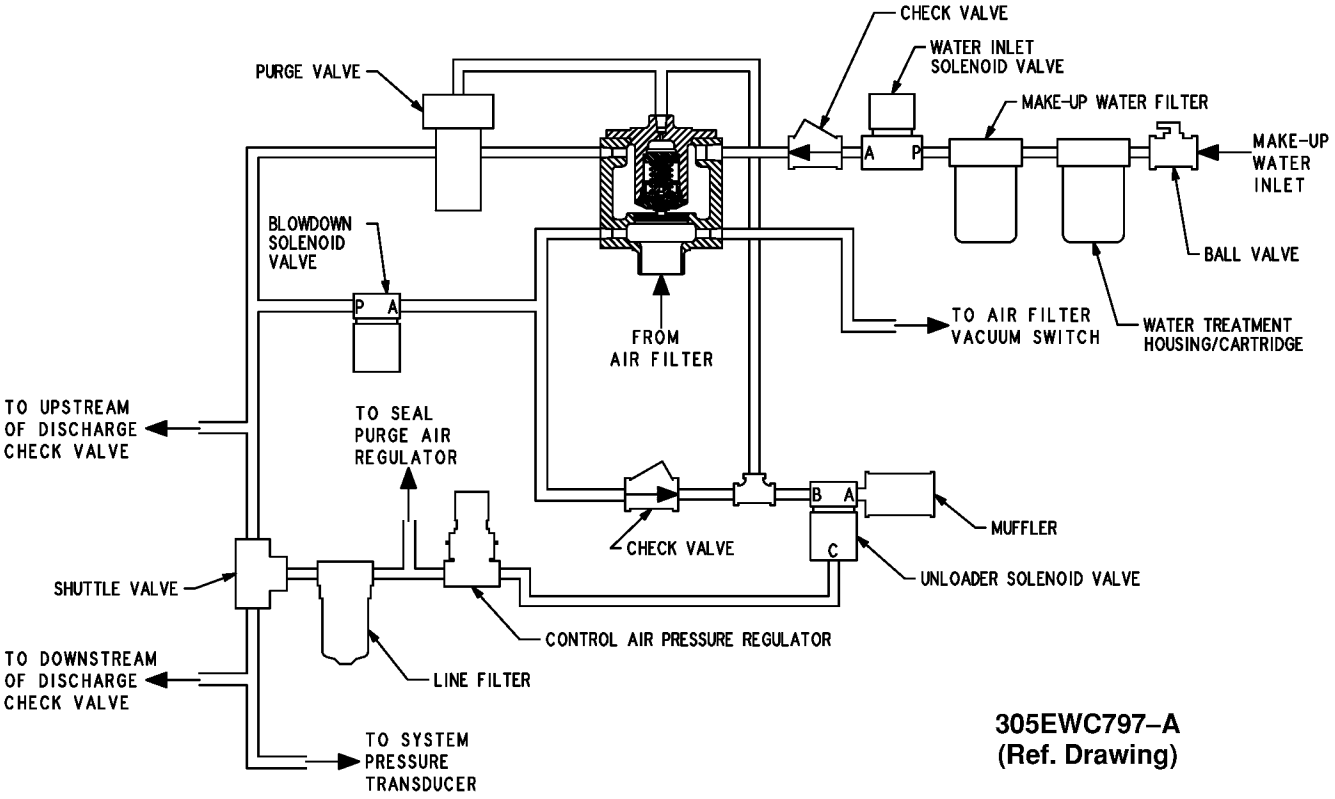


FIGURE 4–4 – INLET VALVE

monitor coolant pressure and monitor the condition of the water filter.

Air Filter Vacuum Switch – This switch is used to monitor air filter condition and alert the user if the filter requires service or replacement.

Discharge Thermistor – This sensor is located directly in the compressor discharge. Its signal is used to monitor compressor temperature and shut down the compressor if a coolant problem is detected.

Water Level Switches – This assembly is located within the reservoir, and normally simply monitors and maintains coolant level. If water cannot be adequately drained, the controller will shut down due to high water level.

Water Solenoid Valves (FIGURE 1–6, page 4) – The fill and drain valves respond to the signal from the water level switches to maintain water level. The fill valve adds coolant to the system by injection into the compressor. The drain valve drains water from the reservoir.

Emergency Stop Push–Button – This is a maintained push–button, and removes power from the con-

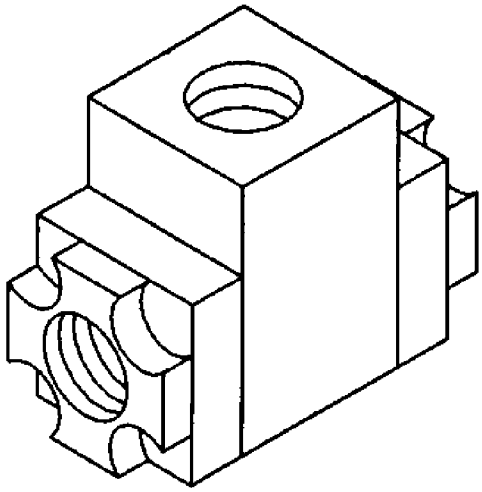


FIGURE 4–5 – SHUTTLE VALVE

troller outputs regardless of controller status. It is located on the upper section of the panel, next to the keypad. This should be used for emergency purposes only – use the keypad [STOP/RESET] for normal controlled stopping.

⚠ WARNING

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

Control Transformer – This changes the incoming power voltage to 110–120 volts for use by all unit control devices. Two primary and one secondary fuse are provided. Refer to adjacent labeling for replacement information.

Terminal Strip – This provides connections for all 110–120 volt devices not contained within the enclosure.

Fan Starter – The starter is used to provide control and overload protection for the fans. Overload heaters should be selected and adjusted based on the motor nameplate amps and the instructions located inside the cover of the electrical enclosure.

Main Starter – This starter is used to provide control and overload protection for the main drive motor. Full voltage starters employ a single contactor, overload heaters should be selected and adjusted based on the motor nameplate amps and the instructions located inside the cover of the enclosure. Wye–delta starters employ three contactors which are controlled sequentially to provide low current starting. For wye–delta starters, the motor nameplate amps must be first multiplied by 0.577 before using the heater table.

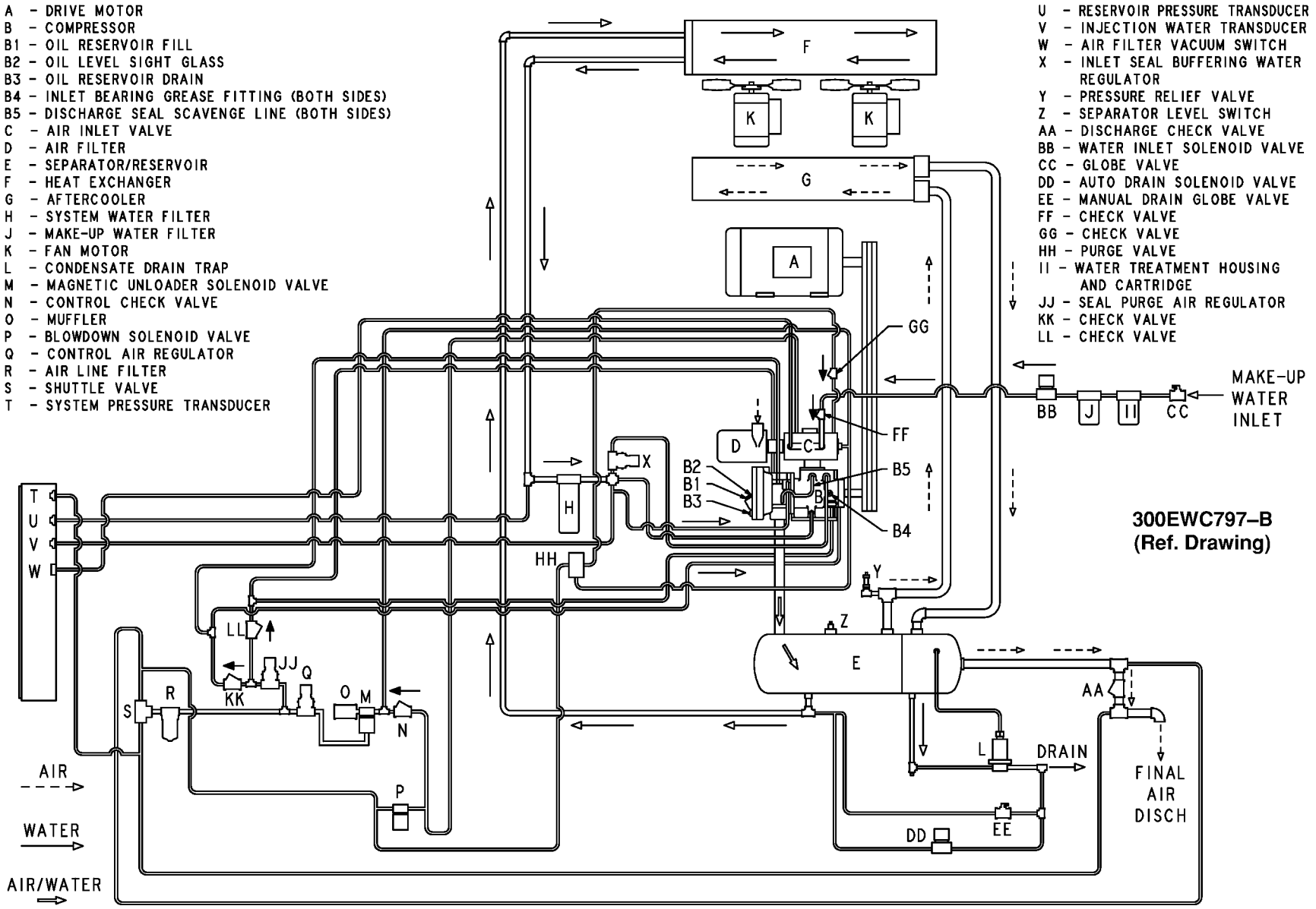
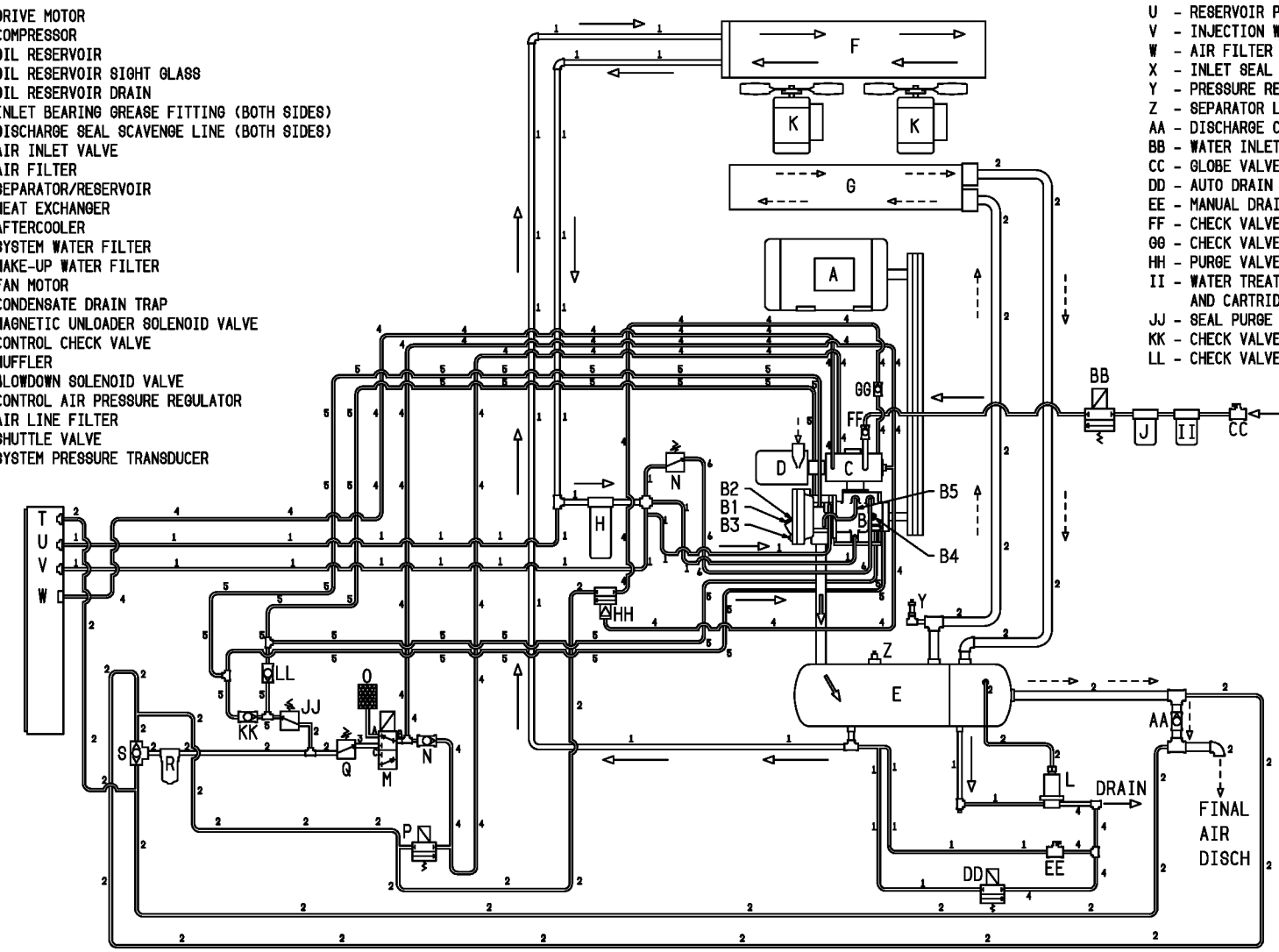


FIGURE 4–6 – CONTROL TUBING SCHEMATIC

A - DRIVE MOTOR
B - COMPRESSOR
B1 - OIL RESERVOIR
B2 - OIL RESERVOIR SIGHT GLASS
B3 - OIL RESERVOIR DRAIN
B4 - INLET BEARING GREASE FITTING (BOTH SIDES)
B5 - DISCHARGE SEAL SCAVENGE LINE (BOTH SIDES)
C - AIR INLET VALVE
D - AIR FILTER
E - SEPARATOR/RESERVOIR
F - HEAT EXCHANGER
G - AFTERCOOLER
H - SYSTEM WATER FILTER
J - MAKE-UP WATER FILTER
K - FAN MOTOR
L - CONDENSATE DRAIN TRAP
M - MAGNETIC UNLOADER SOLENOID VALVE
N - CONTROL CHECK VALVE
O - MUFFLER
P - BLOWDOWN SOLENOID VALVE
Q - CONTROL AIR PRESSURE REGULATOR
R - AIR LINE FILTER
S - SHUTTLE VALVE
T - SYSTEM PRESSURE TRANSDUCER

U - RESERVOIR PRESSURE TRANSDUCER
V - INJECTION WATER TRANSDUCER
W - AIR FILTER VACUUM SWITCH
X - INLET SEAL BUFFERING WATER REGULATOR
Y - PRESSURE RELIEF VALVE
Z - SEPARATOR LEVEL SWITCH
AA - DISCHARGE CHECK VALVE
BB - WATER INLET SOLENOID VALVE
CC - GLOBE VALVE
DD - AUTO DRAIN SOLENOID VALVE
EE - MANUAL DRAIN GLOBE VALVE
FF - CHECK VALVE
GG - CHECK VALVE
HH - PURGE VALVE
II - WATER TREATMENT HOUSING AND CARTRIDGE
JJ - SEAL PURGE AIR REGULATOR
KK - CHECK VALVE
LL - CHECK VALVE



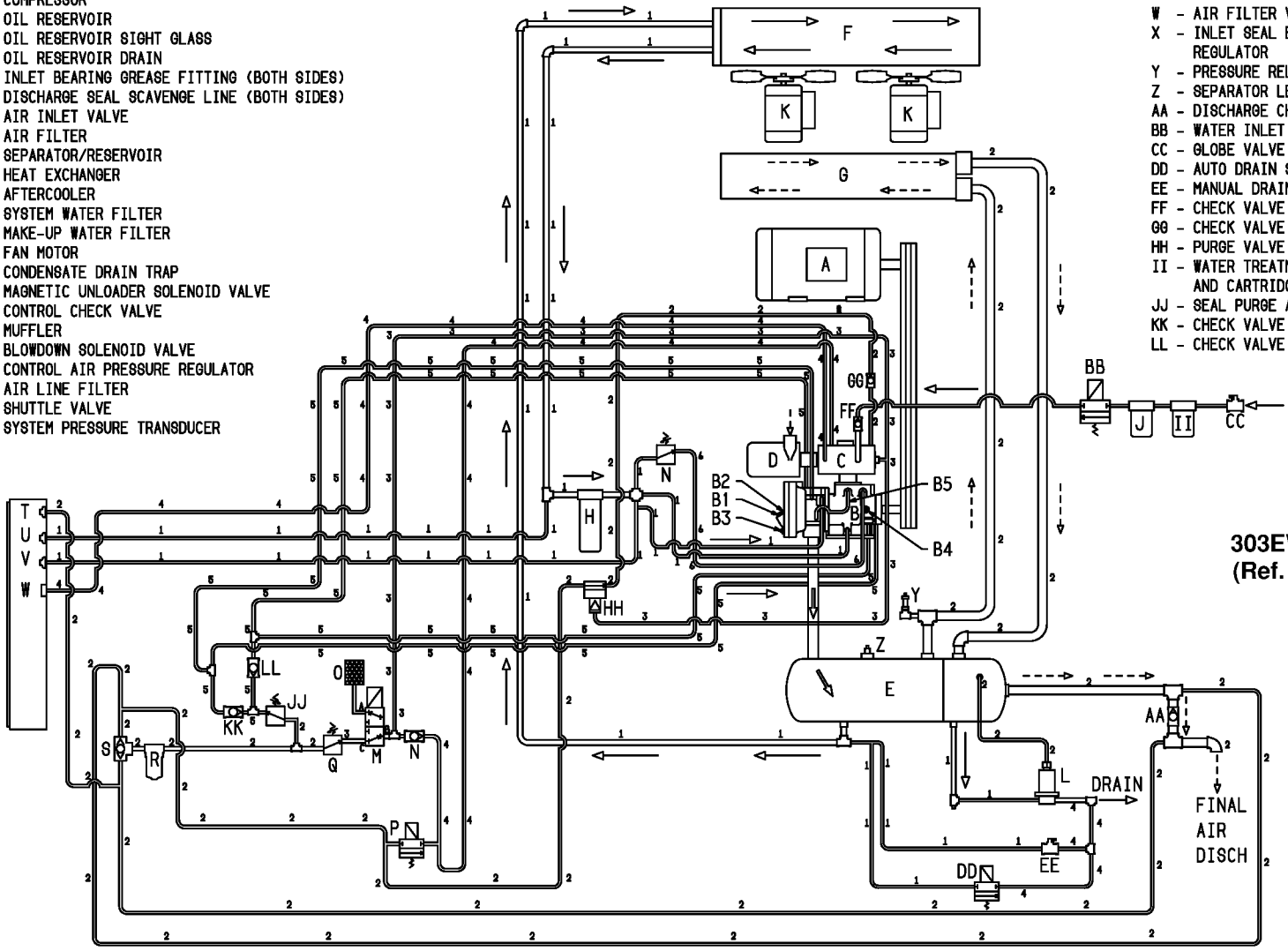
LEGEND NO. DESCRIPTION
1 FULL WATER PRESSURE
2 FULL AIR PRESSURE
3 CONTROL AIR PRESSURE (25-30 PSI)
4 ATMOSPHERIC PRESSURE OR EXHAUSTING
5 SEAL PURGE AIR PRESSURE (5-7 PSI)
6 INLET SEAL BUFFERING WATER PRESSURE (2-3 PSI)

301EWC797–A
(Ref. Drawing)

FIGURE 4–7 – CONTROL SCHEMATIC – COMPRESSOR AT FULL LOAD – CONSTANT SPEED MODE

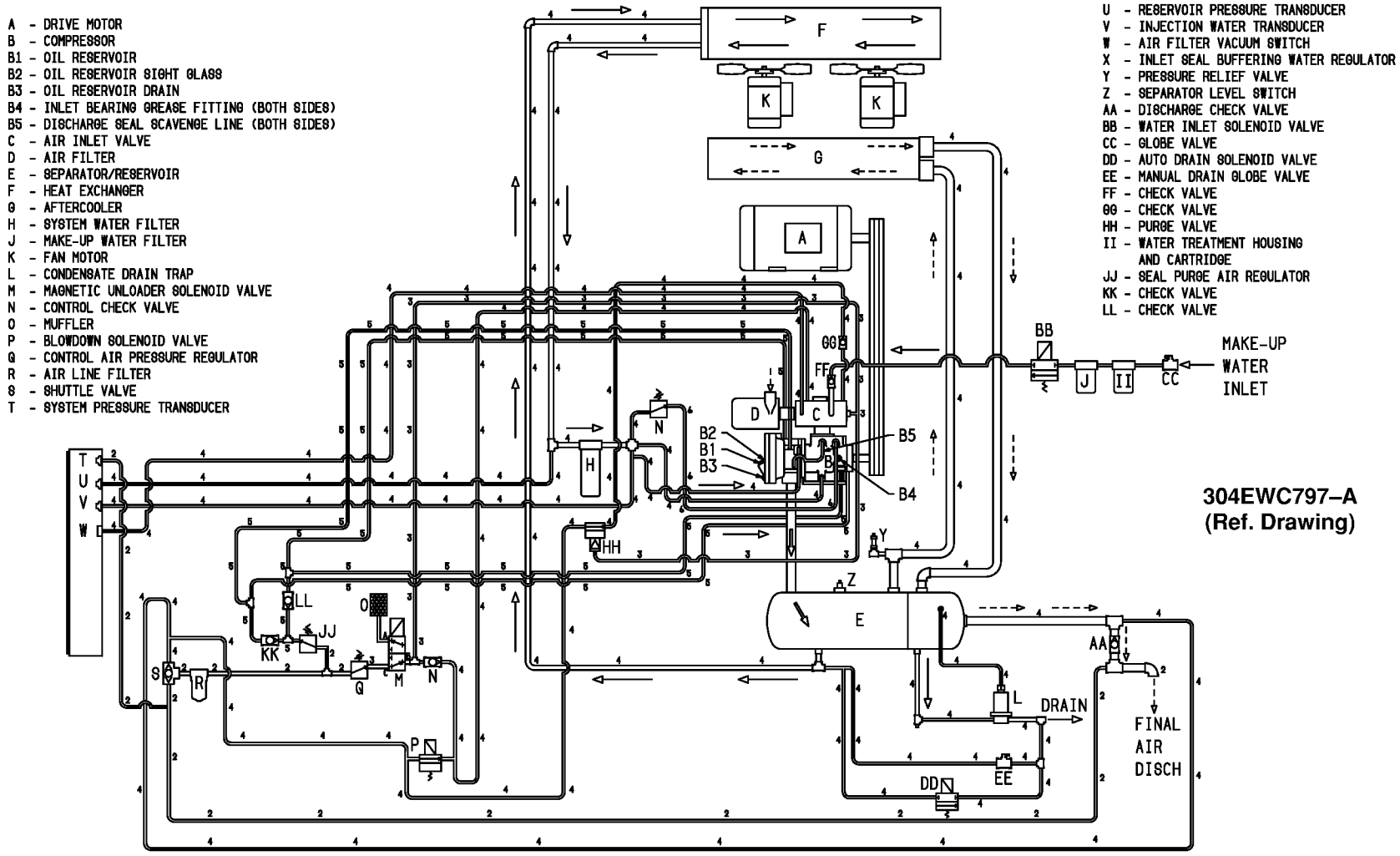
A – DRIVE MOTOR
B – COMPRESSOR
B1 – OIL RESERVOIR
B2 – OIL RESERVOIR SIGHT GLASS
B3 – OIL RESERVOIR DRAIN
B4 – INLET BEARING GREASE FITTING (BOTH SIDES)
B5 – DISCHARGE SEAL SCAVENGE LINE (BOTH SIDES)
C – AIR INLET VALVE
D – AIR FILTER
E – SEPARATOR/RESERVOIR
F – HEAT EXCHANGER
G – AFTERCOOLER
H – SYSTEM WATER FILTER
J – MAKE-UP WATER FILTER
K – FAN MOTOR
L – CONDENSATE DRAIN TRAP
M – MAGNETIC UNLOADER SOLENOID VALVE
N – CONTROL CHECK VALVE
O – MUFFLER
P – BLOWDOWN SOLENOID VALVE
Q – CONTROL AIR PRESSURE REGULATOR
R – AIR LINE FILTER
S – SHUTTLE VALVE
T – SYSTEM PRESSURE TRANSDUCER

U – RESERVOIR PRESSURE TRANSDUCER
V – INJECTION WATER TRANSDUCER
W – AIR FILTER VACUUM SWITCH
X – INLET SEAL BUFFERING WATER REGULATOR
Y – PRESSURE RELIEF VALVE
Z – SEPARATOR LEVEL SWITCH
AA – DISCHARGE CHECK VALVE
BB – WATER INLET SOLENOID VALVE
CC – GLOBE VALVE
DD – AUTO DRAIN SOLENOID VALVE
EE – MANUAL DRAIN GLOBE VALVE
FF – CHECK VALVE
GG – CHECK VALVE
HH – PURGE VALVE
II – WATER TREATMENT HOUSING AND CARTRIDGE
JJ – SEAL PURGE AIR REGULATOR
KK – CHECK VALVE
LL – CHECK VALVE



LEGEND NO. DESCRIPTION
1 FULL WATER PRESSURE
2 FULL AIR PRESSURE
3 CONTROL AIR PRESSURE (25–30 PSI)
4 ATMOSPHERIC PRESSURE OR EXHAUSTING
5 SEAL PURGE AIR PRESSURE (5–7 PSI)
6 INLET SEAL BUFFERING WATER PRESSURE (2–3 PSI)

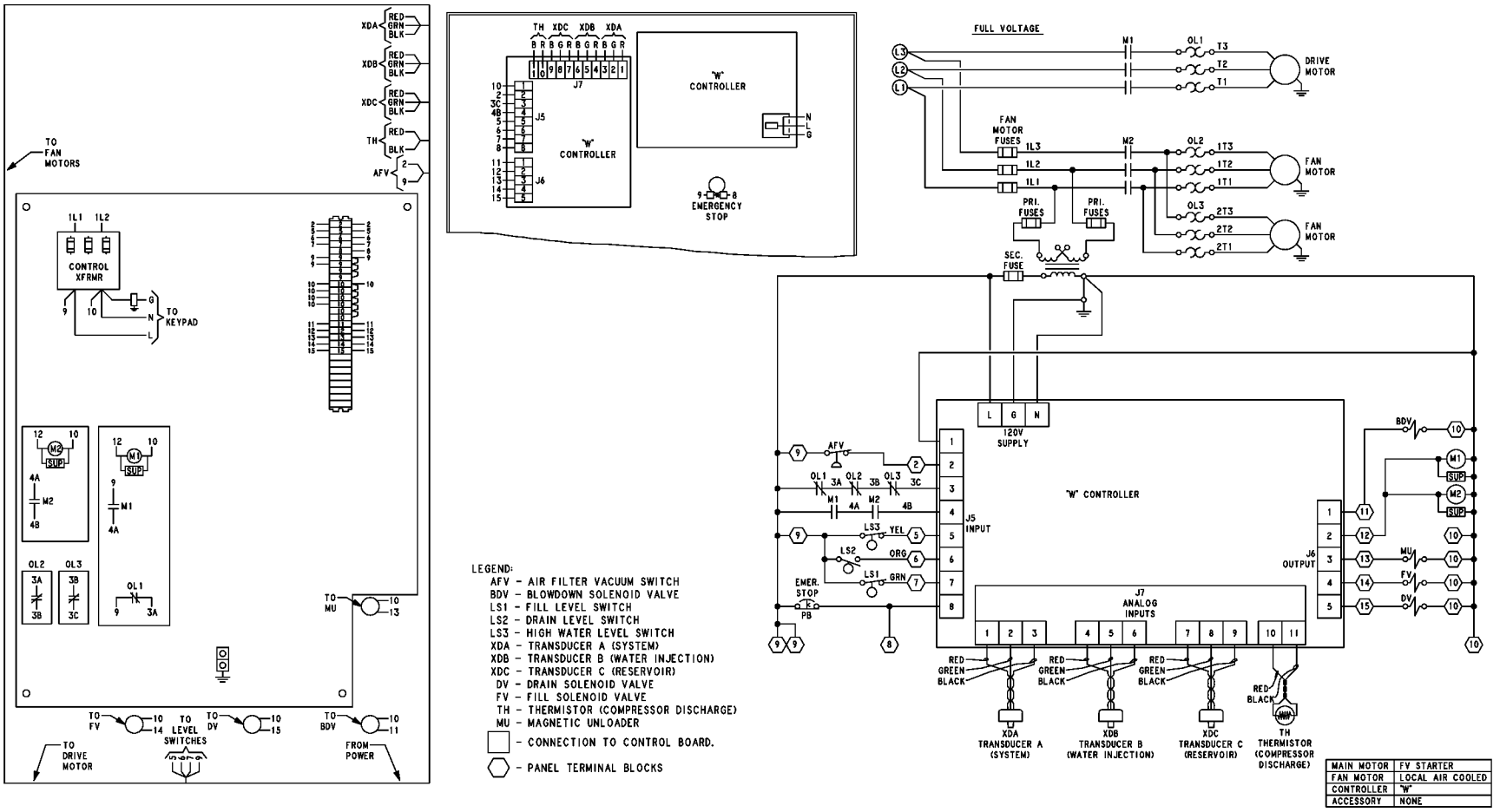
FIGURE 4–8 – CONTROL SCHEMATIC – COMPRESSOR UNLOADED – CONSTANT SPEED MODE



LEGEND NO. DESCRIPTION

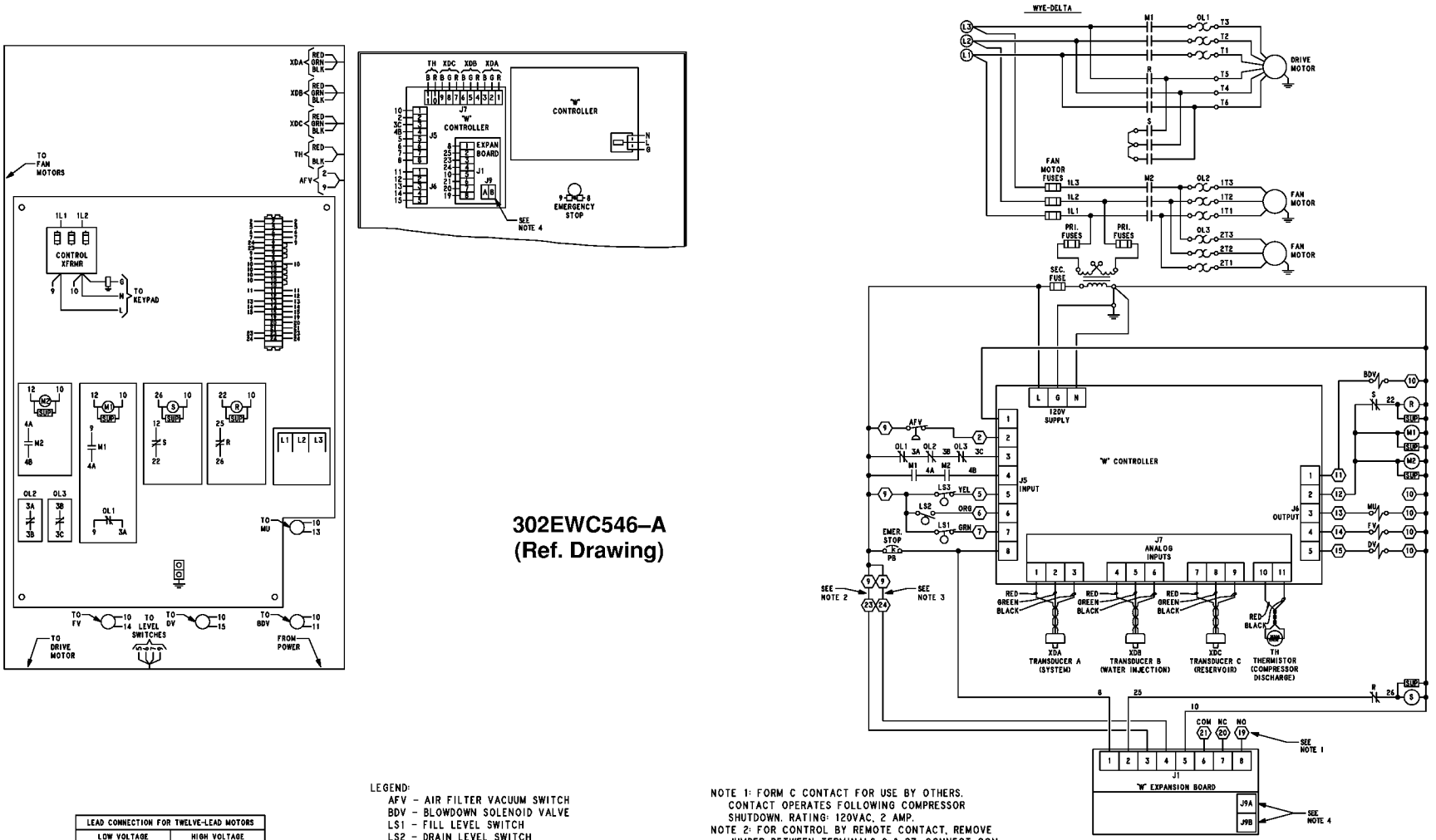
1	FULL WATER PRESSURE
2	FULL AIR PRESSURE
3	CONTROL AIR PRESSURE (25–30 PSI)
4	ATMOSPHERIC PRESSURE OR EXHAUSTING
5	SEAL PURGE AIR PRESSURE (5–7 PSI)
6	INLET SEAL BUFFERING WATER PRESSURE (2–3 PSI)

FIGURE 4–9 – CONTROL SCHEMATIC – COMPRESSOR UNLOADED AND BLOWN DOWN – LOW DEMAND MODE



301EWC546–A
(Ref. Drawing)

FIGURE 4–10 – WIRING DIAGRAM – FULL VOLTAGE



LEGEND:
- AFV – AIR FILTER VACUUM SWITCH
- BDV – BLOWDOWN SOLENOID VALVE
- LS1 – FILL LEVEL SWITCH
- LS2 – DRAIN LEVEL SWITCH
- LS3 – HIGH WATER LEVEL SWITCH
- XDA – TRANSDUCER A (SYSTEM)
- XDB – TRANSDUCER B (WATER INJECTION)
- XDC – TRANSDUCER C (RESERVOIR)
- DV – DRAIN SOLENOID VALVE
- FV – FILL SOLENOID VALVE
- TH – THERMISTOR (COMPRESSOR DISCHARGE)
- MU – MAGNETIC UNLOADER
- ▭ – CONNECTION TO CONTROL BOARD.
- ⬡ – PANEL TERMINAL BLOCKS

NOTE 1: FORM C CONTACT FOR USE BY OTHERS. CONTACT OPERATES FOLLOWING COMPRESSOR SHUTDOWN. RATING: 120VAC, 2 AMP.
NOTE 2: FOR CONTROL BY REMOTE CONTACT, REMOVE JUMPER BETWEEN TERMINALS 9 & 23. CONNECT CONTACT TO TERMINALS 9 & 23.
NOTE 3: FOR USE WITH OPTIONAL SHUTDOWN SWITCH. REMOVE JUMPER BETWEEN TERMINALS 9 & 24. CONNECT N.C. SHUTDOWN SWITCH CONTACT TO TERMINALS 9 & 24.
NOTE 4: J9A & B ARE FOR USE OF OPTIONAL COMMUNICATIONS CABLE.

MAIN MOTOR	Y-D STARTER
FAN MOTOR	LOCAL AIR COOLED
CONTROLLER	"W"
ACCESSORY	EXPANSION BOARD

FIGURE 4–11 – WIRING DIAGRAM – WYE DELTA

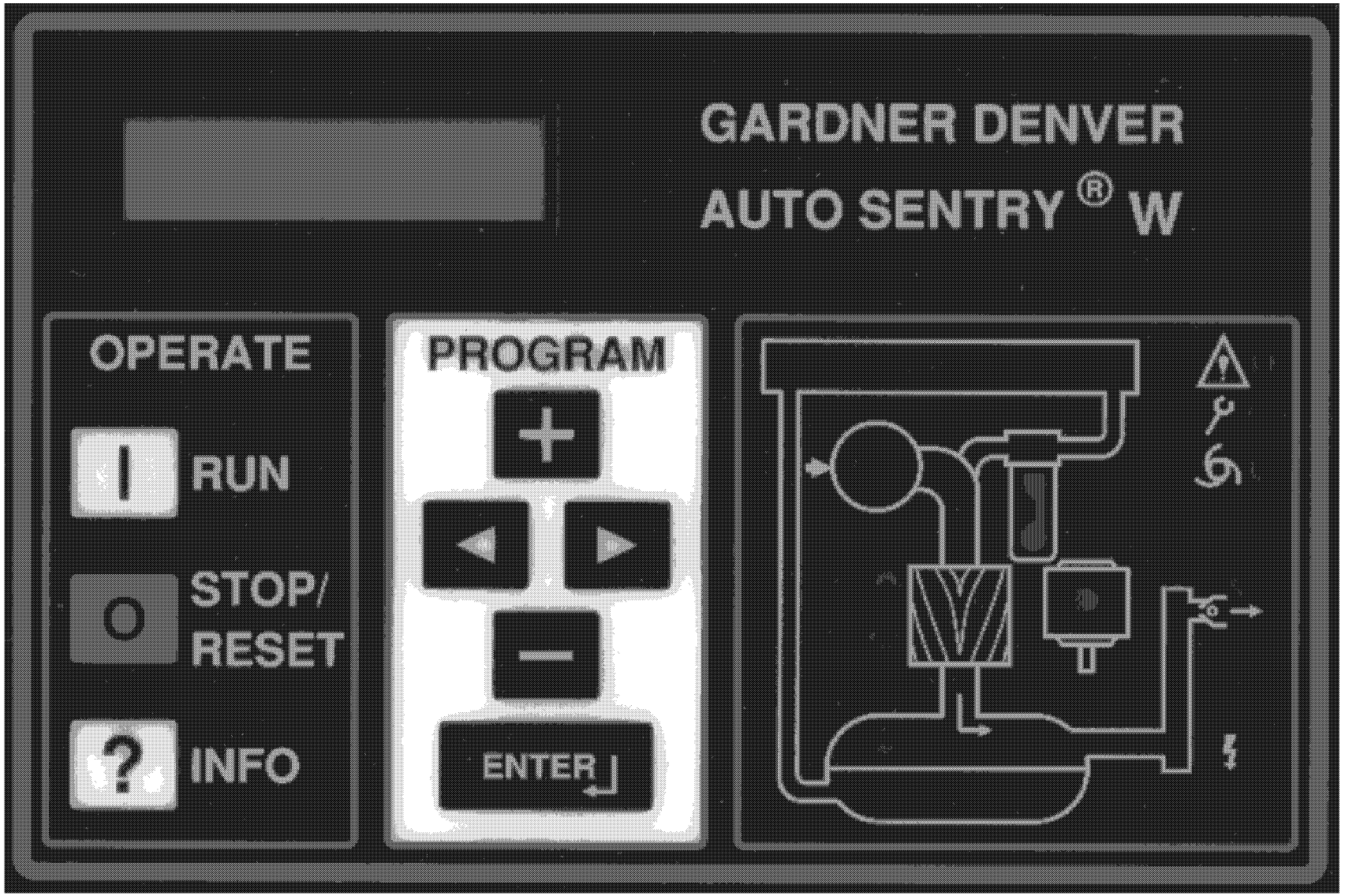


FIGURE 4–12 – AUTO SENTRY W CONTROLLER DISPLAY

SECTION 5
LUBRICATION

COMPRESSOR OIL SYSTEM – The air end oil reservoir is filled with oil and the inlet bearing lubrication fittings are greased at the factory before shipment. A tag on the reservoir fill cap indicates the type of oil in the reservoir as it left the factory.

RECOMMENDED LUBRICANT – Gardner Denver compressors are factory filled with AEON™ lubricants. These lubricants are formulated to the highest quality standards and are factory authorized, tested and approved for use in rotary screw compressors.

AEON™ lubricants are available through your authorized Gardner Denver compressor distributor.

OIL SPECIFICATIONS – The air end reservoir is factory filled with AEON™ 800 lubricant. A lubricant analysis program for a periodic check of lubricant quality and remaining life can maximize the change interval.

For grease specifications, refer to "Electric Motor Grease Specifications," page 14.

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

⚠ CAUTION

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

⚠ CAUTION

Improper equipment maintenance with use of synthetic lubricants will damage equipment. Oil change intervals must be adhered to for maximum compressor protection and efficiency See Maintenance Schedule, page 45.

⚠ 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.

LUBRICANT MAINTENANCE INTERVAL – The oil reservoir at the discharge end of the air end has a capacity of approximately 32 oz. (.8 L). The oil bath type lubrication utilized does not require an oil filter or dedicated circulation hardware. As such, discharge end lubricant change intervals of 2000 hours are recommended as the only maintenance requirement in lieu of filter changes and circulation system maintenance.

The drive end bearings of the air end should be lubricated with the prescribed grease every 1000 hours of operation until a small amount comes lightly out of the relief holes on the lower sides of the compressor inlet end or on the inlet end cover.

During initial start–up and after regreasing, a small amount of grease may be ejected from the relief holes. Wipe off any excess lubricant.

Severe operating conditions may require shorter regreasing intervals.

OIL LEVEL SIGHT GLASS (FIGURE 1–3, page 2, and FIGURE 5–1, page 40) indicates the amount of oil in the air end oil reservoir. Read the oil level when the unit is off. In operation the oil level may fluctuate.

Add oil only when the oil level drops into the lower half of the glass. Drain oil only when the compressor is off.

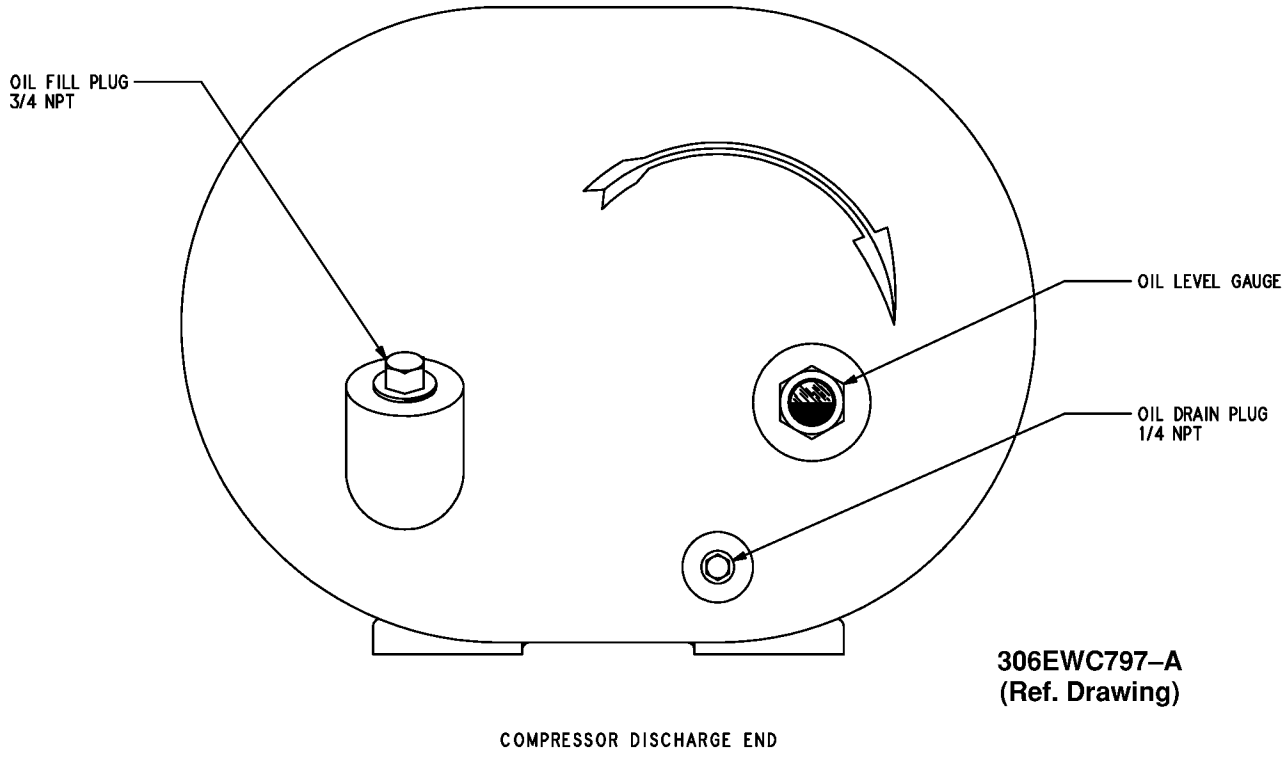


FIGURE 5–1 – OIL LEVEL SIGHT GLASS

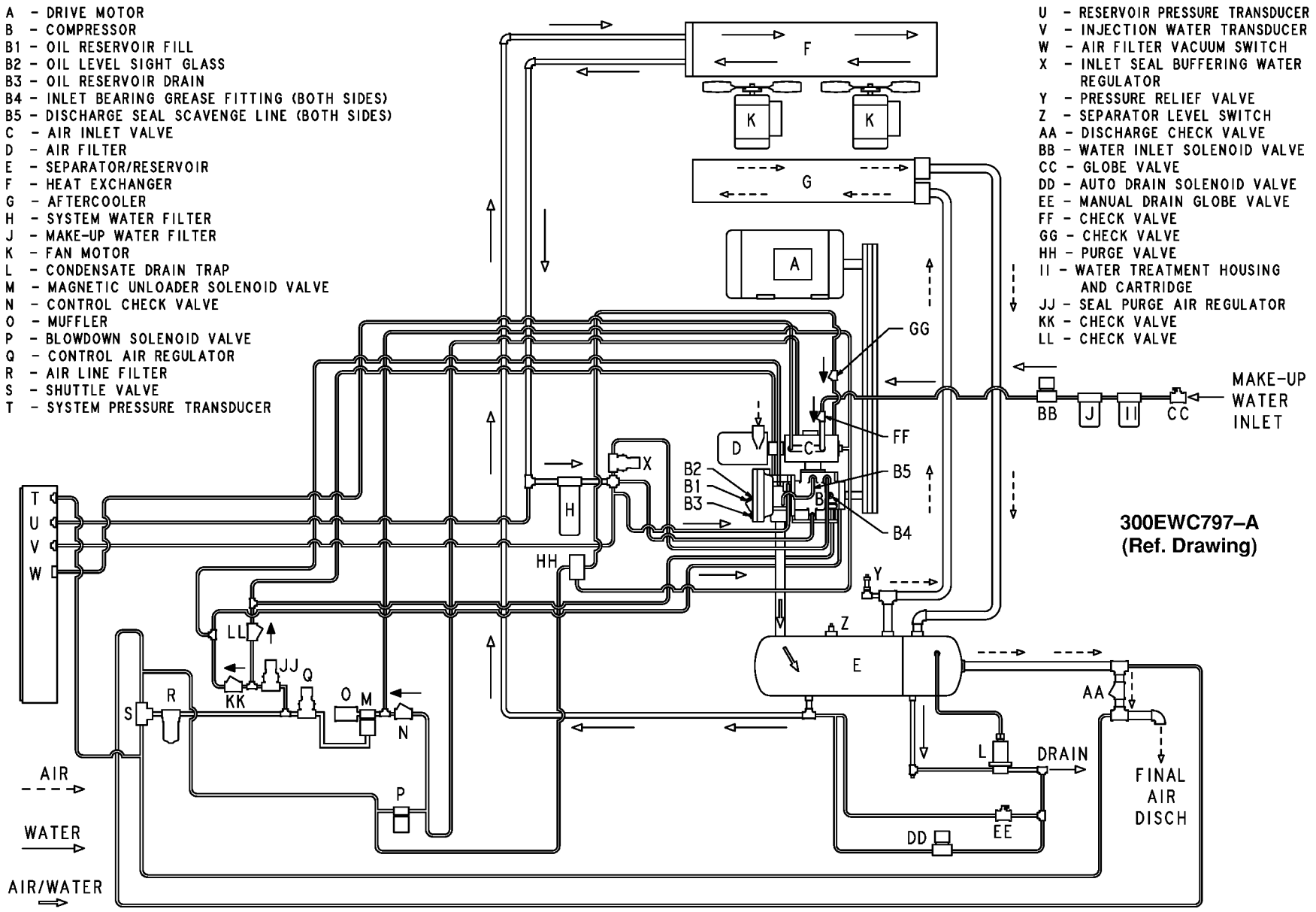


FIGURE 5–2 – FLOW DIAGRAM (AIR COOLED)

SECTION 6
AIR FILTER

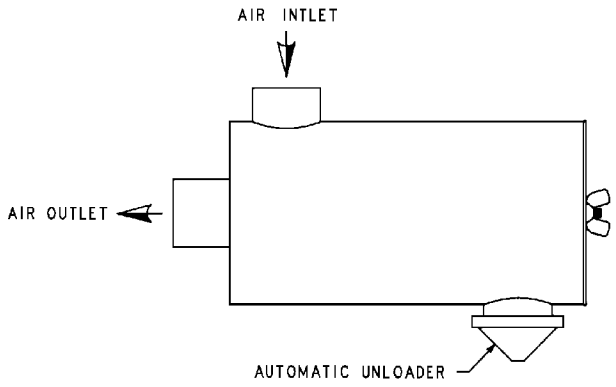


FIGURE 6–1 – HEAVY DUTY AIR FILTER (STANDARD)

HEAVY–DUTY AIR FILTER (FIGURE 6–1) furnished as standard equipment on units with an enclosure is a heavy–duty washable element dry type air filter. The air filter must receive proper maintenance if maximum service is to be obtained from the unit. Establishing adequate and timely filter service is MOST IMPORTANT. Improperly maintained air filter can cause a loss of compressor air delivery.

Filter Element – Service the air filter element when the "CHANGE AIR FILTER" message appears on the display accompanied by a yellow indicator in the status area of the keypad. Clean every 50 to 150 operating hours depending on dust conditions.

NOTICE

Use only genuine Gardner Denver air filter elements on Gardner Denver compressor units. Genuine parts are available through your authorized Gardner Denver distributor.

To service:

1. Remove the wingnut and pull out the filter element.
2. Visually inspect the element. If cleaning is not necessary, reinstall the filter element. If the element requires cleaning, go through steps 3, 4 and 5.
3. Wash the element by soaking about 15 minutes in warm water with a mild nonsudsing detergent. Rinse the element thoroughly with clean water; a hose may be used if the water pressure does not exceed 40 psig (2.8 bar).
4. Inspect the element for ruptures or cracks in the pleated media; replace the element if any are found. Inspect the gasket on the bottom (outlet end) of the element; replace the entire element if the gasket is damaged. A spare element will keep down time to a minimum.
5. Allow the element to air dry COMPLETELY. Do not expose the element to heat over 150° F (66° C). Install the element in the filter body and fasten securely with the wing nut.

⚠ WARNING

Do not oil this element. Do not wash in inflammable cleaning fluids. Do not use solvents other than water. Improper cleaning may damage the element.

NOTICE

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

Filter Element Life – The element should be replaced after six (6) cleanings or if:

1. 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.

2. Pressure drop through a filter with a freshly cleaned element is below three (3) inches (76 mm) of water with the compressor running at full load – this would indicate a rupture or crack.

Inlet Tube – Inspect the inlet screen and tube for dirt accumulation each time the filter is serviced. Clean the tube when required by ramming a clean dry cloth through the tube. Wipe the inside of the filter body to remove any dirt falling from the inlet tube before reinstalling the element.

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

SECTION 7
BELT DRIVE

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

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

⚠ CAUTION

Excessive belt tension can damage the equipment. Tension the belts as shown in FIGURE 7–1.

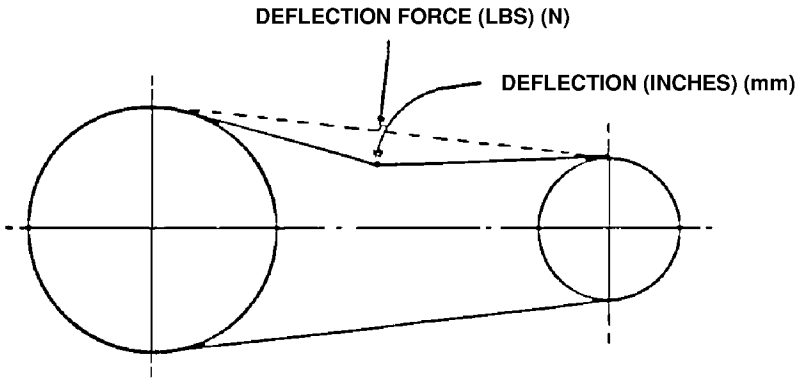
Belts can be changed when necessary by the following instructions. First, disconnect, tag and lockout power to the starter. Then remove the belt guard. Then loosen, but do not remove, the four motor foot nuts.

Next, use the adjusting screws in the motor base to loosen belt tension. Remove the belts, and replace with new belts. Check for correct belt tension and sheave alignment, tighten the motor foots bolts, and re–attach the wire guard.

CHECKING BELT TENSION – Using a spring scale, apply a perpendicular force to each belt at the midpoint of the span and measure the deflection. Correct deflection force and deflection are shown in FIGURE 7–1. To tighten belts, merely increase the center distance between the sheaves.

NOTICE

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



Motor H.P. (KW)	No. Of Belts	Deflection Force Pounds (Newtons) (per belt)	Deflection In Inches (mm)
20 (15 KW)	4	6 to 7 (1.3 to 1.5)	5/16 (8)
25 (19 KW)	4	6 to 8.5 (1.3 to 1.9)	5/16 (8)
30 (22 KW)	4	6 to 7 (1.3 to 1.5)	5/16 (8)

FIGURE 7–1 – BELT TENSION 3VX BELTS

SECTION 8
MAINTENANCE SCHEDULE

SERVICE CHECK LIST –

Air Filter – Operating conditions determine frequency of service. The "CHANGE AIR FILTER" message appears on the display accompanied by a yellow indicator in the status area of the keypad will signal that the air filter requires servicing or changing. See "Air Filter," Section 6, page 42.

Water Filter – Operating conditions and water quality determine the frequency of service. The "CHANGE H2O FILTER" message appears on the display accompanied by a yellow indicator in the status area of the keypad will signal that the water filter requires changing. See "Changing the System Water Filter," Section 2, page 12.

Water Treatment Housing/Cartridge – Operating conditions and water quality determine the frequency of service. The hexametaphosphate crystals are slowly dissolved by make–up water as it is introduced into the circulation system as dictated by the water management controls. As the material is depleted, the level of crystals will drop toward the bottom of the cartridge. Replacement of the cartridge is determined through routine visual inspection. See "Changing the Makeup Water Feeder Cartridge," Section 2, page 12.

Motor Lubrication – Refer to Section 2, page 13.

Every 8 Hours Operation

1. Observe if the unit loads and unloads properly.
2. Check discharge pressure and temperature.
3. Drain the petcock on the control line air pressure regulator.
4. Check Panel Status indicators and message line for advisories.

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.
2. Check the air end reservoir oil level – add oil if required. Loss of oil will be because of seal failure or leaks in the system and should be fixed immediately.

Every 1000 Hours Operation

1. Grease the fittings on the inlet end of the air end (refer to "Oil Change Interval," page 39).

Every 2000 Hours Operation

1. Change the air end lubricant. UNDER ADVERSE CONDITIONS, CHANGE MORE FREQUENTLY (refer to "Oil Change Interval" in Section 5). Flush reservoir if required. DO NOT MIX LUBRICANTS.
2. Visually inspect make–up water feeder cartridge. Replace when no material is observed in the cartridge.

Every Year

1. Check the relief valve for proper operation. See Section 4, page 28.

MAINTENANCE SCHEDULE (See detail notes above)

Maintenance Action	As Indicated By Auto–Sentry®–W	Every 8 Hours	Every 125 Hours	Every 1000 Hours	Every 2000* Hours	Every Year
Change Air Filter	●					
Change Water Filter	●					
Check For Proper Load/Unload		●				
Check Discharge Pressure/Temp		●				
Check Dirt Accumulation on Cooler			●			
Check Reservoir Oil Level			●			
Change Compressor Lubricant (AEON 800)	●				●	●
Check Relief Valve						●
Check Check Valve Seals (Every Year)						●
Drain Petcock on Inlet Valve Control Line		●				
Add Grease to Inlet End Bearings				●		
Inspect Make–Up Water Treatment Cartridge					●	

* Or 3 months, whichever comes first.

SECTION 9
TROUBLE SHOOTING

SYMPTOM	POSSIBLE CAUSE	REMEDY
Compressor fails to start.	1. Wrong lead connections.	1. Change leads.
	2. Blown fuses in control box.	2. Replace fuse.
	3. Motor starter overload heaters tripped.	3. Reset and investigate cause of overload.
	4. Pressure in reservoir.	4. Inspect blowdown valve.
	5. Read error message on control panel.	5. Take appropriate action. See Section 4.
	6. Remote Contact is open.	6. Replace switch or jumper. (terminals 6 & 9).
Compressor starts but stops after a short time.	1. High discharge temperature.	1. See "High Discharge Air Temperature," this section, page 48.
	2. High discharge temperature switch malfunction.	2. Replace switch.
	3. Blown fuse in starter/ control box.	3. Replace fuse (investigate if fuses continue to blow).
	4. Motor starter overload heaters trip.	4. Reset and investigate cause of overload.
Compressor does not unload (or load).	1. Improperly adjusted control.	1. Refer to Section 4 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. Blowdown valve malfunction.	4. Repair, clean or replace valve.
Compressor cycles from load to unload excessively.	1. Insufficient receiver capacity.	1. Increase receiver size.
	2. Restriction in control tubing.	2. Inspect and clean control tubing.

SYMPTOM	POSSIBLE CAUSE	REMEDY
Compressor is low on delivery and pressure.	1. Restricted air filter.	1. Clean or replace filter.
	2. Sticking inlet valve.	2. Inspect and clean inlet valve.
	3. Unload pressure adjusted too low.	3. Adjust the unload pressure. See Section 4, page 18.
	4. Minimum pressure valve stuck closed.	4. Disassemble and clean valve.
High discharge air temperature.	1. Dirty or clogged cooler face.	1. Clean cooler.
	2. Insufficient cooling air flow.	2. Provide unrestricted supply of cooling air.
	3. Clogged water injection filter or cooler (interior).	3. Replace filter or clean cooler.

NOTICE

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

SECTION 10
TROUBLE SHOOTING AUTO SENTRY® –W CONTROLLER

DISPLAY MODES

A green power on light is located in the lower right corner of the keypad. It lights whenever the controls are energized. A steady light indicates that automatic restarting is not enabled, the compressor must be restarted manually following a power failure. A blinking green light indicates that the control will automatically resume its selected mode following an interruption in power.

The normal display indicates the package service pressure, the airend discharge temperature, the total running hours, and one of the following operating modes. The green run light will be on for any operating mode, whether the compressor is running or not.

READY	The compressor has been stopped by pressing the [STOP/RESET] key.
CON	The compressor is operating in the Constant Run mode.
LDM	The compressor is operating in the Low Demand mode.
AUTO	The compressor is operating in the Automatic mode.
SEQ n	The compressor is operating in the Sequence mode.

The following alternate displays may be called by pressing the [?] or a cursor [<] or [>] key. The [?] key always displays DIF PRES on the first press; the cursor keys will redisplay the last alternate display. Any will scroll through the list with additional presses.

DIF PRES	The pressure drop across the water filter
RES PRES	The pressure in the water reservoir
INJ PRES	The pressure between the filter and injectors
SYS PRES	The pressure at the service connection
DIS TMP	The temperature at the airend discharge
TOT HRS	The total hours of compressor running
LOAD HRS	The hours of compressor delivery
BD TMR	The time remaining before a blowdown will be allowed
AUTO TMR	The time remaining of unloaded motor operation

ADVISORY TROUBLE SHOOTING GUIDE

All advisories are indicated on the keypad by a yellow indicator in the Status area, and one of the following messages alternating with the normal lower line display. Perform service or maintenance as indicated, the clear the advisory as instructed in Section 4.

Message	Action Needed
CHNG AIR FILTER	Excessive vacuum has been detected after the air filter, indicating it has become full. Change the air filter to ensure maximum air delivery.
CHNG H_2O FILTER	The differential pressure across the water filter has risen to over 30 psid. Change the filter to ensure an adequate flow of coolant.
RELUBE	The unit has been operated for the programmed number of hours since the last lubricant change or addition. Change or add lubricant as indicated in the lubrication instructions to ensure lubricant quality.

HIGH DISCH TEMP	The temperature was greater than 180 degrees F (82 degrees C) at the airend discharge. Ensure that the compressor receives adequate cooling air or water, and that the coolers are not plugged.
LOW AMB TEMP	The temperature was less than 40 degrees F (4 degrees C) at the airend discharge. Ensure that the compressor is located in a room kept above freezing.

SHUTDOWN TROUBLE SHOOTING GUIDE

All shutdowns are indicated on the keypad by the word "SHUTDOWN" on the top line of the display, and one of the following messages on the lower line of the display. The red indicator in the Status area will be steadily lit while the conditions exist, and will flash after the condition has been corrected. Perform service as indicated. Press the [STOP/RESET] key to clear the shutdown.

Message	**Action Needed**
BAD FLOAT SWITCH	120 volts is present at both terminal 6 and 7 of the terminal strip. This indicates a likely wiring error to the float switch; check and correct. It may also indicate a short within the switch itself.
CHECK CN7	All inputs at connector 7 of the controller are off. The most common cause for this is that the connector plug has been pulled out. Plug the connector back in firmly.
CHECK CN5	120 volts has been removed from ALL inputs to connector 5 of the controller. The most common cause for this is that the connector plug has been pulled out. Plug the connector back in firmly.
CHNG H2O FILTER	The differential pressure across the water filter has risen to over 40 psid. Change the filter to ensure an adequate flow of coolant.
EMERGENCY STOP	The Emergency Stop button has been pressed. Pull it back out to its normal position. If the button has not been pressed, check that the contact block is firmly mounted in the right or left (not center) position of the operator. Check for loose connections which would remove 120 volts from connector 5–8 of the controller.
EXTERNAL DEVICE	120 volts has been removed from J1–4 of the expansion board. This is normally jumpered directly to terminal 9, but the jumper may be removed to add a field installed shutdown switch. Reset the external switch.
HIGH DIS TEMP R	This indicates that the controller has detected a rapid temperature rise in the airend discharge. This normally would indicate a loss of coolant injection into the airend. Completely check all water piping, the filter, and flow controls for blockage or freezing. This may also be caused by a loose connection at connector 7 of the controller. Monitor the temperature carefully during restarts after servicing.
HIGH DISCH TEMP	This indicates that the controller has detected temperature in excess of the programmed high temperature limit at the airend discharge. The most common cause for this is inadequate package cooling. Ensure proper air flow for air–cooled units, or adequate cooling water for water cooled units. Monitor the temperature carefully during restarts after servicing.
HIGH INJ PRESS	Pressure in excess of the programmed high pressure limit has been detected. This shutdown will occur if a loss of pneumatic controls occurs. Check the inlet valve, all control piping, solenoid valves, and all other control devices to find the cause for the inlet valve not closing. Other possible causes are loose connections to the transducer, electrical noise and transients, or improper setting of the high pressure limit.

Message	Action Needed
HIGH RESVR PRESS	Pressure in excess of the programmed high pressure limit has been detected. This shutdown will occur if a loss of pneumatic controls occurs. Check the inlet valve, all control piping, solenoid valves, and all other control devices to find the cause for the inlet valve not closing. Other possible causes are loose connections to the transducer, electrical noise and transients, or improper setting of the high pressure limit.
HIGH SYSTEM PRESS	Pressure in excess of the programmed high pressure limit has been detected. The most likely cause is other, higher pressure compressors on the same air system; separate these from this compressor unit. Other possible causes are loose connections to the transducer, electrical noise and transients, or improper setting of the high pressure limit.
HIGH VIBRATION	120 volts has been removed from J1–4 of the expansion board. This is normally jumpered directly to terminal 9, but the jumper may be removed to add a field installed shutdown switch. Reset the external switch.
HIGH WATER LEVEL	120 volts has been removed from terminal 5 of the terminal strip. This normally indicates that a high water level in the reservoir has opened switch LS3 of the float switch assembly. Check that the drain is clear and that the drain solenoid valve is functioning properly. This may also indicate a loose connection along wire 5.
LOW DISCH TEMP	The temperature, as measured at the airend discharge, has fallen below freezing. Repair room heating to prevent further damage to the unit.
LV RELAY	120 volts has been removed from J1–4 of the expansion board. This is normally jumpered directly to terminal 9, but the jumper may be removed to add a field installed shutdown switch. Reset the external switch.
MOTOR CONTACT	The controller has attempted to turn off the compressor, but is still receiving a return signal from the starters' auxiliary contacts. Check that the starter operates freely and that the contact blocks are properly installed on the starter.
MOTOR OVERLOAD	One of the motor overload relays within the electrical control box has tripped, indicating high motor shaft load, low voltage, or excessive imbalance in the incoming power. Disconnect and lock out power, open the box, and press the reset buttons one at a time – the tripped one will click when reset. Measure motor amps, and take corrective actions to get all currents within the motor nameplate rating. If overloads had not tripped, check for the cause that 120 volts was removed from connector 5–3 of the controller.
MOTOR STARTER	The controller has attempted to start the compressor, but did not receive a return signal from the starter's auxiliary contact. If the starter does not pick up when attempting to start, check that connector 6 of the controller is plugged in firmly, and check the starter coil. If the starter does pick up, but this message appears, check that the auxiliary contact block is properly installed on the starter and wired to connector 1, terminal 4.
OPEN THERMISTOR	The controller has detected an open connection to the airend discharge thermistor. This normally indicates a loose or broken connection at the controller connector 7; check and correct the connection. This could also be indicating a broken wire or thermistor probe.
OPEN XDUCER	Signal voltage has fallen too low at transducer: (A) Final discharge, (B) Water Injection, or (C) Reservoir. This usually indicates a loose connection of the red wire to the transducer or a defective transducer. Check connections, or replace transducer if necessary.
PHASE RELAY	120 volts has been removed from J1–4 of the expansion board. This is normally jumpered directly to terminal 9, but the jumper may be removed to add a field installed shutdown switch. Reset the external switch.

Message	Action Needed
POWER FAILURE	The power to the compressor unit has been turned off and back on. Press [STOP/RESET] and select an operating mode.
SHORTED THERMSTR	The controller has detected a shorted connection to the airend discharge thermistor. This normally indicates a faulty connection (e.g. wire strands touching) at the controller connector 7; check and correct the connection. This could also be indicating a damaged wire or thermistor probe.
SHORTED XDUCER	Signal voltage has exceeded approximately 4.6 volts at transducer: (A) Final discharge, (B) Water Injection, or (C) Reservoir. This may indicate a loose connection of the black wire to the transducer or a defective transducer. Check connections, or replace transducer if necessary.
WATER PRESS	120 volts has been removed from J1–4 of the expansion board. This is normally jumpered directly to terminal 9, but the jumper may be removed to add a field installed shutdown switch. Reset the external switch.
ZERO XDUCER	Signal voltage has fallen too low at transducer: (A) Final discharge, (B) Water Injection, or (C) Reservoir. This error is usually the result of the transducers being improperly zeroed. Disconnect the air lines to the transducers and follow the procedure indicated in the adjustment instructions.

CONTROLS TROUBLESHOOTING GUIDE

The following are recommended service actions. Observe all instructions noted elsewhere in this manual. All electrical service is to be performed only by a qualified electrician.

Symptom	Recommended action
No display, compressor stopped	Check incoming power to the compressor unit. Ensure that the disconnect is on and that fuses have not blown (or circuit beaker tripped). If power is being properly supplied to the control box, check the fuses located at the fan starter, the control transformer fuses, and the fuse located on the AUTO SENTRY®–W keypad chassis.
Compressor will not start.	To operate, the controller must be placed into an operating mode (e.g. AUTO); press the [STOP/RESET] key to put the control into the READY state, then start by pressing the [START] key. In AUTOMATIC and SEQUENCE modes, compressors will not start until the pressure drops below the load pressures.
Display indicates "NOT BLOWN DOWN"	The controller prevents attempts to start the main motor if the reservoir pressure is over 5 psig. Pressure continues to be relieved from the reservoir while this message is on, and the compressor will start automatically after the pressure has dropped. If this message remains with NO pressure in the reservoir, follow the transducer zeroing procedure found in the controls adjustment section.
Display indicates "REMOTE STOP"	The controller is provided with an input for user–furnished remote controls. This display indicates that 120 volt is removed from terminal 23 of the terminal strip. Check all connections of the expansion board, or the customer–provided controls, if applicable.
Display indicates "SHUTDOWN"	If the display indicates "SHUTDOWN", refer to the shutdown trouble–shooting section for assistance. In addition to the messages shown, there are several internal and system diagnostics performed by the controller. Consult the factory for additional assistance.

Symptom	Recommended action
Compressor runs, but does not load.	In the CONSTANT RUN and LOW DEMAND modes, the compressor will not load until the pressure drops below load pressure. Refer to the operating instructions for further information. If pressure is below the load pressure, check that the inlet valve operates freely. Check that the unloader valve is wired and operating properly.
Compressor runs, unloads at low pressure	If the inlet valve closes at low pressure, check the wiring to the blowdown valve and the piping and check valves in its discharge line.
Compressor does not unload.	The W controller operates the inlet valve to maintain pressure near the unload pressure, matching delivery to demand. If the pressure continues to rise above unload pressure, check that the inlet valve operates freely, and that control air is supplied to the unloader solenoid valve. If normal unload control does not close the valve, it will be closed during a blowdown as pressure approaches the high pressure limit.
Compressor cycles rapidly between load and unload.	The external air receiver should be sized appropriately to prevent rapid cycles. The rapid response time in the CONSTANT RUN mode will operate with small receivers, but any plant air system will operate more efficiently with adequately sized storage. Refer to the operating instructions for further information.
Display is illegible.	The LCD contrast is adjustable from all black to all green. To adjust, find the small adjustment screw located on the larger circuit board behind the keypad. Using a small screwdriver, adjust for the most pleasing display.
Erratic pressures in SEQUENCE only	The sequencing system transmits low–level signal between units to communicate pressures. Units must be properly grounded to a good ground system, the communications cable should use only appropriate quality cable, and the cable should be run in its own conduit.
Compressor cycles rapidly in SEQUENCE mode only	In the sequence mode, the operating system requires all compressors be piped directly to receiver, such that all transducers sense the same pressure. Check valves or restrictions between compressors and the storage will cause system instability. Run units in AUTOMATIC mode until the system is corrected.
Pressure display error.	Accuracy of the pressure display and controls requires that the controller and transducers be calibrated together. This MUST be done with no pressure at the transducer, or errors will occur. This is easiest to check with all pressure removed. All pressure displays should indicate 0 psi (0 bar) +1 psi. If the display indicates greater pressures, recalibrate the system as instructed in the configuration adjustments. Note: reservoir pressure may drop below zero psig when the compressor is stopped, but will return slowly to zero as the vacuum is relieved.

Gardner Denver

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 serviced by others.

5. Any reconditioned or prior owned product.

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

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

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

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

MAJOR PACKAGE COMPONENTS
The drive motor, air or water cooled coolers and the auto Sentry ES+, RS2000 or VS2000 Controller are warranted for 24 months from date of initial use or 27 months from date of shipment to the first purchaser, whichever occurs first.

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

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

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

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

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

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

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

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

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

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

Gardner Denver

For additional information contact your local representative or
Gardner Denver, Customer Service Department,
1800 Gardner Expressway, Quincy, Illinois 62301
Telephone: (800) 682–9868 FAX: (217) 224–7814

Sales and Service in all major cities.

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

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